R-306-2025
Contract #205-2025

CONTRACT DOCUMENTS AND SPECIFICATIONS

FOR

East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2

Wastewater System Improvements
Division of Water Quality
Lexington Fayette Urban County Government

Remedial Measures Plan ID No. EH-02

Volume 1 of 2

LFUCG Bid No.65-2025

Date: May 2025

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Edition: Conformance Documents

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ADVERTISEMENT FOR BIDS

1.01 INVITATION

Sealed proposals for the following work will be received by the Lexington-Fayette Urban County Government (LFUCG) via Ion Wave (https://lexingtonky.ionwave.net) until 2:00 pm, local time, June 12, 2025 for furnishing all labor and/or materials and performing all work as set forth in the Contract Documents prepared by and for Lexington-Fayette Urban County Government, Division of Water Quality (OWNER). All forms and Contract Documents normally filled out and attached with bid submission shall be downloaded from Lynn Imaging's Planroom and may be viewed on Ion Wave. All notary requirements are waived for this solicitation. A copy of bid bond must be included with submission. Immediately following the scheduled closing time for reception of Bids, all proposals which have been submitted in accordance with the above will be opened electronically and a bid tab sheet will be posted on Ion Wave within approximately 30 mins.

LFUCG will only be accepting bids on-line through Ion Wave for this solicitation. Base bid and alternate totals (if required) should be provided on the appropriate line items tab on Ion Wave. Submissions without line item totals (if required) may be rejected and deemed non-responsive. THESE INSTRUCTIONS SUPERCEDE ALL OTHER BID SUBMISSION INSTRUCTIONS PROVIDED IN THIS PACKAGE. PLEASE SUBMIT ALL QUESTIONS VIA THE Q&A MODULE ON ION WAVE.

1.02 DESCRIPTION OF WORK

The project includes providing all construction supervision, labor, materials, tools, test equipment necessary for the [East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2.The project includes the removal and replacement of submersible sanitary pumps, removal of mechanical bar screens and replacement with channel grinders, installation of an overhead crane hoist, wet well connector pipe, and update controls and operations sequences as shown on the Contract Documents.].

1.03 OBTAINING PLANS, SPECIFICATIONS, AND BID DOCUMENTS

Plans, Specifications, and Contract Documents shall be obtained from Lynn Imaging, 328 Old Vine Street, Lexington, KY 40507, (859) 255-1021 or (www.lynnimaging.com) and click on planroom for a non-refundable price of reproduction for each full set of plans and documents. Bids must be submitted through LFUCG's Ion Wave.

1.04 METHOD OF RECEIVING BIDS

Bids will be received from Prime Contracting firms on a lump sum basis. Bids shall be submitted in the manner and subject to the conditions as set forth and described in the Information Available to Bidders and Bid Form. Bids should be submitted online via Ion Wave.

1.05 METHOD OF AWARD

Determination of the successful Bid will be based on the lowest responsive and responsible Bidder whose qualifications indicate the award will be in the best interest of the OWNER and whose Bid/proposal complies with all the prescribed requirements. No Notice of Award will be given until the OWNER has concluded such investigation as deemed necessary to establish the responsibility, qualifications and financial ability of Bidders to do the work in accordance with the Contract Documents to the satisfaction of the OWNER within the time prescribed. The OWNER reserves the right to reject the Bid of any Bidder who does not pass such investigation to the OWNER's satisfaction. The OWNER reserves the right to reject the Bid of any Bidder that is deemed to be unbalanced of front loaded. In analyzing Bids, the OWNER may take into consideration alternate and unit prices, if requested by the Bid forms.

1.06 BID WITHDRAWAL

No Bidder may withdraw his Bid for a period of ninety (90) calendar days after the closing date for receipt of Bids. Errors and omissions will not be cause for withdrawal of Bid without forfeit of Bid Bond.

1.07 BID SECURITY

All Bids shall be accompanied by a Bid Bond of not less than five percent (5%) of the amount of the Bid executed by a Surety Company authorized to do business in the Commonwealth of Kentucky and countersigned by a licensed Kentucky Resident Agent, representing the Surety Company. Certified Check or Bid Bond shall be payable to Lexington-Fayette Urban County Government. Bid Bonds are not required for bids under $50,000. A cashier's check or irrevocable letter of credit is an acceptable form of bid security.

A scanned copy of the bid bond is acceptable and must be uploaded with the bid through Ion Wave.

1.08 SUBMISSION OF BIDS

Contractors shall submit their Bids via Ion Wave not later than 2:00 p.m. (local time) June 12, 2025. Bids will remain sealed until 2:00 p.m. (local time) June 12, 2025, the official Bid closure time. Bids received after the scheduled closing time for receipt of Bids will not be considered.

1.09 RIGHT TO REJECT

The OWNER reserves the right to reject any and all Bids and to waive all informalities and/or technicalities where the best interest of the OWNER may be served.

1.10 NOTIFICATION TO THE LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT FOR AFFIRMATIVE ACTION PLAN AND CURRENT WORKFORCE

The successful bidder must submit the following to the OWNER:

1. Affirmative Action Plan for his/her firm.
2. Current Workforce Analysis Form

Failure to submit this as required herein may result in disqualification of the Bidder from the award of the contract.

1.11 NOTICE CONCERNING MWDBE AND VETERAN GOALS

Notice of requirement for Affirmative Action to ensure Equal Employment Opportunities and Disadvantaged Business Enterprises (DBE) Contract participation. Disadvantaged Business Enterprises (DBE) consists of Minority-Owned Business Enterprises (MBE) and Woman-Owned Business Enterprises (WBE).

The OWNER has set a goal that not less than seventeen percent (17%) of the total value of this Contract be subcontracted to Disadvantaged Business Enterprises, with minimum subgoals of five percent (5%) for MBEs and a subgoal of twelve percent (12%) for WBEs, and set a goal that not less than three percent (3%) of the total value of this Contract be subcontracted to Veteran-Owned Small Businesses and/or Service-Disabled Veteran Owned Businesses. The goals for the utilization of Disadvantaged Business Enterprises and Veteran-Owned Small Businesses as subcontractors are recommended goals. Contractor(s) who fail to meet such goals will be expected to provide written explanations to the Director of the Division of Purchasing of efforts they have made to accomplish the recommended goal, and the extent to which they are successful in accomplishing the recommended goal will be a consideration in the procurement process. Depending on the funding source, other DBE goals may apply.

For assistance in locating Disadvantaged Business Enterprise and Veteran-Owned Small Businesses as Subcontractors contact:

Sherita Miller, Division of Central Purchasing
LFUCG
200 East Main Street, 3rd Floor, Room 338
Lexington, Kentucky 40507
859-258-3323
smiller@lexingtonky.gov

1.12 PRE-BID MEETING AND SITE VISIT

A mandatory pre-Bid meeting will be held at ***10:30*** (ADD #1) **pm local time, May, 28, 2025** at DWQ Offices, 125 Lisle Industrial Blvd., Lexington, KY, 40511. A site visit will follow the meeting at the EHPS located at 3318 Buckhorn Drive, Lexington, KY, 40515.

A non-mandatory a site visit to the East Hickman Pump Station will follow 30 minutes after the conclusion of the pre-bid meeting. **(ADD #1)**

1.13 CONSENT DECREE REQUIREMENTS

The work to be provided through this Bid will assist the OWNER in successfully implementing the Agreement (Contract) and complying with any requirements which are related to the CONSENT DECREE entered in a case styled *United States & Commonwealth of Kentucky v. Lexington-Fayette Urban County Government,* United States District Court for the Eastern District of Kentucky, Civil Action No. 5:06-cv-386-KSF (the "CONSENT DECREE"). The services provided through this Bid are hereinafter referred to as the Agreement (Contract). The primary goal of the Agreement (Contract) is to provide the owner with the technical support and/or construction services necessary to successfully meet the obligations and deadlines of the CONSENT DECREE.

The Bidder shall familiarize itself with and shall at all times comply with the CONSENT DECREE, and all federal, state and local laws, ordinances, and regulations that in any manner affect the Agreement (Contract). Time is of the essence in the performance of Agreement (Contract). Bidder is aware that the Owner is subject to penalties for non-compliance with the CONSENT DECREE deadlines.

If delays result solely by reason of acts of the Bidder, the Bidder shall be held liable for any financial penalties incurred by the Owner as a result of the delay, including but not limited to those assessed pursuant to the CONSENT DECREE. In the event the parties cannot mutually agree upon the cause(s) associated with the delays in completing project deliverables, the Bidder must immediately notify the Owner in the event of such delay, and provide the Owner a written action plan within five (5) business days on how it will attempt to resolve the delay.

In the event that Bidder's delay or other nonperformance of its obligations hereunder results in the imposition of penalties against the Owner pursuant to the CONSENT DECREE, or the Owner otherwise suffers damage as a result of such delay or nonperformance, Bidder shall be solely liable to Owner for any and all such damages, including any costs and attorney's fees.

An electronic version of the CONSENT DECREE is available on the LFUCG web page for review or to print a copy at no charge.

END OF SECTION

SECTION 00300

INFORMATION AVAILABLE TO BIDDERS

1.01 RECEIPT AND OPENING OF BIDS

A. The Lexington-Fayette Urban County Government (herein called the OWNER) invites Bids from firms on the project described in the Advertisement for Bids. The OWNER will receive Bids online through Ion Wave (https://lexingtonky.ionwave.net) at the time and in the manner set forth in the Advertisement for Bids, at which time the bids will be opened electronically. The OWNER may consider informal any Bid not prepared and submitted in accordance with the provisions hereof and may waive any informalities or reject any and all Bids. Any Bid may be withdrawn prior to the scheduled time for the opening of Bids or authorized postponement thereof. Any Bid received after the time and date specified shall not be considered. No Bidder may withdraw a Bid within ninety twenty (90) days after the actual time and date of the Bid opening, but OWNER may, in its sole discretion, release any Bid and return the Bid Security prior to that date.

B. The OWNER assumes no responsibility for Bids that are not submitted electronically as indicated above. Bids that are not submitted online by the stated time and date will be rejected.

1.02 PREPARATION OF BID

A. Each Bid must be submitted on the prescribed digital Bid Form within Ion Wave. All blank spaces for the Bid prices must be filled in or the bid will be considered incomplete. Each Bid must be submitted online via Ion Wave.

1.03 SUBCONTRACTS

A. The Bidder is specifically advised that any person, firm, or other party to whom it is proposed to award a subcontract under this Contract must be acceptable to the OWNER. All proposed subcontractors must be identified on Bid Form. Prior to the award of Contract, the OWNER or the OWNER's representative will advise the Contractor of the acceptance and approval thereof or of any action necessary to be taken. Should any Subcontractor be rejected by the OWNER, the Contractor shall present a new name and/or firm to the OWNER at no change in the Contract Price.

1.04 QUALIFICATIONS OF BIDDER

A. The OWNER may make such investigations as the OWNER deems necessary to determine the ability of the Bidder to perform the Work, and the Bidder shall furnish to the OWNER all such information and data for this purpose as the OWNER may request. The OWNER reserves the right to reject any Bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the OWNER that such Bidder is properly qualified to carry out the obligations of the Agreement (Contract) and to complete the Work contemplated therein. Conditional Bids will not be accepted.

B. In evaluating Bids, OWNER shall consider the qualifications of the Bidders, whether or not the Bids comply with the prescribed requirements, and alternatives and unit or lump

sum prices, as requested. OWNER may consider maintenance requirements, performance data, and disruption or damage to private property. The contract, if awarded, will be awarded to the lowest, qualified, responsible Bidder based upon OWNER's evaluation which indicates that the award will be in the best interest of OWNER and the general public.

C. In the event there is any question as to the Bidder's qualifications and ability to complete the work, a final determination will be made in accordance with a fair evaluation by the OWNER of the following listed elements.

1. If the OWNER requires filling out a detailed financial statement, the Bidder may provide its current certified financial statement(s) for the required time interval.

2. Corporate firms are required to be registered and in good standing with the requirements and provisions of the Office of the Secretary of State, Commonwealth of Kentucky.

3. Documents Required of Contractor - (1) A sworn statement signed by the President or owner of the Company regarding all current work in progress anywhere; (2) A document showing the percent of completion of each project and the total worth of each project; and (3) Documentation showing the percentage of the DBE employment levels on each project of the Bidder's current work force, and DBE participation levels for Subcontractors.

4. Optional OWNER Requirements - The OWNER, at its discretion, may require the Bidder/Contractor to provide: (1) A current detailed financial statement for a period including up to 3 prior years. (2) Financial security or insurance in amounts and kinds acceptable to the OWNER to meet the financial responsibility requirements for the Contractor to indemnify the OWNER. (3) Additional information and/or DBE work force data, as well as DBE participation data.

5. Each Bidder agrees to waive any claim it has or may have against the OWNER, the Architect/Engineer, and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any Bid.

1.05 BID SECURITY

A. Each Bid must be accompanied by a Bid bond prepared on a Form of Bid Bond and attached thereto, duly executed by the Bidder as principal and having as surety thereon a surety company approved by the OWNER, in the amount of 5% of the Bid. Such Bid bond will be returned to the unsuccessful Bidder(s) only upon written request to the Director of Central Purchasing within seven (7) days of opening of Bids. Bid bond shall be made payable to the Lexington-Fayette Urban County Government. Bid security is not required for projects under $50,000.

B. Bonds shall be placed with an agent licensed in Kentucky with surety authorized to do business within the state. When the premium is paid for such coverage, the full commission payable shall be paid to such local agent who shall not divide such commission with any person other than a duly licensed resident local agent.

C. Electronic, scanned Bid bond(s) will be accepted and shall be uploaded to Ion Wave prior to close of bids.

1.06 LIQUIDATED DAMAGES FOR FAILURE TO ENTER INTO CONTRACT

A. The successful Bidder, upon his failure or refusal to execute and deliver the Contract and bonds required within ten (10) days after he has received notice of the acceptance of his Bid, shall forfeit to the OWNER, as liquidated damages for such failure or refusal, the security deposited with his Bid.

1.07 TIME OF COMPLETION AND LIQUIDATED DAMAGES

A. Bidder must agree to commence work on or before a date to be specified in a written "Notice to Proceed" from the OWNER and to fully complete the Project within the time as specified in the Contract Documents. Bidder must agree also to pay liquidated damages for each consecutive calendar day thereafter as specified in the Contract Documents.

1.08 EXAMINATION OF CONTRACT DOCUMENTS AND SITE

A. It is the responsibility of each Bidder before submitting a Bid, to (a) examine the Contract Documents thoroughly, (b) visit the site(s) to become familiar with local conditions that may affect cost, progress, performance or furnishing of the work, (c) consider Federal, State and Local laws and regulations that may affect cost, progress, performance or furnishing of the work, (d) study and carefully correlate Bidder's observations with the Contract Documents, and (e) notify Engineer of all conflicts, errors or discrepancies in the Contract Documents.

B. Bidders should examine the requirements of the General Conditions for information pertaining to subsurface conditions, underground structures, underground facilities, and availability of lands, easements, and rights-of-way. The completeness of data, presented in the Contract Documents, pertaining to subsurface conditions, underground structures, and underground facilities for the purposes of bidding or construction is not assured. The Bidder will, at Bidder's own expense, make or obtain any additional examinations, investigations, explorations, tests and studies and obtain any additional information and data which pertain to the physical conditions (surface and subsurface) which may affect cost, progress, performance or furnishing of the Work and which Bidder deems necessary to determine its Bid for performing and furnishing the Work in accordance with the time, price, and other terms and conditions of the Contract Documents. On request in advance, OWNER will provide access to the site to conduct such explorations and tests as each Bidder deems necessary for submission of a Bid. Bidder shall fill all holes, clean up and restore the site to its former condition upon completion of such explorations.

C. The submission of a Bid will constitute an incontrovertible representation by the Bidder that Bidder has complied with every requirement of this Article; that without exception the Bid is premised upon furnishing and performing the Work required by the Contract Documents and such means, methods, techniques, sequences or procedures of construction as may be indicated in or required by the Contract Documents; and that the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

1.09 ADDENDA AND INTERPRETATIONS

A. No interpretation of the meaning of the Contract Documents will be made to any Bidder orally. Every request for such interpretation should be submitted in writing via the Q&A module on Ion Wave. Addenda will be issued by the OWNER through Lynn Imaging's Planroom and posted to Ion Wave as needed. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the specifications. Acknowledgement of the receipt of addenda must be included with all submitted Bids. Failure of any Bidder to receive any such addendum or interpretation shall not relieve such Bidder from any obligation under his Bid as submitted. All addenda so issued shall become part of the Contract Documents.

1.10 SECURITY FOR FAITHFUL PERFORMANCE

A. Simultaneously with the delivery of the executed Contracts, the Contractor shall furnish Performance, Payment, and Erosion and Sediment Control Bonds as security for the faithful performance of this Contract and for payment of all persons performing labor on the Project under this Contract and furnishing materials in connection with this Contract. The surety on such bond or bonds shall be a duly authorized surety company satisfactory to the OWNER and authorized to do business in the Commonwealth of Kentucky.

B. The Contractor shall furnish the Warranty Bond upon completion of the Work, prior to the OWNER's release of the final payment.

C. All bonds required by this Contract and laws of this State shall be placed with agents licensed in the State of Kentucky. When the premium is paid for such coverage's, the full commission shall be paid to such local agent who shall not divide such commission with any person other than a duly licensed resident local agent.

D. Contractor shall use standard Performance, Payment, Warranty, and Erosion and Sediment Control Bond forms such as documents provided with the Contract Documents or AIA form A312 (latest edition), for the Performance and Payment Bonds only.

E. The Performance Bond shall be in the amount of one hundred percent (100%) of the Agreement (Contract) amount. The Payment Bond shall be in the amount of one hundred percent (100%) of the Agreement (Contract) amount. The Warranty Bond shall be in the amount of five percent (5%) of the final construction cost amount (based on contractor's final pay request). The Erosion and Sediment Control Performance Bond shall be in the amount of one percent (1%) of the Agreement (Contract) amount.

1.11 POWER OF ATTORNEY

A. Attorney-in-fact who signs Bid bonds or Contract bonds must file with each bond a certified and effectively dated copy of their Power of Attorney.

1.12 TAXES AND WORKMEN'S COMPENSATION

A. The Contractor and subcontractor will be required to accept liability for payment of all payroll taxes, sales and use tax, and all other taxes or deductions required by local,

state or federal law, such as social security measured by wages. Each shall carry Workmen's Compensation Insurance to the full amounts as required by Statutes and shall include the cost of all foregoing items in the Bid. The Contractor will not otherwise be reimbursed or compensated for such tax payments. The Contractor is urged to ascertain at his own risk his actual tax liability in connection with the execution or performance of this Contract.

1.13 LAWS AND REGULATIONS

A. The Bidder's attention is directed to the fact that all applicable state laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the Project shall apply to the Contract throughout, and they will be deemed to be included in the Contract, the same as though herein written out in full.

1.14 EROSION AND SEDIMENT CONTROL AND PERMITS

A. The Contractor and Subcontractors performing Work on projects on behalf of the OWNER shall also comply with all applicable federal, state, and local environmental regulations and all requirements and conditions set forth in specifications herein.

1.15 PREVAILING WAGE LAW AND MINIMUM HOURLY RATES

A. There are no Federal or State prevailing wage rates for this Project.

1.16 AFFIRMATIVE ACTION PLAN

A. The successful Bidder must submit with their bid the following items to the Urban County Government (see section 00410 – Bid Form):

1. Affirmative Action Plan of the firm
2. Current Work Force Analysis Form
3. Good Faith Effort Documentation to meet the MWDBE goals.
4. List of Disadvantaged Business Enterprise Subcontractors and the Dollar Value of each Subcontract

B. A Work Force Analysis on the prescribed form shall be submitted for each Contract. Failure to submit these items as required herein may result in disqualification of the Bidder from award of the Contract.

C. All submissions should be attached to the Bidder's bid submission on Ion Wave.

1.17 CONTRACT TIME

A. The number of calendar days within which the Work is to be substantially completed and ready for final payment (the Contract Time) is set forth in the Bid Form and the Agreement (Contract).

1.18 SUBSTITUTE OR "OR-EQUAL" ITEMS

A. The Contract, if awarded, will be on the basis of materials and equipment described in the Drawings or specified in the Specifications without consideration of possible substitute or "or-equal" items. Whenever it is indicated in the Drawings or specified in the Specifications that a substitute or "or-equal" item of material or equipment may be furnished or used by the Contractor if acceptable to the Engineer and OWNER, application for such acceptance will not be considered by the Engineer and OWNER until after the effective date of the Agreement (Contract). The procedure for submission of any such application by the Contractor and consideration by the Engineer and OWNER is set forth in the General Conditions.

1.19 EQUIPMENT MANUFACTURERS LIST

A. The Equipment Manufacturers identified in the Equipment Manufacturers List are the only equipment manufacturers/suppliers to be considered in the Bid. There are and will be no other equals considered during the bidding phase for these equipment items. The Contractor may select any of the listed manufacturers for each item and must circle the selected manufacturer for each item at the time of Bid submission.

B. The design was completed based upon the first listed manufacturer. The Contractor, at no cost to the OWNER, will be responsible for any changes to the structures, piping, electrical, instrumentation, or other to accommodate any required changes should a vendor other than the first listed be selected in the bid. This will include payment to the Engineer of Record for any required redesign.

1.20 ALTERNATE BIDS

A. **Bidders shall submit alternate Bids/proposals only if and when such alternate Bids/proposals have been specifically requested in an Advertisement for Bids.** If alternate Bids/proposals are requested in an Advertisement for Bids, the form of submission of such alternate Bid and the conditions under which such alternate Bids will be considered for award of a contract will be established in the Advertisement.

B. Any Bidder who submits a Bid incorporating an alternate proposal when alternate Bids/proposals have not been requested in the Advertisement for Bids shall have his/her Bid rejected as non-responsive.

C. Any Bidder who submits a Bid incorporating two (2) or more prices for an item or groups of items (unless such method of pricing is requested in the Advertisement for Bids), or which imposes conditions for acceptance other than those established in the Advertisement for Bids, shall have their Bid rejected as non-responsive.

1.21 SIGNING OF AGREEMENT (CONTRACT)

A. When OWNER gives a Notice of Award to the successful Bidder, it will be accompanied by the required number of unsigned counterparts of the Agreement (Contract) with all other written Contract Documents attached. Within ten days thereafter, Contractor shall sign and deliver the required number of counterparts of the Agreement (Contract) and attached documents to OWNER with the required Bonds, Certificate of Insurance, and

Power of Attorney. The OWNER will deliver one fully signed counterpart to Contractor at such time as it has been signed by the Mayor.

1.22 ASSISTANCE TO BE OFFERED TO DISADVANTAGED BUSINESS ENTERPRISE (MWDBE) CONTRACTORS

A. Outreach for MWDBE(s)

The Lexington-Fayette Urban County Government (LFUCG) maintains a database of MWDBE contractors and organizations. When a LFUCG construction project is advertised for bidding, notices are sent to companies registered at https://lexingtonky.ionwave.net. The notices describe the project and indicate the deadline for submitting bids.

If you wish to be added to the LFUCG MWDBE contractor database, please contact:

Sherita Miller, Division of Central Purchasing
Lexington-Fayette Urban County Government
200 East Main Street, Room 338
Lexington, Kentucky 40507
859-258-3323
smiller@lexingtonky.gov

B. Bid Bond Assistance for MWDBE(s)

For those MWDBE contractors who wish to bid on LFUCG project, bid bond assistance is available. This bid bond assistance is in the form of a "Letter of Certification" which is accepted by the LFUCG's Division of Purchasing, in lieu of a bid bond. The "Letter of Certification" must be included in the bid package when it is submitted to the Division of Purchasing electronically. The "Letter of Certification" will reference the specific project for which the bid is being submitted, and the time and date on which the bid is due. Bid bond assistance must be requested from the Lexington-Fayette Urban County Government's Division of Central Purchasing.

C. Eligibility for Bid Bond Assistance for MWDBE(s)

In order to be eligible for any Bid bonding assistance, a MWDBE construction company must be owned or controlled at the level of 51% or more by a member or members of a minority group or females. Prior to receiving assistance, a statement providing evidence of ownership and control of the company by a member or members of a minority group or females must be signed by the Owner or corporate officer and by an attorney or accountant submitted to:

Sherita Miller, Division of Central Purchasing
Lexington-Fayette Urban County Government
200 East Main Street, Room 338
Lexington, Kentucky 40507
859-258-3323
smiller@lexingtonky.gov

D. MWDBE and Veteran Subcontractors

The LFUCG will, upon request, assist prime contractors in the procurement of eligible DBE and veteran subcontractors in an effort to achieve 17% minimum MWBE goal and to achieve 3% minimum veteran goal.

For a list of eligible subcontractors, please contact:

Sherita Miller, Division of Central Purchasing
Lexington-Fayette Urban County Government
200 East Main Street, Room 338
Lexington, Kentucky 40507
859-258-3323
smiller@lexingtonky.gov

1.23 MINORITY BUSINESS ENTERPRISE PROGRAM (MBEP) PARTICIPATION GOALS

A. GENERAL

1. The LFUCG request all potential contractors to make a concerted effort to include Certified Minority Business Enterprise (MBE), Certified Woman-Owned (WBE), Certified Disadvantaged (DBE) Business Enterprises, Certified Veteran-Owned Small Businesses (VOSB), and Certified Service-Disabled Veteran Owned Small Business (SDVOSB) as subcontractors or suppliers in their bids. The term "Certified" shall mean the business is appropriately certified, licensed, verified, or validated by an organization or entity recognized by the Division of Procurement as having the appropriate credentials to make a determination as to the status of the business.

2. Toward that end, the LFUCG has established seventeen percent (17%) of total procurement costs as a minimum Goal for participation of Certified Minority and Women Business Enterprise (MWBE) including minimum subgoals of five percent (5%) for MBE and a subgoal of twelve percent (12%) for WBE.

3. **It is therefore a request of each Bidder to include in its bid, the same goal (17%) for Certified MWBE participation and other subgoals and requirements as outlined in this section.**

4. The LFUCG has also established a three percent (3%) of total procurement costs as a minimum Goal for participation for Certified VOSB and/or Certified SDVOSB; and a goal of utilizing Certified DBE where applicable

5. **It is therefore a request of each Bidder to include in its bid, the same goal (3%) for Certified Veteran-Owned participation and other requirements as outlined in this section.**

B. PROCEDURES

1. Prime Contractors, minority and women business enterprises, veteran owned, small businesses, and service-disabled veteran owned small businesses must

complete monthly contract compliance audits in the Diverse Business Management Compliance System, https://lexingtonky.diversitycompliance.com/

2. Replacement of a Minority-Owned, Woman-Owned or Veteran-Owned subcontractor or supplier listed in the original submittal must be requested in writing and must be accompanied by documentation of Good Faith Efforts to replace the subcontractor / supplier with another MWDBE Firm; this is subject to approval by the LFUCG. (See LFUCG MWDBE Substitution Form)

3. For assistance in identifying qualified, certified businesses to solicit for potential contracting opportunities, bidders may contact:

   a. Sherita Miller, smiller@lexingtonky.gov

4. The LFUCG will make every effort to notify interested MWDBE and Veteran-Owned subcontractors and suppliers of each Bid Package, including information on the scope of work, the pre-bid meeting time and location, the bid date, and all other pertinent information regarding the project.

C. DEFINITIONS

1. A Certified Minority-Owned Business Enterprise (MBE) is defined as a business which is certified as being at least 51% owned, managed and controlled by an ethnic minority (i.e. Black American, Asian American, Hispanic American, Native American).

2. A Certified Woman-Owned Business Enterprise (WBE) is defined as a business which is certified as being at least 51% owned, managed and controlled by a woman.

3. A Certified Disadvantaged Business Enterprise (DBE) is defined as a business which is certified as being at least 51% owned, managed and controlled by a person(s) who is socially and economically disadvantaged as defined by 49CFR subpart 26.

4. A Certified Veteran-Owned Small Business (VOSB) is defined as a business which is certified as being at least 51% owned, managed and controlled by a veteran who served on active duty with the U.S. Army, Air Force, Navy, Marines or Coast Guard.

5. A Certified Service-Disabled Veteran Owned Small Business (SDVOSB) is defined as a business in which at least 51% is owned, managed and controlled by a disabled veteran who served on active duty with the U.S. Army, Air Force, Navy, Marines or Coast Guard.

6. The term "Certified" shall mean the business is appropriately certified, licensed, verified, or validated by an organization or entity recognized by the Division of Procurement as having the appropriate credentials to make a determination as to the status of the business.

7. Good Faith Efforts are efforts that, given all relevant circumstances, a bidder or proposer actively and aggressively seeking to meet the goals, can reasonably be expected to make. In evaluating good faith efforts made toward achieving the goals, whether the bidder or proposer has performed the efforts outlined in the Obligations of Bidder for Good Faith Efforts outlined in this document will be considered, along with any other relevant factors.

D. OBLIGATION OF BIDDER FOR GOOD FAITH EFFORTS

1. The bidder shall make a Good Faith Effort to achieve the Participation Goal for MWDBE and Veteran-Owned subcontractors/suppliers. The failure to meet the goal shall not necessarily be cause for disqualification of the bidder; however, bidders not meeting the goal are required to furnish with their bids written documentation of their Good Faith Efforts to do so.

2. Award of Contract shall be conditioned upon satisfaction of the requirements set forth herein.

3. The Form of Proposal includes a section entitled "MWDBE Participation Form". The applicable information must be completed and submitted as outlined below.

4. Failure to submit this information as requested may be cause for rejection of bid or delay in contract award.

E. DOCUMENTATION REQUIRED FOR GOOD FAITH EFFORTS

1. All Bidders are required to submit documentation of their good faith and outreach efforts to ensure all businesses, including small and disadvantaged businesses such as minority-, woman-, and veteran-owned businesses, have an equal opportunity to compete for and participate in the performance of any subcontracts resulting from this procurement. Examples of good faith and outreach efforts that satisfy this requirement to encourage the participation of, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs include:

   a. Advertised opportunities to participate in the contract in at least two (2) publications of general circulation media; trade and professional association publications; small and minority business or trade publications; and publications or trades targeting minority, women and disadvantaged businesses not less than fifteen (15) days prior to the deadline for submission of bids to allow DBEs, MBEs, WBE, VOSBs, and/or SDVOSBs to participate.

   b. Attended LFUCG Procurement Economic Inclusion Outreach event(s) within the past year to meet new small businesses, DBEs, MBEs, WBEs, VOSBs, and/or SDVOSBs to partner with on LFUCG contracts and procurements.

c. Attended pre-bid/pre-proposal meetings that were scheduled by LFUCG to inform small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs of subcontracting opportunities.

d. Sponsored Economic Inclusion event to provide networking opportunities for prime contractors and small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs.

e. Requested a list of certified small, DBE, MBE, WBE, VOSB and/or SDVOSB subcontractors or suppliers from LFUCG and showed evidence of contacting the companies on the list(s).

f. Contacted organizations that work with small, DBE, MBE, WBE, and VOSB companies for assistance in finding certified DBEs, MBEs, WBEs, VOSB and/or SDVOSBs to work on this project. Those contacted and their responses must be a part of the bidder's outreach efforts documentation.

g. Sent written notices, by certified mail, email, or facsimile, to qualified, certified small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs soliciting their participation in the contract not less than seven (7) days prior to the deadline for submission of bids to allow them to participate effectively.

h. Followed up initial solicitations by contacting small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs via tailored communications to determine their level of interest.

i. Provided the interested small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs with adequate and timely information about the plans, specifications, and requirements of the contract.

j. Selected portions of the work to be performed by small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs in order to increase the likelihood of subcontracting participation. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate small, DBE, MBE, WBE, VOSB and/or SDVOSB participation, even when the prime contractor may otherwise perform these work items with its own workforce.

k. Negotiated in good faith with interested small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs, not rejecting them as unqualified without sound reasons based on a thorough investigation of their capabilities. Any rejection must be so noted in writing with a description as to why an agreement could not be reached.

l. Included documentation of quotations received from interested small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs that were not used due to uncompetitive pricing or were rejected as unacceptable and/or copies of responses from firms indicating that they would not be submitting a bid.

1) Bidder has to submit sound reasons why the quotations were considered unacceptable. The fact that the bidder has the ability and/or desire to perform the contract work with its own forces will not be considered a sound reason for rejecting a small business', DBE's MBE's, WBE's, VOSB's and/or SDVOSB's quote. Nothing in this provision shall be construed to require the bidder to accept unreasonable quotes in order to satisfy the participation goals.

m. Made an effort to offer assistance to or refer interested small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs to obtain the necessary equipment, supplies, materials, insurance and/or bonding to satisfy the work requirements of the bid proposal.

n. Made efforts to expand the search for small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs beyond the usual geographic boundaries.

o. Other – any other evidence that the bidder submits that may demonstrate that the bidder has made reasonable efforts to include small, DBE, MBE, WBE, VOSB and/or SDVOSB participation.

2. Bidder must document, with specificity, each of the efforts it made to include small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs as subcontractors in the procurement, including the date on which each effort was made, the medium through which each effort was made, and the outcome of each effort.

3. Outreach efforts demonstrated by the bidder will be evaluated on a pass/fail basis.

NOTE: FAILURE TO SUBMIT THE DOCUMENTATION REQUESTED IN THIS SECTION MAY BE CAUSE FOR REJECTION OF BID. BIDDERS MAY INCLUDE ANY OTHER DOCUMENTATION DEEMED RELEVANT TO THIS REQUIREMENT WHICH IS SUBJECT TO REVIEW BY THE MBE LIAISON. DOCUMENTATION OF GOOD FAITH AND OUTREACH EFFORTS MUST BE SUBMITTED WITH THE BID, REGARDLESS OF THE PROPOSED LEVEL OF SMALL, DBE, MBE, WBE, VOSB AND/OR SDVOSB PARTICIPATION IN THE PROCUREMENT. IF THE GOOD FAITH AND OUTREACH EFFORT DOCUMENTATION IS NOT SUBMITTED WITH THE BID RESPONSE, THE BID MAY BE REJECTED.

LEXINGTON

MINORITY BUSINESS ENTERPRISE PROGRAM

Sherita Miller, MPA, CPSD
Minority Business Enterprise Liaison
Division of Procurement
Lexington-Fayette Urban County Government
200 East Main Street
Lexington, KY 40507
smiller@lexingtonky.gov
859-258-3323

OUR MISSION: The mission of the Minority Business Enterprise Program (MBEP) is to facilitate the full participation of minority and women owned businesses in the procurement process and to promote economic inclusion as a business imperative essential to the long- term economic viability of Lexington-Fayette Urban County Government.

To that end the urban county council adopted and implemented Resolution 272-2024 – a Certified Minority and Women Business Enterprise seventeen percent (17%) minimum goal including minimum subgoals of five percent (5%) for Minority Business Enterprises (MBE) and a subgoal of twelve percent (12%) for Women Business Enterprises (WBE); a three (3%) minimum goal for Certified Veteran-Owned Small Businesses and/or Certified Service- Disabled Veteran Owned Businesses; and a goal of utilizing Disadvantaged Business Enterprises (DBE), where applicable, for government contracts.

The resolution states the following definitions shall be used for the purposes of reaching these goals:

Certified Disadvantaged Business Enterprise (DBE) *– a business in which at least fifty-one percent (51%) is owned, managed and controlled by a person(s) who is socially and economically disadvantaged as define by 49 CFR subpart 26.*

Certified Minority Business Enterprise (MBE) *– a business in which at least fifty-one percent (51%) is owned, managed and controlled by an ethnic minority (i.e. Black American, Asian American, Hispanic American, Native American)*

Certified Women Business Enterprise (WBE) *– a business in which at least fifty-one percent (51%) is owned, managed and controlled by a woman.*

Certified Veteran-Owned Small Business (VOSB) *– a business in which at least fifty-one percent (51%) is owned, managed and controlled by a veteran who served on active duty with the U.S. Army, Air Force, Navy, Marines or Coast Guard.*

Certified Service -Disabled Veteran Owned Small Business (SDVOSB) *– a business in which at least fifty-one percent (51%) is owned, managed and controlled by a disabled veteran who served*

on active duty with the U.S. Army, Air Force, Navy, Marines or Coast Guard.

The term "Certified" shall mean the business is appropriately certified, licensed, verified, or validated by an organization or entity recognized by the Division of Procurement as having the appropriate credentials to make a determination as to the status of the business.

The following certifications are recognized and accepted by the MBEP:

Kentucky Transportation Cabinet (KYTC), Disadvantaged Business Enterprise (DBE)
Kentucky Minority and Women Business Enterprise (MWBE)
Women's Business Enterprise National Council (WBENC)
National Women Business Owners Corporation (NWBOC)
National Minority Supplier Development Council (NMSDC)
Tri-State Minority Supplier Development Council (TSMSDC)
U.S. Small Business Administration Veteran Small Business Certification (VetCert)
Kentucky Service- Disabled Veteran Owned Small Business (SDVOSB)

To comply with Resolution 272-2024, prime contractors, minority and women business enterprises, veteran owned small businesses, and service-disabled veteran owned small businesses must complete monthly contract compliance audits in the Diverse Business Management Compliance system, https://lexingtonky.diversitycompliance.com/

A list of organizations that certify and/or maintain lists of certified businesses (i.e. DBE, MBE, WBE, VOSB and/or SDVOSB) is available upon request by emailing, Sherita Miller, smiller@lexingtonky.gov.

LEXINGTON

LFUCG MWDBE PARTICIPATION FORM

Bid/RFP/Quote Reference #_____

The MWDBE and/or veteran subcontractors listed have agreed to participate on this Bid/RFP/Quote. If any substitution is made or the total value of the work is changed prior to or after the job is in progress, it is understood that those substitutions must be submitted to the Division of Procurement for approval immediately. **Failure to submit a completed form may cause rejection of the bid.**

MWBE Company, Name, Address, Phone, Email	DBE/MBE WBE/VOSB/SDVOSB	Work to be Performed	Total Dollar Value of the Work	% Value of Total Contract
1.				
2.				
3.				
4.				

The undersigned company representative submits the above list of MDWBE and veteran firms to be used in accomplishing the work contained in this Bid/RFP/Quote. Any misrepresentation may result in the termination of the contract and/or be subject to applicable Federal and State laws concerning false statements and false claims.

_____ _____

Company **Company Representative**

_____ _____

Date **Title**

LEXINGTON

LFUCG MWDBE SUBSTITUTION FORM

Bid/RFP/Quote Reference #_____

The substituted MWDBE and/or veteran subcontractors listed below have agreed to participate on this Bid/RFP/Quote. These substitutions were made prior to or after the job was in progress. These substitutions were made for reasons stated below and are now being submitted to the Division of Procurement for approval. By the authorized signature of a representative of our company, we understand that this information will be entered into our file for this project. **Note: Form required if a subcontractor is being substituted on a contract.**

SUBSTITUTED DBE/MBE/WBE/VOSB Company Name, Address, Phone, Email	DBE/MBE/WBE/VOSB/SDVOSB Formally Contracted/ Name, Address, Phone, Email	Work to Be Performed	Reason for the Substitution	Total Dollar Value of the Work	% Value of Total Contract
1.					
2.					
3.					
4.					

The undersigned acknowledges that any misrepresentation may result in termination of the contract and/or be subject to applicable Federal and State laws concerning false statements and false claims.

Company _____ **Company Representative** _____

Date _____ **Title** _____

DOCUMENTATION REQUIRED FOR GOOD FAITH EFFORTS AND OUTREACH PLANS

As affirmed in Resolution Number 272-2024, the Urban County Council has adopted an annual aspirational goal of utilizing at least seventeen percent (17%) of public funds spend from certain discretionary agreements with certified Minority Business Enterprises (MBEs) and certified Woman Business Enterprises (WBEs); utilizing at least three percent (3%) of public funds from certain discretionary agreements with Certified Veteran-Owned Small Business and Certified Service-Disabled Veteran-Owned Small Businesses (VOSBs); and utilizing Disadvantaged Business Enterprises (DBEs) where applicable. Bidders should make every effort to achieve these goals.

Therefore, as an element of the responsiveness of the bid, all Bidders are required to submit documentation of their good faith and outreach efforts to ensure all businesses, including small and disadvantaged businesses such as minority-, woman-, and veteran-owned businesses, have an equal opportunity to compete for and participate in the performance of any subcontracts resulting from this procurement. Examples of good faith and outreach efforts that satisfy this requirement to encourage the participation of, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs include:

1. Advertised opportunities to participate in the contract in at least two (2) publications of general circulation media; trade and professional association publications; small and minority business or trade publications; and publications or trades targeting minority, women, and disadvantaged businesses not less than fifteen (15) days prior to the deadline for submission of bids to allow, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs to participate.

2. Attended LFUCG Procurement Economic Inclusion Outreach event(s) within the past year to meet new small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs to partner with on LFUCG contracts and procurements.

3. Attended pre-bid/pre-proposal meetings that were scheduled by LFUCG to inform small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs of subcontracting opportunities.

4. Sponsored Economic Inclusion event to provide networking opportunities for prime contractors and small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs.

5. Requested a list of certified small, DBE, MBE, WBE, VOSB and/or SDVOSB subcontractors or suppliers from LFUCG and showed evidence of contacting the companies on the list(s).

6. Contacted organizations that work with small, DBE, MBE, WBE, and VOSB companies for assistance in finding certified DBEs, MBEs, WBEs, VOSB and/or SDVOSBs to work on this project. Those contacted and their responses must be a part of the bidder's outreach efforts documentation.

7. Sent written notices, by certified mail, email, or facsimile, to qualified, certified small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs soliciting their participation in the contract not less than seven (7) days prior to the deadline for submission of bids to allow them to participate effectively.

8. Followed up initial solicitations by contacting small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs via tailored communications to determine their level of interest.

9. Provided the interested small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs with adequate and timely information about the plans, specifications, and requirements of the contract.

10. Selected portions of the work to be performed by small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs in order to increase the likelihood of subcontracting participation. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate small, DBE, MBE, WBE, VOSB and/or SDVOSB participation, even when the prime contractor may otherwise perform these work items with its own workforce.

11. Negotiated in good faith with interested small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs, not rejecting them as unqualified without sound reasons based on a thorough investigation of their capabilities. Any rejection must be so noted in writing with a description as to why an agreement could not be reached.

12. Included documentation of quotations received from interested small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs that were not used due to uncompetitive pricing or were rejected as unacceptable and/or copies of responses from firms indicating that they would not be submitting a bid.

    a. Bidder has to submit sound reasons why the quotations were considered unacceptable. The fact that the bidder has the ability and/or desire to perform the contract work with its own forces will not be considered a sound reason for rejecting a small business', DBE's MBE's, WBE's, VOSB's and/or SDVOSB's quote. Nothing in this provision shall be construed to require the bidder to accept unreasonable quotes in order to satisfy the participation goals.

13. Made an effort to offer assistance to or refer interested small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs to obtain the necessary equipment, supplies, materials, insurance and/or bonding to satisfy the work requirements of the bid proposal.

14. Made efforts to expand the search for small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs beyond the usual geographic boundaries.

15. Other – any other evidence that the bidder submits that may demonstrate that the bidder has made reasonable efforts to include small, DBE, MBE, WBE, VOSB and/or SDVOSB participation.

Bidder must document, with specificity, each of the efforts it made to include small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs as subcontractors in the procurement, including the date on which each effort was made, the medium through which each effort was made, and the outcome of each effort.

Note: Failure to submit the documentation requested in this section may be cause for rejection of bid. Bidders may include any other documentation deemed relevant to this requirement which is subject to review by the MBE Liaison. Documentation of Good Faith and Outreach Efforts must be submitted with the Bid, regardless of the proposed level of small, DBE, MBE, WBE, VOSB and/or SDVOSB participation in the procurement. If the Good Faith and Outreach Effort documentation is not submitted with the bid response, the bid may be rejected.

OUTREACH EFFORTS EVALUATION

Outreach efforts demonstrated by the bidder or respondent will be evaluated on a pass/fail basis.

ATTACHMENT A – SMALL AND DISADVANTAGED, MINORITY-, WOMEN-, AND VETERAN-OWNED BUSINESS OUTREACH PLAN

Proposer Name: _____ **Date:** _____

Project Name: _____ **Project Number:** _____

Contact Name: _____ **Telephone:** _____

Email: _____

The mission of the Minority Business Enterprise Program is to facilitate the full participation of disadvantaged businesses, minority-, women-, veteran-, and service-disabled veteran-owned businesses in the procurement process and to promote economic inclusion as a business imperative essential to the long -term economic viability of Lexington-Fayette Urban County Government.

To that end, small and disadvantaged businesses, including minority-, woman-, veteran-, and service-disabled veteran-owned businesses, must have an equal opportunity to be utilized in the performance of contracts with public funds spent from certain discretionary agreements. By submitting its offer, Bidder/Proposer certifies that it has taken, and if there are further opportunities will take, reasonable steps to ensure that small and disadvantaged businesses, including minority-, woman-, veteran-, and service-disabled veteran-owned businesses, are provided an equal opportunity to compete for and participate in the performance of any subcontracts resulting from this procurement.

The information submitted in response to this clause will not be considered in any scored evaluation. Failure to submit this form may cause the bid or proposal to be rejected.

Is the Bidder/ Proposer a certified firm? Yes ☐ No ☐

If yes, indicate all certification type(s):

DBE ☐ MBE ☐ WBE ☐ SBE ☐ VOSB/SDVOSB ☐

and supply a copy of the certificate and/or certification letter if not currently listed on the city's Minority Business Enterprise Program's (MBEP) certified list.

1. Include a list of firms that Bidder/ Proposer has had a contractual relationship with within the last two years that are minority-owned, woman-owned, veteran-owned or small businesses, regardless of their certification status.

Click or tap here to enter text.

2. Does Bidder/Proposer foresee any subcontracting opportunities for this procurement?

Yes ☐ No ☐

If no, please explain why in the field below. Do not complete the rest of this form and submit this first page with your bid and/or proposal. Click or tap here to enter text.

ATTACHMENT A – SMALL and DISADVANTAGED, MINORITY-, WOMEN-, and VETERAN-OWNED BUSINESS OUTREACH PLAN

If yes, please complete the following pages and submit all pages with your bid and/or proposal.

Describe the steps Bidder/Proposer took to solicit small and disadvantaged businesses, including MBEs, WBEs, VOSBs, and SDVOSBs, for subcontracting opportunities for this procurement.

3. Check the good faith and outreach efforts the Bidder/Proposer used to encourage the participation of small and disadvantaged businesses including, MBEs, WBEs, VOSBs and SDVOSBs:

- ☐ Bidder placed advertisements in search of prospective small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs for the solicitation.
- ☐ Bidder attended LFUCG Procurement Economic Inclusion Outreach event(s) within the past year.
- ☐ Bidder attended pre-bid and/or pre-proposal meetings for this solicitation.
- ☐ Bidder sponsored an Economic Inclusion Outreach event.
- ☐ Bidder requested a list of certified small, DBE, MBE, WBE, VOSB and/or SDVOSB subcontractors or suppliers from LFUCG.
- ☐ Bidder contacted organizations that work with small, DBE, MBE, WBE, VOSB and/or SDVOSB companies.
- ☐ Bidder sent written notices to certified small, DBE, MBE, WBE, VOSB and SDVOSB businesses.
- ☐ Bidder followed up to initial solicitations with interested small, DBE, MBE, WBE, VOSB and/or SDVOSB.
- ☐ Bidder provided small, DBE, MBE, WBE, VOSB and/or SDVOSB businesses interested in performing the solicited work with prompt access to the plans, specifications, scope of work, and requirements of the solicitation.
- ☐ Bidder made efforts to segment portions of the work to be performed by small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs, including dividing sub-bid/partnership opportunities into economically feasible units/parcels, to facilitate participation.
- ☐ Bidder negotiated in good faith with interested small, DBE, MBE, WBE, VOSB and/or SDVOSB businesses.

☐ Bidder provided adequate rationale for rejecting any small business', DBEs, MBEs, WBEs, VOSBs or SDVOSBs for lack of qualifications.

☐ Bidder offered assistance in obtaining bonding, insurance, financial, equipment, or other resources to small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs, in an effort to assist them in meeting project requirements.

☐ Bidder made efforts to expand the search for small businesses, DBEs MBEs, WBEs, VOSBs and/or SDVOSBs beyond the usual geographic boundaries.

☐ Bidder made other reasonable efforts to include small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs participation.

4. Bidder/Proposer must include documentation, including the date each effort was made, the medium through which each effort was made, and the outcome of each effort with this form, regardless of the level of small, DBE, MBE, WBE, VOSB and/or SDVOSB participation. Examples of required documentation include copies of email communications, copies of newspaper advertisements, or copies of quotations received from interested small businesses, DBEs, MBEs, WBEs, VOSBs or SDVOSBs.

Click or tap here to enter text.

For detailed information regarding outreach efforts that satisfy the MBE Program's requirements, please see "Documentation Required for Good Faith Efforts and Outreach Plans" page.

Note: The Bidder/Proposer must be willing to report the identity of each subcontractor and the value of each subcontract to MBEP if awarded a contract from this procurement.

Failure to submit the documentation requested may be cause for rejection of the bid. Bidders may include any other documentation deemed relevant to this requirement, which is subject to review by the MBE Liaison. Documentation of Good Faith and Outreach Efforts must be submitted with the bid, regardless of the proposed level of SBEs, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs participation in the procurement. If the Good Faith and Outreach Effort Form and associated documentation is not submitted with the bid response, the bid may be rejected.

The undersigned acknowledges that all information is accurate. Any misrepresentations may result in termination of the contract and/or be subject to applicable Federal and State laws concerning false statements and claims.

Company	**Company Representative**
Date	**Title**

1.25 OWNER PERMITS

A. Bidder shall refer to Section 00890 regarding permits that have been obtained by the OWNER.

1.26 GEOTECHNICAL DATA

A. There is no geotechnical data for this project.

END OF SECTION

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SECTION 00410

BID FORM - KIA

EAST HICKMAN PUMP STATION EXPANSION AND REHABILITATION DESIGN – PHASE 2 WASTEWATER SYSTEM IMPROVEMENTS

Division of Water Quality
Lexington-Fayette Urban County Government

LFUCG Bid No. 65-2025

1.01 GENERAL

Place: Lexington, Kentucky Date: June 12, 2025

The following Bid Form shall be followed exactly in submitting a Bid for this Work.

This Bid Form Submitted by Judy Construction Company

103 S Church Street, Cynthiana, KY 41031
(Name and Address of Bidder)

(Hereinafter called "Bidder"), organized and existing under the laws of the State of Kentucky,

doing business as Judy Construction Company, a corporation
"a corporation," "a partnership", or an "individual" as applicable

To: Lexington-Fayette Urban County Government
(Hereinafter called "Owner"
Office of the Director of Central Purchasing
200 East Main Street, Room 338
Lexington, KY 40507

The Bidder, in compliance with your Advertisement for Bids for the **East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2 Wastewater System Improvements**; Lexington, Kentucky, having examined the Contract Documents including the Plans and Specifications with related documents, having examined the site for proposed Work, and being familiar with all of the conditions and any and all addendums surrounding the construction of the proposed Project, including the availability of materials and labor, hereby proposes to furnish all labor, materials, and supplies, and to construct the Project in accordance with the Contract Documents, within the time set forth therein, and at the [lump sum prices] stated hereinafter. These prices are to cover all expenses incurred in performing the Work required under the Contract Documents, of which this Bid is a part.

The Bidder hereby agrees to commence Work under this Contract on a date to be specified in a written "Notice to Proceed" of the Owner and to substantially complete the Project within **365** days, consecutive calendar days. Bidder further agrees to pay liquidated damages, the sum of Three Thousand Dollars and Zero Cents ($3,000.00) for each consecutive day thereafter. If the Contractor's delay or failure to complete the project within the allowable Contract time, the Contractor is responsible for damages caused by loss of project grant funding. See Specification Section 01170 – Special Conditions for additional information.

The Bidder hereby acknowledges receipt of the following addenda:

Addendum No. 1 Date 05/23/25; Addendum No. ____ Date _____

Addendum No. 2 Date 06/02/25; Addendum No. ____ Date _____

Addendum No. 3 Date 06/05/25; Addendum No. ____ Date _____

Addendum No. ____ Date _____; Addendum No. ____ Date _____

Insert above the number and the date of any Addendum issued and received. If none has been issued and received, the word "NONE" should be inserted.

1.02 LEGAL STATUS OF BIDDER

A. *A corporation duly organized and doing business under the laws of the State of Kentucky, for whom Steve Judy, bearing the official title of President, whose signature is affixed to this Bid is duly authorized to execute contracts.

B. *A Partnership, all of the members of which, with addresses are: (Designate general partners as such)

_____

_____

_____

_____

C. *An individual, whose signature is affixed to this Bid. (Print name)

_____

_____

* The Bidder shall fill out the appropriate form and strike out the other two.

1.03 BIDDERS AFFIDAVIT

Comes the Affiant, Steve Judy, President, and after being first duly sworn, states under penalty of perjury as follows:

A. His/her name is Steve Judy and he/she is the individual submitting the Bid or is the authorized representative of Judy Construction Company, the entity submitting the Bid (hereinafter referred to as "Bidder").

B. Bidder will pay all taxes and fees, which are owed to the Lexington-Fayette Urban County Government at the time the Bid is submitted, prior to award of the Agreement and will maintain a "current" status in regard to those taxes and fees during the life of the Agreement.

C. Bidder will obtain a Lexington-Fayette Urban County Government business license, if applicable, prior to award of the Agreement.

D. Bidder has authorized the Division of Central Purchasing to verify the above-mentioned information with the Division of Revenue and to disclose to the Urban County Council that taxes and/or fees are delinquent or that a business license has not been obtained.

E. Bidder has not knowingly violated any provision of the campaign finance laws of the Commonwealth of Kentucky within the past five (5) years and the award of an Agreement to the Bidder will not violate any provision of the campaign finance laws of the Commonwealth.

F. Bidder has not knowingly violated any provision of Chapter 25 of the Lexington-Fayette Urban County Government Code of Ordinances, known as the "Ethics Act."

G. Bidder acknowledges that "knowingly" for purposes of this Affidavit means, with respect to conduct or to circumstances described by a statute or ordinance defining an offense, that a person is aware or should have been aware that his/her conduct is of that nature or that the circumstance exists.

Further, Affiant sayeth naught.

Affiant Signature Steve Judy, President

STATE OF KENTUCKY

COUNTY OF HARRISON

The foregoing instrument was subscribed, sworn to and acknowledged before me by Steve Judy on this the 12th day of June, 2025.

Jeanie Anness, Notary

NOTARY PUBLIC, STATE AT LARGE

My commission expires: August 1, 2027

1.04 BID SCHEDULE

A. The Bidder agrees to perform all the Work described in the Specifications and shown on the Plans for the following proposed lump sum and/or unit prices, if applicable, which shall include the furnishing of all labor, materials, supplies, equipment and/or vehicle usage, services, all items of cost, overhead, taxes (federal, state, local), and profit for the Contractor and any Subcontractor involved, within the time set forth herein. If unit prices are applicable, Bidder must make the extensions and additions showing the total amount of Bid. In all cases of discrepancies or math errors the amount written in for the unit price of an item shall govern.

B. If a discrepancy between the unit price and the item total exists, the unit price prevails except:

   If the unit price is illegible, omitted, or the same as the item total, item total prevails and the unit price is the quotient of the item total and the quantity.

   If the unit price and the item total are illegible or are omitted, the Bid may be determined nonresponsive. If a lump sum total price is illegible or is omitted, the Bid may be determined nonresponsive.

C. Preliminary indication all areas where potential ground modification strategies are anticipated or will be further explored by the Bidder upon award of the Contract.

D. For a lump sum based bid, the item total is the bid amount the Owner uses for bid comparison.

E. For a unit price based bid, the sum of the item totals is the bid amount the Owner uses for bid comparison.

F. The Bidder must indicate the base bid pipe material by circling the selected pipe material at the time of the submission of the Bid.

G. The Owner's decision on the bid amount is final.

BID SCHEDULE A – BASE BID

Item	Description	Qty	Unit	Unit Price	Item Price
1	Mobilization	1	LS	$40,000	$40,000
2	Bonds and Insurance	1	LS	$30,000	$30,000
3	General Requirements	1	LS	$75,000	$75,000
4	Demobilization	1	LS	$5,000	$5,000
5	Erosion and Sediment Control and Conformance with SWPPP	1	LS	$4,000	$4,000
6	East Hickman Pump Station Phase 2 demolition, modifications, pump replacement, screen removal, grinder pump installation, crane hoist, wet well connector piping, operations and controls and all other work shown on the Contract Documents	1	LS	$2,791,000	$2,791,000
TOTAL BID (Items 1 thru 6)				$2,945,000	

TOTAL BID AMOUNT:

Two Million Nine Hundred Forty Five Thousand Dollars

Dollars ($ $2,945,000 **)**

EQUIPMENT MANUFACTURER LIST

See completion requirement Notes 1 listed at the end of this section.

#	Equipment Item	Specification Section	Base Bid Equipment Manufacturer (circle one)
1	Pumps	11130	KSB Grundfos *Xylem/Flygt*[Add02]
2	Open Channel Grinders	11435	JWC Environmental, Inc (Channel Monster Flex)
7	Level Transmitters	17749	MJK (Pressure)
8	SCADA PLC	17120	Allen Bradley ControlLogix
11	Disconnect Switches	16440	Eaton Schneider (Square D) General Electric Company Siemens
18	Custom Control Panels		ADGO, Inc

Notes:

1. *Where more than one Base Bid equipment manufacturer is listed above, the Bidder has the option of including any of the listed manufacturers in the Base Bid.* ***The bidder must indicate the Base Bid equipment included in the Bid by circling the selected manufacturer at the time of the submission of the Bid.*** *The design has been completed using the first listed Base Bid equipment manufacturer (with exception on item No.1 pumps where both manufacturers were considered). Should the Bidder circle the second, third, or fourth Base Bid equipment, the Bidder, at no additional cost to the Owner, shall make any changes to structure, piping controls, electrical, instrumentation, architectural, mechanical, etc. that may be necessary to accommodate this equipment.*

Respectfully Submitted,

FIRM: Judy Construction Company

ADDRESS: 103 S Church Street

CITY/STATE/ZIP: Cynthiana, KY 41031

DATE: June 12, 2025

BY: _____ Steve Judy
(must be original signature)

TITLE: President

PHONE: 859-234-6900 FAX: 859-234-3480
(area code, number & extension)

EMAIL ADDRESS: sjudy@judycc.com

OFFICIAL ADDRESS AND PHONE:

103 S Church Street

PO Box 457

Cynthiana, KY 41031 (Seal if Bid is by Corporation)

By signing this form, you agree to all the terms and associated forms.

JUDY CONSTRUCTION COMPANY
CORPORATE
SEAL
CYNTHIANA, KY

1.05 STATEMENT OF BIDDER'S QUALIFICATIONS

The following statement of the Bidder's qualifications is required to be filled in, executed, and submitted with the Bid:

A. Name of Bidder: Judy Construction Company

B. Permanent Place of Business: 103 S. Church Street Cynthiana, KY 41031

C. When Organized: April 9, 1974

D. Where Incorporated: Kentucky

E. Financial Condition:

If specifically requested by the Owner, the apparent low Bidder is required to submit its latest three (3) years audited financial statements to the Owner's Division of Central Purchasing within seven (7) calendar days following the Bid opening.

F. In the event the Agreement is awarded to the undersigned, Performance, Payment, Erosion and Sediment Control, and Warranty bonds will be furnished by:

Continental Casualty Company (Surety)

Signed: Paula J. Teague (Representative of Surety)

Paula J. Teague, Atty-in-Fact



G. The following is a list of similar projects performed by the Bidder: (Attach separate sheet if necessary).

NAME	LOCATION	CONTRACT SUM
PLEASE SEE ATTACHED SCHEDULE A		

H. The Bidder has now under contract and bonded the following projects:

NAME	LOCATION	CONTRACT SUM
PLEASE SEE ATTACHED SCHEDULE B		

I. List Key Bidder Personnel who will work on this Project.

NAME	POSITION DESCRIPTION	NO. OF YEARS WITH BIDDER
	SEE ATTACHED SCHEDULE C	

J. MWDBE Participation on current bonded projects under contract:

SUBCONTRACTORS (LIST)	PROJECT (SPECIFIC TYPE)	MWDBE	% of WORK
	SEE ATTACHED SCHEDULE B		

(USE ADDITIONAL SHEETS IF NECESSARY)

K. We acknowledge that, if we are the apparent low Bidder, we may be required to submit to the Owner within seven (7) calendar days following the Bid Opening, a sworn statement regarding all office management and field management personnel. Additionally, if requested by the Owner, we will within seven (7) days following the request submit audited financial statements and loss history for insurance claims for the three (3) most recent years (or a lesser period if stipulated by the Owner)

Schedule A

JUDY CONSTRUCTION COMPANY
PREVIOUS EXPERIENCE

Project Name	Owner	Design Engineer	Year Completed	Description	Contract Price
Lexington, KY Town Branch Digester Complex Improvements Project	Lex-Fay Urban Co Govt Lexington, KY Emily Epperson (423) 298-7063	Strand Associates Lexington, KY Mike Davis (859) 225-8500	2020	Renovation of Three Sludge Digesters Including removing and renovation of lids	$9,806,311
Lexington, KY West Hickman Wet Weather Storage	Lex-Fay Urban Co Govt Lexington, KY Bob Peterson (859) 425-2438	Tetra Tech Lexington, KY Herb Lemaster (859) 223-8000	2019	New Headworks Facility, 70 MGD Influent PS, 80 MGD Wet Weather PS, 22 MGD Wet Weather Storage Tank	$59,637,457
Bowling Green, KY Water Treatment Plant Expansion	Bowling Green Municipal Utilities Mike Gardner (270) 535-4366	Smith Seckman Reid Nashville, TN Richard Chappell (615) 514-6161	2023	15MGD Expansion to Existing WTP Various new Process Structures	$44,522,804
Knoxville, TN New Melton Hill Wastewater Treatment Plant	West Knox Utilities Knoville, TN Drexel Heidel (865) 690-2521	GRW Engineers, Inc. Nashville, TN Lewis Robbins (615) 366-1600	2020	New 6 MGD Wastewater Treatment Plant	$41,271,082
Smyrna, TN Wastewater Treatment Plant Expansion	Town of Smyrna Smyrna, TN Mark Parker (615) 809-6014	Dempsey, Dilling & Assoc Smyrna, TN Jerome Dempsey (615) 220-5800	2023	Upgrading Existing 5.85 MGD WWTP Plant to 9 MGD Various other Upgrades	$34,840,684
Louisville, KY Nightingale Pump Station and CSO Storage Basin	Louisville & Jefferson County MSD Greg Powell (502) 540-6000	HDR Engineers Louisville, KY Kyle Guthrie (502) 909-3249	2018	New 33 MGD Pump Station & 7.7 MGD Below Grade Concrete Storage Basin	$34,004,002
Eastern Regional New Wastewater Treatment Plant	Sanitation Dist #1 of Northern, KY Chris Novak (859) 578-6885	GRW Engineers, Inc. Lexington, KY Brad Montgomery (859) 223-3999	2008	New 10 MGD Wastewater Treatment Plant	$32,401,493
Pigeon Forge, TN New Wastewater Treatment Plant	City of Pigeon Forge Pigeon Forge, TN Mark Miller (865) 429-7312	Smith Seckman Reid Nashville, TN Herby Rader (615) 347-0815	2015	New 6 MGD Wastewater Treatment Plant	$31,083,760
Richmond, KY Otter Creek New Wastewater Treatment Plant	Richmond Utilities Richmond, KY Scott Althauser (859) 623-2323	CDP Engineers, Inc. Lexington, KY Alan Robinson (859) 433-9585	2010	New 8 MGD Wastewater Treatment Plant	$30,638,157
Maryville, TN Const Mgmt Wastewater Treatment Treatment Plant Expansion	City of Maryville, TN Maryville, TN Baron Swafford (865) 273-3304	J.R Wauford & Company Nashville, TN Kevin Young (615) 883-3243	2010	CMAR Expansion from 10 to 17 MGD Wastewater Treatment. Plant	$30,599,224
Logan-Todd Regional Water Treatment Plant	Logan Todd Regional Water Comm Guthrie, KY Kyle Kenner (270) 483-6990	Strand Associates, Inc. Madison, WI Scott Sterns (608) 251-4843	2003	New 10 MGD Regional Membrane Filtration Water Treatment Plant	$26,905,678
Danville, KY Water Treatment Plant Expansion	City of Danville Danville, KY Earl Coffey (859) 326-0787	HDR Engineers Lexington, KY Brent Tippey (859) 629-4831	2017	Exp.from 10 to 12 MGD Various Filtration Systems	$23,988,669
Somerset, KY Water Treatment Plant Expansion	Somerset Water Department Somerset, KY Dana Whitis (606) 425-5364	Bell Engineering Lexington, KY David Schrader (859) 278-5412	2014	Exp. From 4 to 16 MGD Membrane Filtration	$22,732,469
Knoxville, TN Daugherty Water Treatment Plant Upgrade	West Knox Utilities Knoville, TN Drexel Heidel (865) 690-2521	GRW Engineers, Inc. Nashville, TN Lewis Robbins (615) 366-1600	2014	Exp. From 2 to 8 MGD Membrane Filtration	$17,292,026

Schedule B

JUDY CONSTRUCTION COMPANY

Work on Hand
May 31, 2025

Owner	Project	Project Amount	% Complete	DBE Participation %
Georgetown Munic Water & Sewer Georgetown, KY	Water Reclamation Plant No. 1 Upgrade & Expansion	$63,490,786	89.0%	1.1%
City of Clarksville Clarksville, TN	New Water Treatment Plant & Intake	$211,566,178	74.6%	0.6%
Morehead Utility Plant Board Morehead, KY	New Regional Water Treatment Plant	$32,638,809	98.2%	2.0%
City of Sevierville Sevierville, TN	McCorskey Island WWTP Expansion	$75,505,175	81.2%	21.0%
Lexington-Fayette Urban Co Govt Lexington, KY	Armstrong Mill Pump Station Replacement	$7,828,700	92.7%	1.9%
City of Columbia Columbia, TN	WWTP Renovation CMAR $95,279,796 GMP	$95,279,796	19.0%	TBD
City of Paris Paris, KY	Water Treatment Plant Improvements	3,343,045	37.3%	0.1%
Harison County Fiscal Court Cynthiana, KY	Design/Build Harrison Co Recreation Center	3,362,368	8.9%	1.3%
Water Authority of Dickson Co. Dickson, TN	Water Reclamation Plant Sewer Systems Inprovements	29,127,455	9.0%	3.2%
City of Ashland Ashland, KY	Water Booster Station Ashland, KY	2,773,000	3.6%	9.5%
City of Ashland Ashland, KY	Roberts Drive Screen Replacement	2,968,000	18.1%	2.1%
London Utility Commission London, KY	London Water Treatment Plant Improvements	3,307,000	0.0%	0.0%
Georgetown Munic Water & Sewer Georgetown, KY	Sanitary Sewer Collections New Operations Center	629,524	0.0%	0.0%
City of Versailles Versailles, KY	Water Treatment Plant Generator Installment	4,081,000	0.0%	0.1%

This is a true representation of our current work in progress.

BY: _____
Steve Judy, President

Schedule C

JUDY CONSTRUCTION COMPANY
Key Employees

Name	Position	Years of Const. Experience	Type of Work	In What Capacity
Steve Judy	President	39	General Construction	Executive Management
Ben Williams	Vice President	34	General Construction	Construction Management
James K. Cowley	Secretary/Treasurer	44	Accounting	Financial Management
Owen Yocum	Project Manager	45	General Construction	Construction Management
Danny Howard	Safety Director	25	General Construction	Occupational Safety
Ethan Arthur	Asst. Safety Director	8	General Construction	Occupational Safety
Tim Courtney	Engineer	28	General Construction	Civil Engineering
Kista Thomas	Engineer	25	General Construction	Civil Engineering
John Whalen	Engineer	24	General Construction	Civil Engineering
Paul Lawrence	Project Management	24	General Construction	Construction Management
Clay Arthur	Engineer	9	General Construction	Civil Engineering
Cameron Bess	Project Management	5	General Construction	Construction Management
Clinton Jones	Estimator	25	General Construction	Construction Management
Rob Cole	Fleet Manager	22	Construction Equipment	Equipment Management
Jeanie Anness	Office Manager	44	Clerical	Office Manager
Brad McKeel	Superintendent	47	General Construction	Construction Supervision
Darryl Wells	Superintendent	38	General Construction	Construction Supervision
Steven Sandlin	Superintendent	36	General Construction	Construction Supervision
Rick Thomas	Superintendent	32	General Construction	Construction Supervision
Charles Alverson	Superintendent	31	General Construction	Construction Supervision
Stewart Parmley	Superintendent	31	General Construction	Construction Supervision
Steve Sullivan	Superintendent	30	General Construction	Construction Supervision
Macy Gibson	Superintendent	24	General Construction	Construction Supervision
Nathan Robinson	Superintendent	24	General Construction	Construction Supervision
Matthew Keeton	Superintendent	24	General Construction	Construction Supervision

Detailed Resumes available on request.

1.06 LIST OF PROPOSED SUBCONTRACTORS

The following list of proposed subcontractors is required by the Owner to be executed, completed and submitted with the Bid Form. All subcontractors are subject to approval of the Lexington-Fayette Urban County Government. Failure to submit this list completely filled out may be cause for rejection of Bid.

BRANCH OF WORK** (List each major item)	SUBCONTRACTOR	MWDBE (yes/no)	% of WORK
1. Electrical	Name: AE Electrical Solutions	NO	2%
	Address: Frankfort, KY		
2.	Name:		
	Address:		
3.	Name:		
	Address:		
4.	Name:		
	Address:		
5.	Name:		
	Address:		
6.	Name:		
	Address:		

** Such as: Grading, asphalt paving, concrete, seeding and protection, construction staking, etc.

1.07 AUTHENTICATION OF BID AND STATEMENT OF NON-COLLUSION AND NON-CONFLICT OF INTEREST

I hereby swear (or affirm) under the penalty for false swearing:

A. That I am the Bidder (if the Bidder is an individual), a partner of the Bidder (if the Bidder is a partnership), or an officer or employee of the Bidding corporation having authority to sign on its behalf (if the Bidder is a corporation);

B. That the attached Bid has been arrived at by the Bidder independently, and has been submitted without collusion with, and without any agreement, understanding or planned common course of action, with any other contractor, vendor of materials, supplies, equipment or services described in the Advertisement for Bid, designed to limit independent bidding or competition;

C. That the contents of the Bid or Bids have not been communicated by the Bidder or its employees or agents to any person not an employee or agent of the Bidder or its surety on any bond furnished, with the Bid or Bids, and will not be communicated to any such person, prior to the official opening of the Bid or Bids;

D. That the Bidder is legally entitled to enter into the contracts with the Lexington-Fayette Urban County Government, and is not in violation of any prohibited conflict of interest;

E. (Applicable to corporation only) That as a foreign corporation, we are registered with the Secretary of State, Commonwealth of Kentucky, and authorized to do business in the State_____ or, that as a domestic corporation, we are in good standing with the Secretary of State, Commonwealth of Kentucky__✓__. [Check the statement applicable.]

F. This offer is for ninety (90) calendar days from the date this Bid is opened. In submitting the above, it is expressly agreed that, upon proper acceptance by the Lexington-Fayette Urban County Government of any or all items Bid above, an Agreement shall thereby be created with respect to the items accepted.

G. That I have fully informed myself regarding the accuracy of the statements made in this statement.

H. That I certify that Subcontractors have not and will not be awarded to any firm(s) that have been debarred from noncompliance with the Federal Labor Standards, Title VI of the Civil Rights Act of 1964 As Amended, Executive Order 11246 As Amended or any other Federal Law.

Judy Construction Company	June 12, 2025	Steve Judy, President
Company	Date	Representative

PLEASE SEE SCHEDULE C

1.08 STATEMENT OF EXPERIENCE

NAME OF INDIVIDUAL: _____

POSITION/TITLE: _____

STATEMENT OF EXPERIENCE: _____

_____

NAME OF INDIVIDUAL: _____

POSITION/TITLE: _____

STATEMENT OF EXPERIENCE: _____

_____

NAME OF INDIVIDUAL: _____

POSITION/TITLE: _____

STATEMENT OF EXPERIENCE: _____

_____

NAME OF INDIVIDUAL: _____

POSITION/TITLE: _____

STATEMENT OF EXPERIENCE: _____

_____

NAME OF INDIVIDUAL: _____

POSITION/TITLE: _____

STATEMENT OF EXPERIENCE: _____

_____

* Include all officers, office management, Affirmative Action officials, and field management personnel. Attach separate sheets if necessary.

1.09 EQUAL OPPORTUNITY AGREEMENT

The Law

* Title VII of the Civil Rights Act of 1964 (amended 1972) states that it is unlawful for an employer to discriminate in employment because of race, color, religion, sex, age (40-70 years) or national origin.

* Executive Order No. 11246 on Nondiscrimination under Federal contract prohibits employment discrimination by contractor and subcontractor doing business with the Federal Government or recipients of Federal funds. This order was later amended by Executive Order No. 11375 to prohibit discrimination on the basis of sex.

* Section 503 of the Rehabilitation Act of 1973 States:

  The Contractor will not discriminate against any employee or applicant for employment because of physical or mental handicap.

* Section 2012 of the Vietnam Era Veterans Readjustment Act of 1973 requires Affirmative Action on behalf of disabled veterans and veterans of the Vietnam Era by contractors having Federal Contracts.

* Section 206 (A) of Executive Order 12086, Consolidation of Contract Compliance Functions for Equal Employment Opportunity, states:

  The Secretary of Labor may investigate the employment practices of any Government contractor or sub-contractor to determine whether or not the contractual provisions specified in Section 202 of this order have been violated.

The Lexington-Fayette Urban County Government practices Equal Opportunity in recruiting, hiring and promoting. It is the Government's intent to affirmatively provide employment opportunities for those individuals who have previously not been allowed to enter into the mainstream of society. Because of its importance to the local Government, this policy carries the full endorsement of the Mayor, Commissioners, Directors, and all supervisory personnel. In following this commitment to Equal Employment Opportunity and because the Government is the benefactor of the Federal funds, it is both against the Urban County Government policy and illegal for the Government to let contracts to companies which knowingly or unknowingly practice discrimination in their employment practices. Violation of the above mentioned ordinances may cause an Agreement to be canceled and the contractor may be declared ineligible for future consideration.

Please sign this statement in the appropriate space acknowledging that you have read and understand the provisions contained herein. Return this document as part of your application packet.

Bidders

I/We agree to comply with the Civil Rights Laws listed above that govern employment rights of minorities, women, Vietnam veterans, handicapped, and aged persons.

Steve Judy, President

Signature

Judy Construction Company

Name of Business

The Entity (regardless of whether construction Contractor, non-construction Contractor or supplier) agrees to provide equal opportunity in employment for all qualified persons, to prohibit discrimination in employment because of race, color, creed, national origin, sex or age, and to promote equal employment through a positive, continuing program from itself and each of its sub-contracting agents. This program of equal employment opportunity shall apply to every aspect of its employment policies and practices.

The Kentucky Equal Employment Opportunity Act of 1978 (KRS 45.560-45.640) requires that any county, city, town, school district, water district, hospital district, or other political subdivision of the state shall include in directly or indirectly publicly funded contracts for supplies, materials, services, or equipment hereinafter entered into the following provisions:

During the performance of this contract, the contractor agrees as follows:

(1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, age or national origin;

(2) The contractor will state in all solicitations or advertisements for employees placed by or on behalf of the contractors that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, age or national origin;

(3) The contractor will post notices in conspicuous places, available to employees and applicants for employment, setting forth the provisions of the non-discrimination clauses required by this section; and

(4) The contractor will send a notice to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding advising the labor union or workers' representative of the contractor's commitments under the nondiscrimination clauses.

The Act further provides:

KRS 45.610. Hiring minorities - Information required

(1) For the length of the contract, each contractor shall hire minorities from other sources within the drawing area, should the union with which he has collective bargaining agreements be unwilling to supply sufficient minorities to satisfy the agreed upon goals and timetable.

(2) Each contractor shall, for the length of the contract, furnish such information as required by KRS 45.560 to KRS 45.640 and by such rules, regulations and orders issued pursuant thereto and will permit access to all books and records pertaining to his employment practices and work sites by the contracting agency and the department for purposes of investigation to ascertain compliance with KRS 45.560 to 45.640 and such rules, regulations and orders issued pursuant thereto.

KRS 45.620. Action against contractor - Hiring of minority contractor or subcontractor

(1) If any contractor is found by the department to have engaged in an unlawful practice under this chapter during the course of performing under a contract or subcontract covered under KRS 45.560 to 45.640, the department shall so certify to the contracting

agency and such certification shall be binding upon the contracting agency unless it is reversed in the course of judicial review.

(2) If the contractor is found to have committed an unlawful practice under KRS 45.560 to 45.640, the contracting agency may cancel or terminate the contract, conditioned upon a program for future compliance approved by the contracting agency and the department. The contracting agency may declare such a contractor ineligible to bid on further contracts with that agency until such time as the contractor complies in full with the requirements of KRS 45.560 to 45.640.

(3) The equal employment provisions of KRS 45.560 to 45.640 may be met in part by a contractor by subcontracting to a minority contractor or subcontractor. For the provisions of KRS 45.560 to 45.640, a minority contractor or subcontractor shall mean a business that is owned and controlled by one or more persons disadvantaged by racial or ethnic circumstances.

KRS 45.630 Termination of existing employee not required, when

Any provision of KRS 45.560 to 45.640 notwithstanding, no contractor shall be required to terminate an existing employee upon proof that that employee was employed prior to the date of the contract.

KRS 45.640 Minimum skills

Nothing in KRS 45.560 to 45.640 shall require a contractor to hire anyone who fails to demonstrate the minimum skills required to perform a particular job.

In the case of an Agreement exceeding $250,000, the Contractor will be required within seven (7) days following the Bid Opening to furnish evidence that its work-force in Kentucky is representative of the available work-force in the area from which it draws employees, or to supply an Affirmative Action plan which will achieve such representation during the life of the Contract.

TO BE PROVIDED UPON AWARD

LEXINGTON

1.10 LFUCG MWDBE PARTICIPATION FORM

LFUCG Bid/RFP/Quote Reference No. East Hickman PS Expansion & Rehabilitation Design
LFUCG Bid # 65-2025

The MWDBE and/or Veteran subcontractors listed have agreed to participate on this Bid/RFP/Quote. If any substitution is made or the total value of the Work is changed prior to or after the job is in progress, it is understood that those substitutions must be submitted to the Division of Procurement for approval immediately. **Failure to submit a completed form may cause rejection of the bid.**

MWBE Company, Name, Address, Phone, Email	DBE / MBE WBE / VOSB SDVOSB	Work to be Performed	Total Dollar Value of the Work	% Value of Total Contract
1.				
2.				
3.				
4.				

The undersigned company representative submits the above list of MDWBE firms to be used in accomplishing the work contained in this Bid/RFP/Quote. Any misrepresentation may result in the termination of the Contract and/or be subject to applicable Federal and State laws concerning false statements and false claims.

Judy Construction Company
Company

Company Representative

June 12, 2025
Date

Steve Judy, President
Title

LEXINGTON

1.11 LFUCG MWDBE SUBSTITUTION FORM

LFUCG Bid/RFP/Quote Reference No East Hickman PS Expansion & Rehabilitation Design - Phase 2 LFUCG BID NO: 65-2025

The substituted MWDBE and/or Veteran subcontractors listed below have agreed to participate on this Bid/RFP/Quote. These substitutions were made prior to or after the job was in progress. These substitutions were made for reasons stated below and are now being submitted to the Division of Procurement for approval. By the authorized signature of a representative of our company, we understand that this information will be entered into our file for this project. **Note: Form required if a subcontractor is being substituted on a contract.**

SUBSTITUTED DBE/MBE/WBE/VOSB Company Name, Address, Phone, Email	DBE/MBE/WBE/ VOSB/SDVOSB Formally Contracted/ Name, Address, Phone, Email	Work to Be Performed	Reason for the Substitution	Total Dollar Value of the Work	% Value of Total Contract

The undersigned acknowledges that any misrepresentation may result in termination of the Contract and/or be subject to applicable Federal and State laws concerning false statements and false claims.

Judy Construction Company
Company

Company Representative

June 12, 2025
Date

Steve Judy, President
Title

ATTACHMENT A – SMALL AND DISADVANTAGED, MINORITY-, WOMEN-, AND VETERAN-OWNED BUSINESS OUTREACH PLAN

Proposer Name:	Judy Construction Company	**Date:**	June 12, 2025
Project Name:	East Hickman PS Expansion & Rehabilitation Design - Phase 2	**Project Number:**	LFUCG BID NO: 65-2025
Contact Name:	Steve Judy, President	**Telephone:**	859-234-6900
Email:	sjudy@judycc.com		

The mission of the Minority Business Enterprise Program is to facilitate the full participation of disadvantaged businesses, minority-, women-, veteran-, and service-disabled veteran-owned businesses in the procurement process and to promote economic inclusion as a business imperative essential to the long -term economic viability of Lexington-Fayette Urban County Government.

To that end, small and disadvantaged businesses, including minority-, woman-, veteran-, and service-disabled veteran-owned businesses, must have an equal opportunity to be utilized in the performance of contracts with public funds spent from certain discretionary agreements. By submitting its offer, Bidder/Proposer certifies that it has taken, and if there are further opportunities will take, reasonable steps to ensure that small and disadvantaged businesses, including minority-, woman-, veteran-, and service-disabled veteran-owned businesses, are provided an equal opportunity to compete for and participate in the performance of any subcontracts resulting from this procurement.

The information submitted in response to this clause will not be considered in any scored evaluation. Failure to submit this form may cause the bid or proposal to be rejected.

Is the Bidder/ Proposer a certified firm? Yes ☐ No ☑

If yes, indicate all certification type(s):

DBE ☐ MBE ☐ WBE ☐ SBE ☐ VOSB/SDVOSB ☐

and supply a copy of the certificate and/or certification letter if not currently listed on the city's Minority Business Enterprise Program's (MBEP) certified list.

1. Include a list of firms that Bidder/ Proposer has had a contractual relationship with within the last two years that are minority-owned, woman-owned, veteran-owned or small businesses, regardless of their certification status.

(See Attached Schedule D)

2. Does Bidder/Proposer foresee any subcontracting opportunities for this procurement?

Yes ☑ No ☐

If no, please explain why in the field below. Do not complete the rest of this form and submit this first page with your bid and/or proposal. (Click or tap here to enter text.)

ATTACHMENT A – SMALL and DISADVANTAGED, MINORITY-, WOMEN-, and VETERAN-OWNED BUSINESS OUTREACH PLAN

If yes, please complete the following pages and submit all pages with your bid and/or proposal.

Describe the steps Bidder/Proposer took to solicit small and disadvantaged businesses, including MBEs, WBEs, VOSBs, and SDVOSBs, for subcontracting opportunities for this procurement.

3. Check the good faith and outreach efforts the Bidder/Proposer used to encourage the participation of small and disadvantaged businesses including, MBEs, WBEs, VOSBs and SDVOSBs:

☑ Bidder placed advertisements in search of prospective small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs for the solicitation.

☑ Bidder attended LFUCG Procurement Economic Inclusion Outreach event(s) within the past year.

☑ Bidder attended pre-bid and/or pre-proposal meetings for this solicitation.

☐ Bidder sponsored an Economic Inclusion Outreach event.

☑ Bidder requested a list of certified small, DBE, MBE, WBE, VOSB and/or SDVOSB subcontractors or suppliers from LFUCG.

☑ Bidder contacted organizations that work with small, DBE, MBE, WBE, VOSB and/or SDVOSB companies.

☑ Bidder sent written notices to certified small, DBE, MBE, WBE, VOSB and SDVOSB businesses.

☑ Bidder followed up to initial solicitations with interested small, DBE, MBE, WBE, VOSB and/or SDVOSB.

☑ Bidder provided small, DBE, MBE, WBE, VOSB and/or SDVOSB businesses interested in performing the solicited work with prompt access to the plans, specifications, scope of work, and requirements of the solicitation.

☑ Bidder made efforts to segment portions of the work to be performed by small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs, including dividing sub-bid/partnership opportunities into economically feasible units/parcels, to facilitate participation.

☑ Bidder negotiated in good faith with interested small, DBE, MBE, WBE, VOSB and/or SDVOSB businesses.

☑ Bidder provided adequate rationale for rejecting any small business', DBEs, MBEs, WBEs, VOSBs or SDVOSBs for lack of qualifications.

☑ Bidder offered assistance in obtaining bonding, insurance, financial, equipment, or other resources to small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs, in an effort to assist them in meeting project requirements.

☑ Bidder made efforts to expand the search for small businesses, DBEs MBEs, WBEs, VOSBs and/or SDVOSBs beyond the usual geographic boundaries.

☑ Bidder made other reasonable efforts to include small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs participation.

4. Bidder/Proposer must include documentation, including the date each effort was made, the medium through which each effort was made, and the outcome of each effort with this form, regardless of the level of small, DBE, MBE, WBE, VOSB and/or SDVOSB participation. Examples of required documentation include copies of email communications, copies of newspaper advertisements, or copies of quotations received from interested small businesses, DBEs, MBEs, WBEs, VOSBs or SDVOSBs.

See Attached Documentation

(Click or tap here to enter text.)

For detailed information regarding outreach efforts that satisfy the MBE Program's requirements, please see "Documentation Required for Good Faith Efforts and Outreach Plans" page.

Note: The Bidder/Proposer must be willing to report the identity of each subcontractor and the value of each subcontract to MBEP if awarded a contract from this procurement.

Failure to submit the documentation requested may be cause for rejection of the bid. Bidders may include any other documentation deemed relevant to this requirement, which is subject to review by the MBE Liaison. Documentation of Good Faith and Outreach Efforts must be submitted with the bid, regardless of the proposed level of SBEs, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs participation in the procurement. If the Good Faith and Outreach Effort Form and associated documentation is not submitted with the bid response, the bid may be rejected.

The undersigned acknowledges that all information is accurate. Any misrepresentations may result in termination of the contract and/or be subject to applicable Federal and State laws concerning false statements and claims.

Judy Construction Company	
Company	**Company Representative**
June 12, 2025	Steve Judy, President
Date	**Title**

JUDY CONSTRUCTION COMPANY
EAST HICKMAN PUMP STATION EXPANSION AND REHABILITATION DESIGN – PHASE 2
SCHEDULE D

Judy Construction Company current contractual relationships with minority-owned, woman-owned, veteran-owned and small businesses.

- Cedar Valley Seeding, Inc.
- Hek Glass, Inc.
- Herb Geddes Fence Company
- HTA Enterprises, Inc.
- Lykins Reinforcing, Inc.
- McKinney Painting, Inc.
- N.H. Stone, Inc.
- Philmor Contracting, Inc.
- Service One, Inc.
- TEM Group, Inc.

East Hickman PS Expansion & Rehab
Lexington, KY

6/12/2025

VENDOR	PHONE	Cert. Letter Sent	Interested	Spoke With
A&A Concrete	502-995-7500	5/28/2025	No	Melissa Malone
Core Drilling				
Abbie Jones	859-699-3440	5/28/2025	No	Michelle Pennington
Surveying				
Cedar Valley Seeding	859-749-8006	5/28/2025	Yes	Susan Redmon
Erosion/Seeding/Landscaping				
HB Masonry	859-624-0741	5/28/2025	Yes	Sherry Alexander
Masonry				
JAG, Inc	859-523-7507	5/28/2025	No	Gena Ruth
Fencing/Steel Tying				
Lykins Reinforcing	502-634-5030	5/28/2025	Yes	Rick Lykins
Reinforcing Steel				
M&M Manufacturing	270-586-8208	5/28/2025	Yes	Jessica Vaughn
Misc. Metals				
McKinney Painting	859-873-6424	5/28/2025	Yes	Matt Gamlin
Painting				
NH Stone	606-247-2311	5/28/2025	No	Vicki Quisenberry
Fence, Seeding				
TEM Electric	502-454-0101	5/28/2025	No	Carson Sullivan
Electrical				
SBA KY District Office		5/28/2025	N/A	
Diversity Business Liaison		5/28/2025	N/A	
KY APEX Accelerator		5/28/2025	N/A	

JUDY Construction Co.
EMPLOYEE 100% OWNED
P.O. BOX 457 CYNTHIANA, KENTUCKY 41031
Telephone (859) 234-6900 Fax (859) 234-3480
www.judycc.com

May 27, 2025

SBA KY District Office
600 Dr. MLK, Jr Place Room 188
Louisville, KY 40202

Ref: East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2
Lexington, KY

Dear Estimator:

We will be bidding as prime contractor to the Lexington-Fayette Urban County Government (LFUCG) on the above referenced project on June 12, 2025.

We are interested in receiving subcontract bids on the following categories of work:

Seeding, Masonry, Miscellaneous Fabricated Metals, Plumbing, Painting, Electrical, Paving, and Reinforced Steel Installation

The plans and specifications for this project can be seen by stopping at our office in Cynthiana, KY, or by contacting the estimator listed below for access to digital plans on our website.

We would appreciate your scope of work and price being submitted to us before June 11, 2025 for review and discussion (if necessary). **Please check the appropriate space, indicating your interest or not, and return to us by fax (859-234-3480) or email at mccoy@judycc.com**

Yes, I am interested _____ No, I am not interested _____

If you are interested in any portion of this project, please contact our office and we will provide specific quantities, description of the work and any additional details you may require. If you cannot quote a complete portion of the work listed above, please notify us in advance so that this can be discussed.
Should you require assistance with providing the required insurance, bonding, or have any other concerns, please let us know.

If we can be of help in any way, do not hesitate to contact the undersigned.

Sincerely,

Clinton Jones

Clinton Jones

JUDY Construction Co.
EMPLOYEE 100% OWNED
P.O. BOX 457 CYNTHIANA, KENTUCKY 41031
Telephone (859) 234-6900 Fax (859) 234-3480
www.judycc.com

May 27, 2025

Diversity Business Liaison
Capital Projects, 3rd Floor CPO
312 Rosa L Parks Ave.
Nashville, TN 37243

Ref: East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2
Lexington, KY

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Sincerely,

Clinton Jones

Clinton Jones

KAHC

JUDY Construction Co.
EMPLOYEE 100% OWNED

P.O. BOX 457 CYNTHIANA, KENTUCKY 41031
Telephone (859) 234-6900 Fax (859) 234-3480
www.judycc.com

May 27, 2025

T.E.M. Group, Inc.
3560 Bashford Ave., Suite 100
Louisville, KY 40218

Ref: East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2
Lexington, KY

Dear Estimator:

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www.judycc.com

May 27, 2025

Lykins Reinforcing Steel
P.O. Box 21325
Louisville, KY 40221

Ref: East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2
Lexington, KY

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100% EMPLOYEE OWNED
P.O. BOX 457 CYNTHIANA, KENTUCKY 41031
Telephone (859) 234-6000 Fax (859) 234-3480
www.judycc.com

May 27, 2025

McKinney Painting
104 Industry Drive
Versailles, KY 40383

Ref: East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2
Lexington, KY

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EMPLOYEE 100% OWNED

P.O. BOX 457 CYNTHIANA, KENTUCKY 41031
Telephone (859) 234-6900 Fax (859) 234-3480
www.judycc.com

May 27, 2025

M & M Manufacturing
709 Sportsman Lake Road
Franklin, KY 42134

Ref: East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2
Lexington, KY

Dear Estimator:

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Clinton Jones

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EMPLOYEE 100% OWNED

P.O. BOX 457 CYNTHIANA, KENTUCKY 41031
Telephone (859) 234-6900 Fax (859) 234-3480
www.judycc.com

May 27, 2025

A & A Concrete
P.O. Box72282
Louisville, KY 40272

Ref: East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2
Lexington, KY

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www.judycc.com

May 27, 2025

Abbie Jones
1022 Fontaine Road
Lexington, KY40509

Ref: East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2
Lexington, KY

Dear Estimator:

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EMPLOYEE 100% OWNED
P.O. BOX 457 CYNTHIANA, KENTUCKY 41031
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www.judycc.com

May 27, 2025

Cedar Valley Seeding
851 Redmon Road
Paris, KY 40361

Ref: East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2
Lexington, KY

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P.O. BOX 457 CYNTHIANA, KENTUCKY 41031
Telephone (859) 234-6900 Fax (859) 234-3480
www.judycc.com

May 27, 2025

N.H. Stone
P.O. Box 239
Sharpsburg, KY 40374

Ref: East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2
Lexington, KY

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Sincerely,

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Clinton Jones

JUDY Construction Co.
EMPLOYEE 100% OWNED
P.O. BOX 457 CYNTHIANA, KENTUCKY 41031
Telephone (859) 234-6900 Fax (859) 234-3480
www.judycc.com

May 27, 2025

HB Masonry
1024 Fortune Drive
Richmond, KY 40475

Ref: East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2
Lexington, KY

Dear Estimator:

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Sincerely,

Clinton Jones

Clinton Jones

JUDY Construction Co.
EMPLOYEE 100% OWNED
P.O. BOX 467 CYNTHIANA, KENTUCKY 41031
Telephone (859) 234-6900 Fax (859) 234-3480
www.judycc.com

May 27, 2025

JAG, Inc
657 Bayswater Way
Lexington, KY 40503

Ref: East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2
Lexington, KY

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Telephone (859) 234-6900 Fax (859) 234-3460
www.judycc.com

May 27, 2025

Herald Leader
Lexington, KY

TO WHOM IT MAY CONCERN:

We request that the following ad be run in your paper in the "Bids/Proposals" section:

NOTICE TO SUBCONTRACTORS (Bold Print Please)

Judy Construction Company is bidding as a general contractor to the Lexington-Fayette Urban County Government (LFUCG) on the East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2 project on June 12, 2025. Opportunities exist for the following trades: Seeding, Masonry, Miscellaneous Fabricated Metals, Plumbing, Painting, Electrical, Paving, and Reinforced Steel Installation. Subcontractors should contact our office (859) 234-6900. The plans and specifications for this project can be seen by stopping at our office in Cynthiana, KY, or by contacting our estimator for access to digital plans on our website. Minorities are encouraged to apply.

AN EQUAL OPPORTUNITY ORGANIZATION

We would appreciate it if you would run this ad in your next available edition.

Please send a copy of the ad to our office to the attention of the undersigned. All billing information appears on the top of this letter.

Thank you,

Clinton Jones

Clinton Jones

CJ/mc

McClatchy

The Beaufort Gazette
The Belleville News-Democrat
Bellingham Herald
Centre Daily Times
Sun Herald
Idaho Statesman
Bradenton Herald
The Charlotte Observer
The State
Ledger-Enquirer
Durham | The Herald-Sun
Fort Worth Star-Telegram
The Fresno Bee
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Miami Herald
El Nuevo Herald
The Modesto Bee
The Sun News - Myrtle Beach
Raleigh News & Observer
Rock Hill | The Herald
The Sacramento Bee
San Luis Obispo Tribune
Tacoma | The News Tribune
Tri-City Herald
The Wichita Eagle
The Olympian

AFFIDAVIT OF PUBLICATION

Account #	Order Number	Identification	Order PO	Cols	Depth
21943	665978	Print Legal Ad-IPL02356010 - IPL0235601		1	24 L

Attention: Jim Cowley
JUDY CONSTRUCTION COMPANY
PO BOX 457
CYNTHIANA, KY 41031

mccoy@judycc.com

NOTICE TO SUBCONTRACTORS
Judy Construction Company is bidding as a general contractor to the Lexington-Fayette Urban County Government (LFUCG) on the East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2 project on June 12, 2025. Opportunities exist for the following trades: Seeding, Masonry, Miscellaneous Fabricated Metals, Plumbing, Painting, Electrical, Paving, and Reinforced Steel Installation. Subcontractors should contact our office (859) 234-6900. The plans and specifications for this project can be seen by stopping at our office in Cynthiana, KY, or by contacting our estimator for access to digital plans on our website. Minorities are encouraged to apply.
AN EQUAL OPPORTUNITY ORGANIZATION
IPL0235601
May 29 2025

STATE OF)

KENTUCKY) AFFIDAVIT

COUNTY OF FAYETTE)

I, Mary Castro makes oath that the advertisement, was published in the Lexington Herald- Leader, a newspaper in Fayette County, State and County aforesaid, in the issue(s) of

1 insertion(s) published on:
05/29/25

Mary Castro

Legal Clerk

Sworn to and subscribed before me this 29th day of May in the year of 2025

Amy Robbins

Notary Public in and for the state of South Carolina, residing in Beaufort County

AMY L. ROBBINS
NOTARY PUBLIC
SOUTH CAROLINA
MY COMMISSION EXPIRES 11-03-32

Extra charge for lost or duplicate affidavits.
Legal document please do not destroy!

JUDY Construction Co.
EMPLOYEE 100% OWNED
P.O. BOX 457 CYNTHIANA, KENTUCKY 41031
Telephone (859) 234-6900 Fax (859) 234-3480
www.judycc.com

May 27, 2025

Richmond Register
Richmond KY, KY

TO WHOM IT MAY CONCERN:

We request that the following ad be run in your paper in the "Bids/Proposals" section:

NOTICE TO SUBCONTRACTORS (Bold Print Please)

Judy Construction Company is bidding as a general contractor to the Lexington-Fayette Urban County Government (LFUCG) on the East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2 project on June 12, 2025. Opportunities exist for the following trades: Seeding, Masonry, Miscellaneous Fabricated Metals, Plumbing, Painting, Electrical, Paving, and Reinforced Steel Installation. Subcontractors should contact our office (859) 234-6900. The plans and specifications for this project can be seen by stopping at our office in Cynthiana, KY, or by contacting our estimator for access to digital plans on our website. Minorities are encouraged to apply.

AN EQUAL OPPORTUNITY ORGANIZATION

We would appreciate it if you would run this ad in your next available edition.

Please send a copy of the ad to our office to the attention of the undersigned. All billing information appears on the top of this letter.

Thank you,

Clinton Jones

Clinton Jones

CJ/mc

From: Pamela Bowlin
To: Mary Coy
Subject: Re: East Hickman PS Expansion
Date: Wednesday, May 28, 2025 8:54:46 AM

This sender is trusted.

I will get it in for Thursdays paper

On 5/27/2025 1:45 PM, Mary Coy wrote:

> Pam,
>
> Please see the attached and run it in the next available edition.
>
> Let me know if you have any questions.
>
> Thanks!
>
> Mary Charles
>
> **Mary Charles Coy**
> Judy Construction Company
> P.O. Box 457
> 103 S. Church St. | Cynthiana, KY 41031
> Tel: 859-234-6900 | Fax: 859-234-3480
> mccoy@judycc.com
> www.judycc.com



--
Pam Bowlin, Office and Sales Coordinator
Richmond Register/Madison Magazine
859-624-6606 or pbowlin@richmondregister.com

859-623-1669 Richmond Register Classifieds

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165 Public Notices

Carol's Wrecker Service
257 East Irvine St.
Richmond, KY 40475
859-623-2265
This is a public notice that a application was filed on or about June 6, 2025 for a motor vehicle storage and / or SALVAGE/JUNK/SCRAP permit for the following vehicle:
2007 Silver Honda Elantra
Owners
Erica Bolden & Jacob Smith
231 Commerce Rd.
Richmond, KY 40475
lienholder
Prestige Financial
311 West Opportunity
Draper, UT 84020

390 Furniture

2 Mid Century Lane Coffee Tables
Vahisa VA
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455 Misc Merchandise

SALE
ITEMS FOR SALE
2 riding mowers $350 ea
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2bd, 1 bath
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Call 859-625-0917

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NOTICE TO SUBCONTRACTORS

Judy Construction Company, Inc. of Mayfield, Kentucky is a general contractor for the Lexington-Fayette Urban County Government (LFUCG) for the East Hickman Pump Station Expansion and Force Main Project - Phase 1 project no. 2022-12. Opportunities exist for the following trades: Sanitary, Miscellaneous Submerged Metals, Plumbing, Painting, Electrical, Paving, and Reinforced Steel Installation. Subcontractors should contact our office at (859) 234-4900. The plans and specifications for this project may be seen by stopping at our office in Cynthiana, KY, or by contacting our estimator for access to digital plans or our website. Multiple bids are encouraged to apply.

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Sell your car in the Richmond Register.
623-1669

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1 and 2 bedroom Apartments
range, refrigerator, NO PETS
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ALL REAL ESTATE ADVERTISING IN THIS NEWSPAPER IS Subject to the Fair Housing Act which makes it illegal to advertise "any preference, limitation or discrimination based on race, color, religion, sex, handicap, familial status or national origin, or intention, to make any such preference, limitation or discrimination." Familial status includes children under the age of 18 living with parents or legal custodians, pregnant women and people securing custody of children under 18. This newspaper will not knowingly accept any advertising for real estate which is in violation of the law. Our readers are hereby informed that all dwellings advertised in this newspaper are available on an equal opportunity basis.

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Online Only Auction
MATT & SARAH ABRAMS' HOUSE & LOT
BIDDING ENDS FRIDAY, MAY 30TH @ 6 P.M.
3192 POOSEY RIDGE RD., RICHMOND
NEAR KENTUCKY RIVER





This home has 3 bedrooms, 1 bathroom, den & bath on the first floor. There is a large bedroom or multi purpose room on the second floor. This house has carpet, laminated and vinyl flooring, vinyl exterior and metal roof. Central heat & air, kitchen cabinetry and much more. The lot measures approx. 2/10 acre. In addition to the house, there is a barn.

AUCTIONEER'S NOTE: If you're looking for a property in the country near the river, close to the boat ramp, check this one out. Ideal for a home or rental.

PREVIEW: Friday, May 23rd & 30th from 4-6 p.m.

NOTE: The purchaser of a single family residence built before 1978 has a minimum of 10 days to inspect the property of lead-based paint. The period for inspections begins May 20th through May 30th. The successful bidder must sign a waiver of the 10 day inspection period.

AUCTION PREMIUM: A 10% Auction Premium will be added to the winning bid to determine the final sale price.

TERMS: 20% down day of sale with 48 hours of close of bidding, with balance in 30 days with deed.

Auctioneer/Broker/Seller Disclaimer: The information contained herein is believed to be correct to the best of the auctioneer's knowledge. The information is being provided for the bidder's convenience and it is the bidder's responsibility to determine the information correct and if error is accurate and complete. The property is being sold "as is" and does not warrant any expressed or implied.

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Noah Schwartz 859-432-2294

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Telephone (859) 234-6900 Fax (859) 234-3480
www.judycc.com

BID Notification/Solicitation

General title of work RFP for DBE Subcontracting & Materials
Solicitor's POC and title: Clinton Jones, Estimator

Today's Date:	**May 27, 2025**
Solicitor's Name:	**Judy Construction Company**
Solicitor's Address:	**P.O. Box 457**
City:	**Cynthiana, KY 41031**

BID DUE DATE: **June 12, 2025**

BID DUE TIME: **2:00 pm (Local Time)**

Judy Construction Company is inviting quotes on the following.

Project:

East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2

Project Location:

Lexington, KY

Proposal or Quotes Requested for the following work:

Seeding, Masonry, Miscellaneous Fabricated Metals, Plumbing, Painting, Electrical, Paving, and Reinforced Steel Installation

DBEs, WOSBs, MBEs and VOSBs are strongly encouraged to bid

Solicitation and other documents available at the following location(s):

www.judycc.com and at our office: 103 South Church Street, Cynthiana, KY 41031

Project Contact Information:

Name: Clinton Jones

Phone: 859-234-6900

Email: cjones@judyconstructionco.com

From: KY APEX Accelerator
To: Mary Coy
Cc: KY APEX Accelerator
Subject: RE: East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2 Bid Date 6/12/25
Date: Tuesday, June 3, 2025 4:01:59 PM

This sender is trusted.

Thanks Mary, we will post this opportunity to our Bid Notice Center this week.

DISCLAIMER:
AT THIS TIME, WE ARE MANAGING AN INFLUX OF BID NOTICE SUBMISSIONS FROM ACROSS THE STATE. WE WILL DO OUR BEST TO ADVERTISE ALL OPPORTUNITIES SENT TO US BUT CANNOT GUARANTEE ADVERTISEMENT WITHIN A SHORT TIMETABLE. WE REQUEST A MINIMUM OF 10 BUSINESS DAYS BETWEEN SUBMISSION OF BID NOTICE AND BID DUE DATE.

MANUAL UPLOADING OF BID NOTICES INTO OUR AUTOMATED BID MATCH SYSTEM IS A SUPPLEMENTAL SERVICE THAT WE CURRENTLY PROVIDE TO PRIME CONTRACTORS, LOCAL GOVERNMENT AGENCIES AND GOVERNMENT-FUNDED GRANT RECIPIENTS, ABOVE AND BEYOND THE BID NOTICE DATA AUTOMATICALLY PULLED FROM A VARIETY OF AGENCY WEBSITES BY OUR AUTOMATED SYSTEM. WE RESERVE THE RIGHT TO SUSPEND THIS MANUAL UPLOAD SERVICE – EITHER TEMPORARILY OR PERMANENTLY – AT ANY TIME AS DEEMED NECESSARY BY OUR ORGANIZATIONAL LEADERSHIP.

Anna Leigh O'Brien, PMP
Senior Communications Coordinator
The Kentucky APEX Accelerator
aobrien@kstc.com
(859) 259-0986

This APEX Accelerator is funded in part through a cooperative agreement with the Department of Defense.

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Click here to register as a client or log in to your account.

From: Mary Coy <mccoy@judycc.com>
Sent: Tuesday, May 27, 2025 1:52 PM
To: Anna Leigh O'Brien <aobrien@kstc.com>; KY APEX Accelerator <kyapex@kstc.com>
Subject: East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2 Bid Date 6/12/25

Anna,

Please see the attached and distribute to your clients.

Thank you,

Mary Charles

Mary Charles Coy
Judy Construction Company
P.O. Box 457
103 S. Church St. | Cynthiana, KY 41031
Tel: 859-234-6900 | Fax: 859-234-3480
mccoy@judycc.com
www.judycc.com



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Si T.E.M. Group, Inc.
Ci 3560 Bashford Ave., Suite 100
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City, St P.O. Box 21325
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City, S 709 Sportsman Lake Road
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MAY 29 2025

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Abbie Jones
1022 Fontaine Road
Lexington, KY40509

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N.H. Stone
P.O. Box 239
Sharpsburg, KY 40374

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HB Masonry
1024 Fortune Drive
Richmond, KY 40475

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JAG, Inc
657 Bayswater Way
Lexington, KY 40503

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E. Hickman PS

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- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

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SBA KY District Office
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Louisville, KY 40202

9590 9402 8365 3156 7576 04

2. Article Number *(Transfer from service label)*
9589 0710 5270 0189 8121 18

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X [signature] ☐ Agent ☐ Addressee

B. Received by *(Printed Name)* Robert Coffey C. Date of Delivery 12.3.25

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
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- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Cedar Valley Seeding
851 Redmon Road
Paris, KY 40361

9590 9402 8365 3156 7576 80

2. Article Number *(Transfer from service label)*
9589 0710 5270 0189 8121 94

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X [signature] ☐ Agent ☐ Addressee

B. Received by *(Printed Name)* C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☐ Adult Signature
☐ Adult Signature Restricted Delivery
☐ Certified Mail®
☐ Certified Mail Restricted Delivery
☐ Collect on Delivery
☐ Collect on Delivery Restricted Delivery
☐ Insured Mail
☐ Priority Mail Express®
☐ Registered Mail™
☐ Registered Mail Restricted Delivery
☐ Signature Confirmation™
☐ Signature Confirmation Restricted Delivery

PS Form 3811, July 2020 PSN 7530-02-000-9053 Domestic Return Receipt

E. Hickman PS

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

HB Masonry
1024 Fortune Drive
Richmond, KY 40475

9590 9402 8365 3156 7575 98

2. Article Number *(Transfer from service label)*
9589 0710 5270 0189 8122 17

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X ☐ Agent ☐ Addressee

B. Received by *(Printed Name)* C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☐ Adult Signature
☐ Adult Signature Restricted Delivery
☐ Certified Mail®
☐ Certified Mail Restricted Delivery
☐ Collect on Delivery
☐ Collect on Delivery Restricted Delivery
☐ Priority Mail Express®
☐ Registered Mail™
☐ Registered Mail Restricted Delivery
☐ Signature Confirmation™
☐ Signature Confirmation Restricted Delivery

PS Form 3811, July 2020 PSN 7530-02-000-9053 Domestic Return Receipt

E. Hickman PS

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Lykins Reinforcing Steel
P.O. Box 21325
Louisville, KY 40221

9590 9402 8365 3156 7576 35

2. Article Number *(Transfer from service label)*

9589 0710 5270 0189 8121 49

COMPLETE THIS SECTION ON DELIVERY

A. Signature

X [signature] ☐ Agent ☐ Addressee

B. Received by *(Printed Name)* Rick Lykins C. Date of Delivery

D. Is delivery address different from Item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
- ☐ Adult Signature
- ☐ Adult Signature Restricted Delivery
- ☐ Certified Mail®
- ☐ Certified Mail Restricted Delivery
- ☐ Collect on Delivery
- ☐ Collect on Delivery Restricted Delivery
- ☐ Priority Mail Express®
- ☐ Registered Mail™
- ☐ Registered Mail Restricted Delivery
- ☐ Signature Confirmation™
- ☐ Signature Confirmation Restricted Delivery

Restricted Delivery

PS Form 3811, July 2020 PSN 7530-02-000-9053 Domestic Return Receipt

E. Hickman PS

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

M & M Manufacturing
709 Sportsman Lake Road
Franklin, KY 42134

9590 9402 8365 3156 7576 59

2. Article Number *(Transfer from service label)*

9589 0710 5270 0189 8121 63

COMPLETE THIS SECTION ON DELIVERY

A. Signature

X [signature] ☐ Agent ☐ Addressee

B. Received by *(Printed Name)* J Vaughn C. Date of Delivery 6/2/25

D. Is delivery address different from Item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
- ☐ Adult Signature
- ☐ Adult Signature Restricted Delivery
- ☐ Certified Mail®
- ☐ Certified Mail Restricted Delivery
- ☐ Collect on Delivery
- ☐ Collect on Delivery Restricted Delivery
- ☐ Priority Mail Express®
- ☐ Registered Mail™
- ☐ Registered Mail Restricted Delivery
- ☐ Signature Confirmation™
- ☐ Signature Confirmation Restricted Delivery

Mail
Mail Restricted Delivery
500)

PS Form 3811, July 2020 PSN 7530-02-000-9053 Domestic Return Receipt

E. Hickman PS

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

McKinney Painting
104 Industry Drive
Versailles, KY 40383

9590 9402 8365 3156 7576 42

2. Article Number *(Transfer from service label)*

9589 0710 5270 0189 8121 56

COMPLETE THIS SECTION ON DELIVERY

A. Signature

X [signature] ☐ Agent ☐ Addressee

B. Received by *(Printed Name)* Amy Stratton C. Date of Delivery 5-30-25

D. Is delivery address different from Item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
- ☐ Adult Signature
- ☐ Adult Signature Restricted Delivery
- ☐ Certified Mail®
- ☐ Certified Mail Restricted Delivery
- ☐ Collect on Delivery
- ☐ Collect on Delivery Restricted Delivery
- ☐ Priority Mail Express®
- ☐ Registered Mail™
- ☐ Registered Mail Restricted Delivery
- ☐ Signature Confirmation™
- ☐ Signature Confirmation Restricted Delivery

Mail
Mail Restricted Delivery
(over $500)

PS Form 3811, July 2020 PSN 7530-02-000-9053 Domestic Return Receipt

East Hickman PS

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

N.H. Stone
P.O. Box 239
Sharpsburg, KY 40374

9590 9402 8365 3156 7576 97

2. Article Number *(Transfer from service label)*

9589 0710 5270 0189 8122 00

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X

☐ Agent
☐ Addressee

B. Received by *(Printed Name)*

C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☐ Adult Signature
☐ Adult Signature Restricted Delivery
☐ Certified Mail®
☐ Certified Mail Restricted Delivery
☐ Collect on Delivery
☐ Collect on Delivery Restricted Delivery
☐ Priority Mail Express®
☐ Registered Mail™
☐ Registered Mail Restricted Delivery
☐ Signature Confirmation™
☐ Signature Confirmation Restricted Delivery

PS Form 3811, July 2020 PSN 7530-02-000-9053 Domestic Return Receipt

E. Hickman PS

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

T.E.M. Group, Inc.
3560 Bashford Ave., Suite 100
Louisville, KY 40218

9590 9402 8365 3156 7576 28

2. Article Number *(Transfer from service label)*

9589 0710 5270 0189 8121 32

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X

☐ Agent
☐ Addressee

B. Received by *(Printed Name)* Jennifer Ty

C. Date of Delivery 6/3/25

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☐ Adult Signature
☐ Adult Signature Restricted Delivery
☐ Certified Mail®
☐ Certified Mail Restricted Delivery
☐ Collect on Delivery
☐ Collect on Delivery Restricted Delivery
☐ Priority Mail Express®
☐ Registered Mail™
☐ Registered Mail Restricted Delivery
☐ Signature Confirmation™
☐ Signature Confirmation Restricted Delivery

PS Form 3811, July 2020 PSN 7530-02-000-9053 Domestic Return Receipt

1.12 EQUAL EMPLOYMENT OPPORTUNITY AFFIRMATIVE ACTION POLICY

It is the policy of Judy Construction Company
(Name of Bidder)

to assure that all applicants for employment and all employees are treated on a fair and equitable basis without regard to their race, religion, sex, color, handicap, natural origin or age.

Such action shall include employment, promotion, demotion, recruitment or recruitment advertising, layoff or termination, rates of pay and other forms of compensation, and selection for training, whether apprenticeship and/or on-the-job-training.

Furthermore, this company agrees to make special recruitment efforts to hire the protected class whenever feasible. This company also agrees to adhere to all applicable federal, state, and local laws relating to Equal Employment Opportunity for all individuals.

1.13 WORKFORCE ANALYSIS FORM

Please See Attached Workforce Analysis Form

Name of Organization: Judy Construction Company

Categories	Total	White (not Hispanic or Latino)		Hispanic or Latino		Black or African-American (not Hispanic or Latino)		Native Hawaiian and other Pacific Islander (not Hispanic or Latino)		Asian (not Hispanic or Latino)		American Indian or Alaskan Native (not Hispanic or Latino)		Two or more races (not Hispanic or Latino)		Total	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Administrators																	
Professionals																	
Superintendents																	
Supervisors																	
Foremen																	
Technicians																	
Protective Service																	
Para-Professionals																	
Office/Clerical																	
Skilled Craft																	
Service/Maintenance																	
Total																	

Prepared By: _____ Date ___/___/___

WORKFORCE ANALYSIS FORM

Name of Organization: Judy Construction Company

Week Ending Date: 06/07/2025

Categories	Total	White (Not Hispanic or Latino)		Hispanic or Latino		Black or African-American (Not Hispanic or Latino)		Native Hawaiian and Other Pacific Islander (Not Hispanic or Latino)		Asian (Not Hispanic or Latino)		American Indian or Alaskan Native (not Hispanic or Latino)		Two or more races (Not Hispanic or Latino)		Total	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Administrators	5	4	1													4	1
Professionals	11	10					1									10	1
Superintendents	8	8														8	0
Supervisors	0															0	0
Foremen	4	4														4	0
Technicians	0															0	0
Protective Service	0															0	0
Para-Professionals	0															0	0
Office/Clerical	6	2	4													2	4
Skilled Craft	116	40		68	5	2	1									110	6
Service/Maintenance	2	2														2	0
Total:	152	70	5	68	5	2	2	0	0	0	0	0	0	0	0	140	12

Prepared by: James K. Cowley, EEO Officer
(Name and Title)

Date: _____/_____/_____

1.14 EVIDENCE OF INSURABILITY

LEXINGTON-FAYETTE UBAN COUNTY GOVERNMENT CONTRUCTION PROJECT

(Use separate form for each Agency or Brokerage agreeing to provide coverage)

Names Insured: Judy Construction Company

Address: 103 Church Street, Cynthiana KY 41031

Project to be insured: East Hickman Pump Station Expansion and Rehabilitation Design-Phase 2 LFUCG Bid No. 65-2025

In lieu of obtaining certificates of insurance at this time, the undersigned agrees to provide the above Named Insured with the minimum coverage listed below. These are outlined in the Insurance and Risk Management of Section 00600 - Bonds and Certifications, including all requirements, and conditions:

Article Items	Coverage	Minimum Limits and Policy Requirements	Limits Provided to Insured	Name of Insurer	A.M. Best's	
					Code	Rating
1.05.D.1	CGL	$1,000,000/per occ., $2,000,000/aggregate or $2,000,000 combined single limit Requirements (a) through (e)	$1,000.000 OCC $2,000,000 AGG	Travelers	A++	XV
1.05.D.1	Auto	Combined single $1,000,000/per occ. aggregate Requirements (a) through (c)	$1,000.000 OCC	Travelers	A++	XV
1.05.D.1	WC	$ Statutory	Statutory	KY AGC	A-	VIII
1.05.D.1	Employer's Liability	$500,000	$4,500,000	KY AGC	A-	VIII

Section 00600 includes required provisions, statements regarding insurance requirements, and the undersigned agrees to abide by all provisions for the coverage's checked above unless stated otherwise when submitting

Acrisure LLC
Agency or Brokerage

780 Winchester Road
Street Address

Lexington, KY 40505
City

859-254-1836
Telephone Number

John W. Hampton
Name of Authorized Representative

Producer
Title

Authorized Signature

June 5, 2025
Date

NOTE: Authorized signatures may be the agent's if agent has placed insurance through an agency agreement with the insurer. If insurance is brokered, authorized signature must be that of authorized representative of insurer.

IMPORTANT: CONTRACT MAY NOT BE AWARDED IF A COMPLETED AND SIGNED COPY OF THIS FORM FOR ALL COVERAGES LISTED ABOVE IS NOT PROVIDED.

1.15 DEBARRED FIRMS

PROJECT NAME: East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2 Wastewater System Improvements

LFUCG BID NO.: 65-2025

LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT
LEXINGTON, KY

All prime Contractors shall certify that Subcontractors have not and will not be awarded to any firms that has been debarred for noncompliance with the Federal Labor Standards, Title VI of the Civil Rights Act of 1964 As Amended, Executive Order 11246 As Amended or any other Federal Law.

All Bidders shall complete the Debarment Certification in duplicate and submit both copies to the Owner with the Bid Form. The Owner (grantee) shall transmit one copy to the Lexington-Fayette Urban County Government, Division of Community Development within fourteen (14) days after Bid opening.

The undersigned hereby certifies that the firm of Judy Construction Company has not and will not award a subcontract, in connection with any Agreement award to it as the result of this bid, to any firm that has been debarred for noncompliance with the Federal Labor Standards, Title VI of the Civil Rights Act of 1964, Executive Order 11246 As Amended or any Federal Law.

Judy Construction Company
Name of Firm Submitting Bid

Signature of Authorized Official

Steve Judy, President
Title

June 12, 2025
Date

1.16 DEBARMENT CERTIFICATION

A. All Contractors/Subcontractors shall complete this certification.

B. The Contractor/Subcontractor certifies in accordance with Executive Order 12549 (Debarment and Suspension 2/18/86) that to the best of its knowledge and belief, that it and its principals:

1. Are not presently debarred, suspended, proposed for debarment, declared negligible, or voluntarily excluded from covered transactions or contract by any Federal department or agency for noncompliance with the Federal Labor Standards, Title VI of the Civil Rights Act of 1964 As Amended, Executive Order 11246 As Amended or any other Federal Law.

   a. Have not within a three year period preceding this Bid been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements or receiving stolen property;

   b. Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(a) of this certification; and

   c. Have not within a three (3) year period preceding this Bid has one or more public (Federal, State or local) transactions or contracts terminated for cause or default.

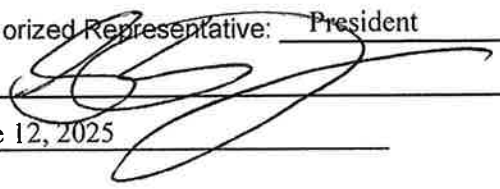
2. Where the Contractor is unable to certify to any of the statements in this certification, such prospective contractors shall attach an explanation to this certification form.

Firm Name: Judy Construction Company

Project: East Hickman Pump Station Expansion & Rehabilitation Design - Phase 2

Printed Name: Steve Judy

Title of Authorized Representative: President

Signature: 

Date: June 12, 2025

1.17 CERTIFICATION REGARDING LOBBYING

Certification for Contracts, Grants, Loans, and Cooperative Agreements

A. The undersigned certifies, to the best of his or her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

3. The undersigned shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including subcontracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

B. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty for not less than $10,000 and not more than $100,000 for each such failure.

Steve Judy, President
Typed Name & Title of Authorized Representative

Signature of Authorized Representative

June 12, 2025
Date

_____I am unable to certify to the above statements. My explanation is attached.

ANNUAL MEETING OF BOARD OF DIRECTORS
JUNE 29, 2023

The annual meeting of the Directors of the corporation was called to order by Steve Judy, President at Cynthiana, Kentucky at 9:30 AM. Steve Judy and James K. Cowley, Directors of the corporation were present in person and consented to the transaction of any and all business to come before the meeting.

The minutes of the last special meeting of the Board of Directors were read and approved.

On motion duly made and seconded, it was unanimously ordered and

RESOLVED, that the following officers were elected to the offices set opposite their names to serve for a term of one year or until their successors are elected and qualified:

Steve Judy	-	President
Ben Williams	-	Vice President
James K. Cowley	-	Secretary/Treasurer

On motion duly made and seconded, it was unanimously ordered and

RESOLVED, that for the corporation's fiscal year ending March 31, 2024, the President, Steve Judy's salary was approved. This salary will be paid if the funds become available.

On motion duly made and seconded, it was unanimously ordered and

RESOLVED, that Steve Judy, Ben Williams and/or James K. Cowley is hereby authorized to sign any and all contracts, agreements, options, leases, deeds, mortgages, bills of sale and any and all other legal documents to bind Judy Construction Company.

On motion duly made and seconded, it was unanimously ordered and

RESOLVED, that Traditional Bank, Mount Sterling, KY, is authorized to pay any check drawn on the Bank by the Corporation when same is signed by Steve Judy. James K. Cowley and Ben Williams are authorized to sign any check in an amount less than $500,000.00. If Steve Judy is temporarily unavailable, any check in excess of $500,000.00 will require signatures from both James K. Cowley and Ben Williams. That the authority vested by this Resolution shall continue until written notice shall be given to and acknowledged by an

officer of Traditional Bank, Mount Sterling, KY, setting forth any change with respect thereto.

On motion duly made and seconded, it was unanimously ordered and

There being no further business to come before the meeting, on motion duly made and seconded, the annual meeting of the Board of Directors was unanimously adjourned.

President

Secretary

Judy Construction Company
103 South Church Street
Cynthiana, KY 41031

State of Incorporation: Kentucky
Date of Incorporation: April 9, 1974

Commonwealth of Kentucky
Trey Grayson, Secretary of State

4/9/2009

Division of Corporations
Business Filings

P. O. Box 718
Frankfort, KY 40602
(502) 564-2848
http://www.sos.ky.gov

Certificate of Existence

Authentication Number: 78947
Jurisdiction: Judy Construction Company
Visit http://apps.sos.ky.gov/business/obdb/certvalidate.aspx to authenticate this certificate.

I, Trey Grayson, Secretary of State of the Commonwealth of Kentucky, do hereby certify that according to the records in the Office of the Secretary of State,

JUDY CONSTRUCTION COMPANY

is a corporation duly incorporated and existing under KRS Chapter 271B, whose date of incorporation is April 9, 1974 and whose period of duration is perpetual.

I further certify that all fees and penalties owed to the Secretary of State have been paid; that articles of dissolution have not been filed; and that the most recent annual report required by KRS 271B.16-220 has been delivered to the Secretary of State.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my Official Seal at Frankfort, Kentucky, this 9th day of April, 2009.

COMMONWEALTH OF KENTUCKY
OFFICE OF SECRETARY OF STATE

Trey Grayson
Secretary of State
Commonwealth of Kentucky
78947/0114048

1.18 BID BOND

Bond Number: Bid Bond

KNOW ALL MEN BY THESE PRESENTS, that we Judy Construction Company

as principal (the "Principal") and Continental Casualty Company

hereinto called Surety, are held and firmly bound unto

LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT
200 East Main Street, Third Floor
Lexington, Kentucky 40507

as obligee (the "Obligee"), in the penal sum of Five Percent of Total Amount Bid (5% of Bid) dollars for the payment of which sum well and truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for
Bid No. 65-2025 East Hickman Pump Station Expansion & Rehabilitation Design - Phase 2

NOW, THEREFORE, if the Obligee shall accept the bid of the Principal within the period specified therein, or, if no period be specified, within ninety (90) days after opening, and the Principal shall enter into a contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or contract documents, or in the event of the failure of the Principal to enter into such contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference in money not to exceed the penal sum hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void; otherwise to remain in full force and effect. In no event shall the liability hereunder exceed the penal sum thereof.

PROVIDED AND SUBJECT TO THE CONDITION PRECEDENT, that any claim by Obligee under this bond must be submitted in writing by registered mail, to the attention of the Surety Law Department at the address above, within 120 days of the date of this bond. Any suit under this bond must be instituted before the expiration of one (1) year from the date of this bond. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall apply.

Continued on next page.

DATED as of this 12th day of June, 2025.

WITNESS / ATTEST:

James K. Cowley
Principal (Secretary)

By: _____ (seal)

Judy Construction Company
Principal

Name and Title Steve Judy, President

SEE ATTACHED POWER OF ATTORNEY
Surety (Secretary)

By: _____ (seal)
Madison Haller, Witness

Continental Casualty Company
Surety

Name and Title Paula J. Teague, Atty-In-Fact

POWER OF ATTORNEY APPOINTING INDIVIDUAL ATTORNEY-IN-FACT

Know All Men By These Presents, That Continental Casualty Company, an Illinois insurance company, National Fire Insurance Company of Hartford, an Illinois insurance company, and American Casualty Company of Reading, Pennsylvania, a Pennsylvania insurance company (herein called "the CNA Companies"), are duly organized and existing insurance companies having their principal offices in the City of Chicago, and State of Illinois, and that they do by virtue of the signatures and seals herein affixed hereby make, constitute and appoint

Paula J Teague, Todd P Loehnert, John B Ayres, Monica A Kaiser, Michael W Baxter, Madison M Haller, Individually

of Louisville, KY, their true and lawful Attorney(s)-in-Fact with full power and authority hereby conferred to sign, seal and execute for and on their behalf bonds, undertakings and other obligatory instruments of similar nature

- In Unlimited Amounts -

and to bind them thereby as fully and to the same extent as if such instruments were signed by a duly authorized officer of their insurance companies and all the acts of said Attorney, pursuant to the authority hereby given is hereby ratified and confirmed.

This Power of Attorney is made and executed pursuant to and by authority of the By-Laws and Resolutions, printed below, duly adopted, as indicated, by the Boards of Directors of the insurance companies.

In Witness Whereof, the CNA Companies have caused these presents to be signed by their Vice President and their corporate seals to be hereto affixed on this 19th day of December, 2023.

Continental Casualty Company
National Fire Insurance Company of Hartford
American Casualty Company of Reading, Pennsylvania

Larry Kasten — Vice President

State of South Dakota, County of Minnehaha, ss:

On this 19th day of December, 2023, before me personally came Larry Kasten to me known, who, being by me duly sworn, did depose and say: that he resides in the City of Sioux Falls, State of South Dakota; that he is a Vice President of Continental Casualty Company, an Illinois insurance company, National Fire Insurance Company of Hartford, an Illinois insurance company, and American Casualty Company of Reading, Pennsylvania, a Pennsylvania insurance company described in and which executed the above instrument; that he knows the seals of said insurance companies; that the seals affixed to the said instrument are such corporate seals; that they were so affixed pursuant to authority given by the Boards of Directors of said insurance companies and that he signed his name thereto pursuant to like authority, and acknowledges same to be the act and deed of said insurance companies.

My commission expires
March 2, 2026

M. BENT
NOTARY PUBLIC
SOUTH DAKOTA

M. Bent — Notary Public

CERTIFICATE

I, D. Johnson, Assistant Secretary of Continental Casualty Company, an Illinois insurance company, National Fire Insurance Company of Hartford, an Illinois insurance company, and American Casualty Company of Reading, Pennsylvania, a Pennsylvania insurance company do hereby certify that the Power of Attorney herein above set forth is still in force, and further certify that the By-Laws and Resolutions of the Board of Directors of the insurance companies printed below are still in force. In testimony whereof I have hereunto subscribed my name and affixed the seal of the said insurance companies this 12th day of June, 2025

Continental Casualty Company
National Fire Insurance Company of Hartford
American Casualty Company of Reading, Pennsylvania

D. Johnson — Assistant Secretary

Authorizing By-Laws and Resolutions

ADOPTED BY THE BOARD OF DIRECTORS OF EACH OF CONTINENTAL CASUALTY COMPANY, NATIONAL FIRE INSURANCE COMPANY OF HARTFORD, and AMERICAN CASUALTY COMPANY OF READING, PENNSYLVANIA (as defined above, the "CNA Companies"):

This Power of Attorney is made and executed pursuant to and by authority of the following resolution duly adopted by the Board of Directors of each of the above CNA Companies at a meeting held on May 12, 1995:

"RESOLVED: That any Senior or Group Vice President may authorize an officer to sign specific documents, agreements and instruments on behalf of the Company provided that the name of such authorized officer and a description of the documents, agreements or instruments that such officer may sign will be provided in writing by the Senior or Group Vice President to the Secretary of the Company prior to such execution becoming effective."

This Power of Attorney is signed by Larry Kasten, Vice President, who has been authorized pursuant to the above resolution to execute power of attorneys on behalf of each of the CNA Companies.

This Power of Attorney is signed and sealed by facsimile under and by the authority of the following Resolution adopted by the Board of Directors of each of the above Companies by unanimous written consent dated the 25th day of April, 2012:

"Whereas, the bylaws of the Company or specific resolution of the Board of Directors has authorized various officers (the "Authorized Officers") to execute various policies, bonds, undertakings and other obligatory instruments of like nature; and

Whereas, from time to time, the signature of the Authorized Officers, in addition to being provided in original, hard copy format, may be provided via facsimile or otherwise in an electronic format (collectively, "Electronic Signatures"); Now therefore be it resolved: that the Electronic Signature of any Authorized Officer shall be valid and binding on the Company."

This Power of Attorney may be signed by digital signature and sealed by a digital or otherwise electronic-formatted corporate seal under and by the authority of the following Resolution adopted by the Board of Directors of each of the above CNA Companies by unanimous written consent dated the 27th day of April, 2022:

"RESOLVED: That it is in the best interest of the Company to periodically ratify and confirm any corporate documents signed by digital signatures and to ratify and confirm the use of a digital or otherwise electronic-formatted corporate seal, each to be considered the act and deed of the Company."

Go to www.cnasurety.com > Owner / Obligee Services > Validate Bond Coverage, if you want to verify bond authenticity.

SECTION 00510

NOTICE OF AWARD

CONTRACTOR: Judy Construction Company
103 S. Church Street
Cynthiana, KY 41031

OWNER: Lexington-Fayette Urban County Government
Division of Water Quality
Lexington, Kentucky

PROJECT: East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2
Lexington-Fayette Urban County Government
LFUCG Bid No.65-2025

You are hereby notified that the Owner has considered the Bid submitted by you for the above-described project in response to its Advertisement for Bids dated June 12th, 2025

It appears that it is to the best interest of said Owner to accept your Bid in the amount of Two Million Nine Hundred Forty Five Thousand dollars ($2,945,000.00), and you are hereby notified that your Bid has been accepted for

EAST HICKMAN PUMP STATION EXPANSION AND REHABILITATION DESIGN – PHASE 2
LFUCG Bid No.65-2025

The Contractor is required by these Contract Documents to execute and deliver the formal Agreement (Contract) with the undersigned Owner and to furnish the required Contractor's Performance, Payment, Warranty, and Erosion and Sediment Control Bonds within fifteen (15) days from the date of the delivery of this Notice.

If you fail to execute said Agreement (Contract) and to furnish said Bonds within fifteen (15) days from the date of delivery of this Notice, said Owner will be entitled to consider all your rights arising out of the Owner's acceptance of your Bid as abandoned and to award the Work covered by your Bid to another, or to re-advertise the Work or otherwise dispose thereof as the Owner may deem appropriate.

Dated this 2nd day of July, 2025.

Lexington-Fayette Urban County Government

By: _____

Title: Remedial Measures Program Manager

NOTICE OF ACCEPTANCE

Receipt of the above Notice of Award is hereby acknowledged this 7th day of July, 2025.

By: _____

Title: President

END OF SECTION

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SECTION 00520

AGREEMENT (CONTRACT)

THIS AGREEMENT, made on the 15th day of July, 2025, by and between Lexington Fayette Urban County Government, acting herein called "OWNER" and Judy Construction Company doing business as a Corporation located in the City of Cynthiana, County of Harrison, State of Kentucky, hereinafter called "CONTRACTOR".

WITNESSETH: That the CONTRACTOR and the OWNER in consideration of Two Million Nine Hundred Forty-Five and 00/100 dollars quoted in the BID by the CONTRACTOR, dated June 12, 2025, hereby agree to commence and complete the construction described as follows:

1.01 SCOPE OF WORK

A. The CONTRACTOR shall furnish all the materials, supplies, machinery, equipment, tools, supervision, labor, insurance, and other accessories and services necessary to complete the said project in accordance with the BID, the Contract Documents, and the Specifications prepared by the Engineer for the

East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2
LFUCG Bid No.65-2025.

1.02 TIME OF COMPLETION

A. The time period estimated and authorized by the OWNER for Substantial Completion of Work by the AGREEMENT, in full, is hereby fixed as **365 consecutive calendar days**. The time shall begin ten (10) calendar days after CONTRACTOR is issued the Notice to Proceed.

1.03 ISSUANCE OF NOTICE TO PROCEED

A. Notice to Proceed for Work will be issued in whole or in part of the Work as determined by the OWNER pending the availability of funds. The order of construction will be as determined by the Engineer after consultation with the CONTRACTOR and the OWNER.

1.04 AGREEMENT (CONTRACT) AMOUNT

A. The OWNER agrees to pay the CONTRACTOR in current funds for the performance of the AGREEMENT as quoted in the BID, subject to any additions and deductions, as provided therein.

1.05 PROGRESS PAYMENTS

A. The OWNER shall make payments on account of the AGREEMENT in accordance with the General Conditions, as recommended by the Engineer and authorized by the OWNER, less the aggregate of previous payments.

1.06 ACCEPTANCE AND FINAL PAYMENT

A. Final payment shall be due within ninety (90) days after Final Completion of the Work, provided the Work is deemed "Final Completion" and fully accepted by the OWNER.

B. Before issuance of final certificate, the CONTRACTOR shall submit evidence satisfactory to the Engineer that all payrolls, material bills, and other indebtedness connected with the AGREEMENT (CONTRACT) has been paid.

C. If, after the Work has been substantially completed, full completion thereof is materially delayed through no fault of the CONTRACTOR, and the ENGINEER so certifies, the OWNER shall upon certificate of the ENGINEER, and without terminating the AGREEMENT (CONTRACT), make payment of the balance due for that portion of the Work fully completed and accepted. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

1.07 EXTRA WORK

A. The OWNER, without invalidating the AGREEMENT (CONTRACT) may order extra work or make changes by altering, adding to or deducting from the Work, the AGREEMENT (CONTRACT) amount being adjusted accordingly. All such work shall be executed and paid for in accordance with the General Conditions.

1.08 LIQUIDATED DAMAGES

A. If the CONTRACTOR shall fail or refuse to complete the Work within the AGREEMENT (CONTRACT) Time, or extension of time granted by the OWNER, then the CONTRACTOR agrees as a partial consideration for the awarding of this AGREEMENT (CONTRACT) that the OWNER may retain the compensation otherwise to be paid to the CONTRACTOR the amount of three thousand dollars ($3,000.00) per consecutive calendar day that the CONTRACTOR shall be in default after the Final Completion time stipulated in the Contract Documents. The said amount is fixed and agreed upon by and between the CONTRACTOR and the OWNER because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the OWNER would in such event sustain.

B. If the Contractor's delay or failure to complete the project within the allowable Contract time, the Contractor is responsible for damages caused by loss of project grant funding. See Specification Section 01170 – Special Conditions for additional information.

1.09 CONSENT DECREE REQUIREMENTS

A. The OWNER, the United States Environmental Protection Agency, and the Commonwealth of Kentucky have entered into a Consent Decree in a case styled *United States, et al. v. Lexington-Fayette Urban County Government,* United States District Court for the Eastern District of Kentucky, Case No. 5:06-CV-00386 ("CONSENT

DECREE"), that requires OWNER to complete numerous projects related to its sanitary sewer system and stormwater management program within specific periods of time.

B. **Time is of the essence in the performance of this Agreement (CONTRACT).** CONTRACTOR is aware that the OWNER is subject to penalties for non-compliance with the CONSENT DECREE deadlines. The CONTRACTOR shall be specifically liable and responsible for payment of any and all penalties, fines, or fees assessed against or incurred by the OWNER as a result of any delay in, or non-performance of, any of the CONTRACTOR's obligations or responsibilities under this AGREEMENT (CONTRACT), or for any other damages suffered by OWNER as a result of such delay or non-performance. This shall specifically include, but shall not be limited to, any penalty, fine, fee, or assessment against the OWNER by the U.S. Department of Justice, U.S. Environmental Protection Agency, and/or the Kentucky Energy and Environment Cabinet related to the CONSENT DECREE.

C. The provisions of the Contract Documents and the various rates of compensation for CONTRACTOR's services provided for elsewhere in this AGREEMENT (CONTRACT) have been agreed to in anticipation of the orderly and continuous progress of the AGREEMENT (CONTRACT) through completion.

D. If delays result by reason of acts of the OWNER or approving agencies, which are beyond the control of the CONTRACTOR, an extension of time for such delay will be considered. If delays occur, the CONTRACTOR shall immediately notify the OWNER and within five (5) business days from the date of the delay apply in writing to the OWNER for an extension of time for such reasonable period as may be mutually agreed upon between the parties, and if approved, the AGREEMENT (CONTRACT) schedule shall be revised to reflect the extension. Such extension of time to the completion date shall in no way be construed to operate as a waiver on the part of the OWNER of any of its rights in the AGREEMENT (CONTRACT). In the event the parties cannot agree upon an extension of time, the Dispute shall be addressed in the manner outlined hereinafter under this Article.

   In the event that the overall delay resulting from the above-described causes is sufficient to prevent complete performance of the AGREEMENT (CONTRACT) within six (6) months of the time specified herein, the fees to be paid to CONTRACTOR shall be subject to adjustment as agreed upon by the parties.

E. If delays result solely by reason of acts of the CONTRACTOR, the CONTRACTOR shall be held liable for any financial penalties incurred by the OWNER as a result of the delay, including but not limited to those assessed pursuant to the CONSENT DECREE. Disputes as outlined hereinafter in this Article shall apply in the event the parties cannot mutually agree upon the cause(s) associated with delays in completing project deliverables. The CONTRACTOR must immediately notify the OWNER in the event of such delay, and provide the OWNER a written action plan within five (5) business days on how it will attempt to resolve the delay.

F. DISPUTES

1. Except as otherwise provided in this AGREEMENT (CONTRACT), any dispute hereunder may be resolved by agreement of the OWNER's Agent (Charles H. Martin, P.E., Director of Water Quality) and the CONTRACTOR. In the absence of such an agreement, the dispute shall be submitted to the OWNER's Commissioner, Department of Public Works and Environmental Quality, whose decision shall be final and conclusive unless determined by a court of competent jurisdiction to have been fraudulent, capricious, arbitrary, or so grossly erroneous as necessarily to imply bad faith. Pending a final decision of a dispute hereunder the CONTRACTOR shall proceed diligently with the performance of the AGREEMENT (CONTRACT) in accordance with the direction of the OWNER.

1.10 RIGHT TO REVIEW, AUDIT, AND INSPECT

A. The CONTRACTOR shall provide to the OWNER or its duly authorized representative(s), at any time during the course of the contract and up to five (5) years thereafter, access to any books, documents, papers, emails, and/or other records or communications which are directly pertinent to this specific contract for the purpose of making audit, examination, excerpts, and transcriptions.

1.11 CONTRACT DOCUMENTS

A. In general, the Advertisement for Bids, Information Available to Bidders, the Bid, the General Conditions, Performance, Payment, Erosion and Sediment Control and Warranty Bonds, AGREEMENT (CONTRACT), Supplementary Conditions, Supplemental General Conditions for SRF, Technical Specifications, any and all Addenda, and Plan Drawings form the AGREEMENT (CONTRACT) and they are fully a part of the AGREEMENT (CONTRACT) as if hereto attached or herein repeated.

A full listing of the Contract Documents consist of the following:

Specifications:	Per Table of Contents
Drawings (Plans):	Per Table of Contents

IN WITNESSETH WHEREOF, the parties hereto have executed this AGREEMENT (CONTRACT) as of the date and year above written.

(Seal)

Lexington-Fayette Urban County Government
Lexington, Kentucky
(Owner)

ATTEST:

Mackenzie Stock
Clerk of Urban County Council

By: Linda Gorton
(Signature of Mayor)

Linda Gorton, Mayor
(Name/Title)

(Seal)

JUDY CONSTRUCTION COMPANY CORPORATE SEAL CYNTHIANA KY

Judy Construction Company
(Contractor)

(Secretary)*

By:
(Contractor's Signature)

Angie Noble
(Witness)

Steve Judy, President
(Name/Title)

PO Box 457
(Address)

Cynthiana, KY 41031

*IMPORTANT: Strike out any non-applicable terms.

Secretary of the OWNER should attest. If the CONTRACTOR is corporation, Secretary should attest. Give proper title of each person-executing AGREEMENT (CONTRACT).

END OF SECTION

SECTION 00600
BONDS AND CERTIFICATES

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1.01 PERFORMANCE BOND

Bond #30240466

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that

Judy Construction Company
(Name of CONTRACTOR)

103 S. Church Street Cynthiana, KY 41031
(Address of CONTRACTOR)

a Corporation, hereinafter
(Corporation, Partnership, or Individual)

called Principal, and Continental Casualty Company
(Name of Surety)

151 N. Franklin Street Chicago, IL 60606
(Address of Surety)

hereinto called Surety, are held and firmly bound unto

LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT
200 East Main Street, Third Floor
Lexington, Kentucky 40507

Obligee, hereinafter called "OWNER" in the penal sum of:

Two Million Nine Hundred Forty Five Thousand and 00/100 dollars ($ 2,945,000.00),
for the payment of whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, Principal by written agreement is entering into an Agreement (Contract) with OWNER for the East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2, LFUCG Bid No. 65-2025 in accordance with Contract Documents prepared by _____ and dated _____, 2025, which Agreement (Contract) is by reference made a part hereof, and is hereinafter referred to as the Agreement (Contract).

NOW THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if the Principal shall promptly and faithfully perform said Agreement (Contract), then this obligation shall be null and void; otherwise it shall remain in full force and effect.

The Surety hereby waives notice of any alteration or extension of time made by the OWNER.

Whenever, Principal shall be, and declared by OWNER to be in default under the Agreement (Contract), the OWNER having performed OWNER'S obligations thereunder, the Surety may promptly remedy the default, or shall promptly:

A. Complete the Agreement (Contract) in accordance with its terms and conditions or

B. Obtain a Bid or Bids for completing the Agreement (Contract) in accordance with its terms and conditions, and upon determination by Surety of the lowest responsible bidder, or if the OWNER elects, upon determination by the OWNER and Surety jointly of the lowest responsible bidder, arrange for an Agreement (Contract) between such bidder and OWNER, and make available as Work progresses (even though there may be a default or a succession of defaults under the Agreement (Contract) or Agreements (Contracts) of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the Agreement (Contract) Amount; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "Balance of the Agreement (Contract) Amount", as used in this paragraph shall mean the total amount payable by OWNER to Principal under the Agreement (Contract) and any amendments thereto, less the amount properly paid by OWNER to Principal.

Any suit under this bond must be instituted before the expiration of one (1) year from the date on which final payment under the Contract falls due.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the OWNER named herein or the heirs, executors, administrators or successors of OWNER.

IN WITNESS WHEREOF, this instrument is executed in Six (6) (number) counterparts, each one of which shall be deemed an original, this the _____ day of _____, 20_____.

ATTEST:

(Principal) Secretary James K. Conley
Secretary-Treasurer

Witness as to Principal

103 S. Church Street
Address

Cynthiana, KY 41031

Judy Construction Company
Principal

By: _____
Steve Judy, President

Address
103 S. Church Street Cynthiana, KY 41031

Continental Casualty Company
Surety

By: _____
Attorney-in-Fact

ATTEST:

SEE ATTACHED POWER OF ATTORNEY
(Surety) Secretary

(SEAL)

Witness to Surety

127 S. Sherrin Avenue
Address

Louisville, KY 40207

127 S. Sherrin Avenue
Address

Louisville, KY 40207

Title: Paula J. Teague
Surety

By: Attorney-in-Fact

Title: Madison Haller, Witness

NOTE: The number of executed counterparts of the bond shall coincide with the number of executed counterparts of the Agreement (Contract).

1.02 PAYMENT BOND

Bond #30240466

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS, that

Judy Construction Company
(Name of CONTRACTOR)

103 S. Church Street Cynthiana, KY 41031
(Address of CONTRACTOR)

a Corporation, hereinafter
(Corporation, Partnership, or Individual)

called Principal, and Continental Casualty Company
(Name of Surety)

151 N. Franklin Street Chicago, IL 60606
(Address of Surety)

hereinto called Surety, are held and firmly bound unto

LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT
200 East Main Street, Third Floor
Lexington, Kentucky 40507

Obligee, hereinafter called "OWNER" in the penal sum of: Two Million Nine Hundred Forty Five Thousand and 00/100 dollars ($2,945,000.00),

for the payment of whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, Principal by written agreement is entering into an Agreement (Contract) with OWNER for the East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2, LFUCG Bid No. 65-2025 in accordance with Contract Documents prepared by _____ and dated _____, 2025, which Agreement (Contract) is by reference made a part hereof, and is hereinafter referred to as the Agreement (Contract).

NOW, THEREFORE THE CONDITION OF THIS OBLIGATION is such that, if Principal shall promptly make payment to all claimants as hereinafter defined for all labor and material used or reasonably required for use in the performance of the Agreement (Contract), then this obligation shall be void; otherwise it shall remain in full force and effect, subject, however, to the following conditions:

A. A claimant is defined as one having a direct contract with the Principal or with a Subcontractor of the Principal for labor material, or both, used or reasonably required for use in the performance of the Agreement (Contract), labor and material being construed to include that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental of equipment directly applicable to the Agreement (Contract).

B. The above named Principal and Surety hereby jointly and severally agree with the OWNER that every claimant as herein defined, who has not been paid in full before the expiration of a period of ninety (90) days after the date on which the last of such claimant's work or labor was done or performed, or materials were furnished by such claimant, may sue on this bond for the use of such claimant, prosecute the suit to final judgment for such sum or sums as may be justly due claimant and have execution thereon. The OWNER shall not be liable for the payment of any costs or expenses of any such suit.

C. No suit or action shall be commenced hereunder by any claimant:

1. Unless claimant, other than one having a direct contract with the Principal, shall have given written notice to any two of the following: The Principal, the OWNER, or the Surety above named, within ninety (90) days after such claimant did or performed the last of the Work or labor, or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished, or for whom the Work or labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail, postage prepaid, in an envelope addressed to the Principal, OWNER, or Surety, at any place where an office is regularly maintained for the transaction of business, or served in any manner in which legal process may be served in the state in which the aforesaid project is located, save that such service need not be made by a public officer.

2. After the expiration of one (1) year following the date on which Principal ceased Work on said Agreement (Contract), it being understood, however, that if any limitation embodied in this bond is prohibited by any law controlling the construction hereof such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

3. Other than in a state court of competent jurisdiction in and for the county or other political subdivision of the state in which the project, or any part thereof, is situated, or in the United States District Court for the district in which the project, or any part thereof, is situated, and not elsewhere.

D. The amount of this bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder, inclusive of the payment by Surety of mechanics' liens which may be filed of record against aid improvement, whether or not claim for the amount of such lien be presented under and against this bond.

IN WITNESS WHEREOF, this instrument is executed in Six (6) (number) counterparts, each one of which shall be deemed an original, this the _____ day of _____, 20_____.

ATTEST:

Judy Construction Company
Principal

(Principal) Secretary James K. Cowley
Secretary/Treasurer

By: _____
Steve Judy, President

Address
103 S. Church Street Cynthiana, KY 41031

Witness as to Principal

103 S. Church Street
Address

Cynthiana, KY 41031

Continental Casualty Company
Surety

ATTEST:

By: _____
Attorney-in-Fact

SEE ATTACHED POWER OF ATTORNEY
(Surety) Secretary

127 S. Sherrin Avenue
Address

Louisville, KY 40207

(SEAL)

Witness to Surety

Title: Attorney-in-Fact
Surety

By: Paula J. Teague

127 S. Sherrin Avenue
Address

Louisville, KY 40207

Title: Madison Haller, Witness

NOTE: The number of executed counterparts of the bond shall coincide with the number of executed counterparts of the Agreement (Contract).

POWER OF ATTORNEY APPOINTING INDIVIDUAL ATTORNEY-IN-FACT

Know All Men By These Presents, That Continental Casualty Company, an Illinois insurance company, National Fire Insurance Company of Hartford, an Illinois insurance company, and American Casualty Company of Reading, Pennsylvania, a Pennsylvania insurance company (herein called "the CNA Companies"), are duly organized and existing insurance companies having their principal offices in the City of Chicago, and State of Illinois, and that they do by virtue of the signatures and seals herein affixed hereby make, constitute and appoint

Paula J Teague, Todd P Loehnert, John B Ayres, Monica A Kaiser, Michael W Baxter, Madison M Haller, Individually

of Louisville, KY, their true and lawful Attorney(s)-in-Fact with full power and authority hereby conferred to sign, seal and execute for and on their behalf bonds, undertakings and other obligatory instruments of similar nature

- In Unlimited Amounts -

and to bind them thereby as fully and to the same extent as if such instruments were signed by a duly authorized officer of their insurance companies and all the acts of said Attorney, pursuant to the authority hereby given is hereby ratified and confirmed.

This Power of Attorney is made and executed pursuant to and by authority of the By-Laws and Resolutions, printed below, duly adopted, as indicated, by the Boards of Directors of the insurance companies.

In Witness Whereof, the CNA Companies have caused these presents to be signed by their Vice President and their corporate seals to be hereto affixed on this 19th day of December, 2023.

Continental Casualty Company
National Fire Insurance Company of Hartford
American Casualty Company of Reading, Pennsylvania

Larry Kasten — Vice President

State of South Dakota, County of Minnehaha, ss:

On this 19th day of December, 2023, before me personally came Larry Kasten to me known, who, being by me duly sworn, did depose and say: that he resides in the City of Sioux Falls, State of South Dakota; that he is a Vice President of Continental Casualty Company, an Illinois insurance company, National Fire Insurance Company of Hartford, an Illinois insurance company, and American Casualty Company of Reading, Pennsylvania, a Pennsylvania insurance company described in and which executed the above instrument; that he knows the seals of said insurance companies; that the seals affixed to the said instrument are such corporate seals; that they were so affixed pursuant to authority given by the Boards of Directors of said insurance companies and that he signed his name thereto pursuant to like authority, and acknowledges same to be the act and deed of said insurance companies.

My commission expires

March 2, 2026

M. BENT
NOTARY PUBLIC
SOUTH DAKOTA

M. Bent — Notary Public

CERTIFICATE

I, D. Johnson, Assistant Secretary of Continental Casualty Company, an Illinois insurance company, National Fire Insurance Company of Hartford, an Illinois insurance company, and American Casualty Company of Reading, Pennsylvania, a Pennsylvania insurance company do hereby certify that the Power of Attorney herein above set forth is still in force, and further certify that the By-Laws and Resolutions of the Board of Directors of the insurance companies printed below are still in force. In testimony whereof I have hereunto subscribed my name and affixed the seal of the said insurance companies this day of ,

Continental Casualty Company
National Fire Insurance Company of Hartford
American Casualty Company of Reading, Pennsylvania

D. Johnson — Assistant Secretary

Authorizing By-Laws and Resolutions

ADOPTED BY THE BOARD OF DIRECTORS OF EACH OF CONTINENTAL CASUALTY COMPANY, NATIONAL FIRE INSURANCE COMPANY OF HARTFORD, and AMERICAN CASUALTY COMPANY OF READING, PENNSYLVANIA (as defined above, the "CNA Companies"):

This Power of Attorney is made and executed pursuant to and by authority of the following resolution duly adopted by the Board of Directors of each of the above CNA Companies at a meeting held on May 12, 1995:

"RESOLVED: That any Senior or Group Vice President may authorize an officer to sign specific documents, agreements and instruments on behalf of the Company provided that the name of such authorized officer and a description of the documents, agreements or instruments that such officer may sign will be provided in writing by the Senior or Group Vice President to the Secretary of the Company prior to such execution becoming effective."

This Power of Attorney is signed by Larry Kasten, Vice President, who has been authorized pursuant to the above resolution to execute power of attorneys on behalf of each of the CNA Companies.

This Power of Attorney is signed and sealed by facsimile under and by the authority of the following Resolution adopted by the Board of Directors of each of the above Companies by unanimous written consent dated the 25th day of April, 2012:

"Whereas, the bylaws of the Company or specific resolution of the Board of Directors has authorized various officers (the "Authorized Officers") to execute various policies, bonds, undertakings and other obligatory instruments of like nature; and

Whereas, from time to time, the signature of the Authorized Officers, in addition to being provided in original, hard copy format, may be provided via facsimile or otherwise in an electronic format (collectively, "Electronic Signatures"); Now therefore be it resolved: that the Electronic Signature of any Authorized Officer shall be valid and binding on the Company."

This Power of Attorney may be signed by digital signature and sealed by a digital or otherwise electronic-formatted corporate seal under and by the authority of the following Resolution adopted by the Board of Directors of each of the above CNA Companies by unanimous written consent dated the 27th day of April, 2022:

"RESOLVED: That it is in the best interest of the Company to periodically ratify and confirm any corporate documents signed by digital signatures and to ratify and confirm the use of a digital or otherwise electronic-formatted corporate seal, each to be considered the act and deed of the Company."

Go to www.cnasurety.com > Owner / Obligee Services > Validate Bond Coverage, if you want to verify bond authenticity.

1.03 EROSION AND SEDIMENT CONTROL PERFORMANCE BOND

Bond #30240467

EROSION AND SEDIMENT CONTROL PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that

Judy Construction Company
(Name of CONTRACTOR)

103 S. Church Street Cynthiana, KY 41031
(Address of CONTRACTOR)

a Corporation, hereinafter
(Corporation, Partnership, or Individual)

called Principal, and Continental Casualty Company
(Name of Surety)

151 N. Franklin Street Chicago, IL 60606
(Address of Surety)

hereinto called Surety, are held and firmly bound unto

LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT
200 East Main Street, Third Floor
Lexington, Kentucky 40507

Obligee, hereinafter called "OWNER" in the penal sum of:

[1% of Total Bid Price] Twenty Nine Thousand Four Hundred Fifty dollars ($ 29,450.00), for the payment of whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, Principal by written agreement is entering into an Agreement (Contract) with OWNER for the East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2, LFUCG Bid No. 65-2025 in accordance with Contract Documents prepared by _____ and dated _____, 2025, which Agreement (Contract) is by reference made a part hereof, and is hereinafter referred to as the Agreement (Contract).

NOW THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if the Principal shall promptly and faithfully perform said Agreement (Contract), then this obligation shall be null and void; otherwise it shall remain in full force and effect.

The Surety hereby waives notice of any alteration or extension of time made by the OWNER.

Whenever, Principal shall be, and declared by OWNER to be in default under the Agreement (Contract), the OWNER having performed OWNER's obligations thereunder, the Surety may promptly remedy the default, or shall promptly:

A. Complete the installation, maintenance, and removal of the soil erosion and sediment controls and final stabilization of the site in accordance with the Agreement (Contract), the LFUCG Land Disturbance Permit, Chapter 16 Article X Division 5 of the LFUCG Code of Ordinances, and the KPDES General Permit for Stormwater Discharges Associated with Construction Activities (KYR 10).

B. Obtain a Bid or Bids for completing the installation, maintenance, and removal of the soil erosion and sediment controls and final stabilization of the site in accordance with the Agreement's (Contract's) terms and conditions, and upon determination by Surety of the lowest responsible bidder, or if the OWNER elects, upon determination by the OWNER and Surety jointly of the lowest responsible bidder, arrange for an Agreement (Contract) between such bidder and OWNER, and make available as Work progresses (even though there may be a default or a succession of defaults under the Agreement (Contract) or Agreements (Contracts) of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the Agreement (Contract) Amount; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "balance of the Agreement (Contract) Amount", as used in this paragraph shall mean the total amount payable by OWNER to Principal under the Agreement (Contract) and any amendments hereto, less the amount properly paid by OWNER to Principal.

Any suit under this bond must be instituted before the expiration one (1) year from the date on which final payment under the Agreement (Contract) falls due.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the OWNER named herein or the heirs, executors, administrators or successors of OWNER.

IN WITNESS WHEREOF, this instrument is executed in Six (6) (number) counterparts, each one of which shall be deemed an original, this the _____ day of _____, 20_____.

ATTEST:

Judy Construction Company
Principal

(Principal) Secretary James K. Cowley
Secretary, Treasurer

By: _____
Steve Judy, President

Address
103 S. Church Street Cynthiana, KY 41031

Witness as to Principal

103 S. Church Street
Address

Cynthiana, KY 41031

Continental Casualty Company
Surety

ATTEST:

By: _____
Attorney-in-Fact

SEE ATTACHED POWER OF ATTORNEY
(Surety) Secretary

127 S. Sherrin Avenue
Address
Louisville, KY 40207

(SEAL)

Witness to Surety

Title: Attorney-in-Fact
Surety

127 S. Sherrin Avenue
Address
Louisville, KY 40207

By: Paula J. Teague

Title: Madison Haller, Witness

NOTE: The number of executed counterparts of the bond shall coincide with the number of executed counterparts of the Agreement (Contract).

POWER OF ATTORNEY APPOINTING INDIVIDUAL ATTORNEY-IN-FACT

Know All Men By These Presents, That Continental Casualty Company, an Illinois insurance company, National Fire Insurance Company of Hartford, an Illinois insurance company, and American Casualty Company of Reading, Pennsylvania, a Pennsylvania insurance company (herein called "the CNA Companies"), are duly organized and existing insurance companies having their principal offices in the City of Chicago, and State of Illinois, and that they do by virtue of the signatures and seals herein affixed hereby make, constitute and appoint

Paula J Teague, Todd P Loehnert, John B Ayres, Monica A Kaiser, Michael W Baxter, Madison M Haller, Individually

of Louisville, KY, their true and lawful Attorney(s)-in-Fact with full power and authority hereby conferred to sign, seal and execute for and on their behalf bonds, undertakings and other obligatory instruments of similar nature

- In Unlimited Amounts -

and to bind them thereby as fully and to the same extent as if such instruments were signed by a duly authorized officer of their insurance companies and all the acts of said Attorney, pursuant to the authority hereby given is hereby ratified and confirmed.

This Power of Attorney is made and executed pursuant to and by authority of the By-Laws and Resolutions, printed below, duly adopted, as indicated, by the Boards of Directors of the insurance companies.

In Witness Whereof, the CNA Companies have caused these presents to be signed by their Vice President and their corporate seals to be hereto affixed on this 19th day of December, 2023.

Continental Casualty Company
National Fire Insurance Company of Hartford
American Casualty Company of Reading, Pennsylvania

Larry Kasten — Vice President

State of South Dakota, County of Minnehaha, ss:

On this 19th day of December, 2023, before me personally came Larry Kasten to me known, who, being by me duly sworn, did depose and say: that he resides in the City of Sioux Falls, State of South Dakota; that he is a Vice President of Continental Casualty Company, an Illinois insurance company, National Fire Insurance Company of Hartford, an Illinois insurance company, and American Casualty Company of Reading, Pennsylvania, a Pennsylvania insurance company described in and which executed the above instrument; that he knows the seals of said insurance companies; that the seals affixed to the said instrument are such corporate seals; that they were so affixed pursuant to authority given by the Boards of Directors of said insurance companies and that he signed his name thereto pursuant to like authority, and acknowledges same to be the act and deed of said insurance companies.

My commission expires

March 2, 2026

M. BENT NOTARY PUBLIC SOUTH DAKOTA

M. Bent — Notary Public

CERTIFICATE

I, D. Johnson, Assistant Secretary of Continental Casualty Company, an Illinois insurance company, National Fire Insurance Company of Hartford, an Illinois insurance company, and American Casualty Company of Reading, Pennsylvania, a Pennsylvania insurance company do hereby certify that the Power of Attorney herein above set forth is still in force, and further certify that the By-Laws and Resolutions of the Board of Directors of the insurance companies printed below are still in force. In testimony whereof I have hereunto subscribed my name and affixed the seal of the said insurance companies this day of ,

Continental Casualty Company
National Fire Insurance Company of Hartford
American Casualty Company of Reading, Pennsylvania

D. Johnson — Assistant Secretary

Authorizing By-Laws and Resolutions

ADOPTED BY THE BOARD OF DIRECTORS OF EACH OF CONTINENTAL CASUALTY COMPANY, NATIONAL FIRE INSURANCE COMPANY OF HARTFORD, and AMERICAN CASUALTY COMPANY OF READING, PENNSYLVANIA (as defined above, the "CNA Companies"):

This Power of Attorney is made and executed pursuant to and by authority of the following resolution duly adopted by the Board of Directors of each of the above CNA Companies at a meeting held on May 12, 1995:

"RESOLVED: That any Senior or Group Vice President may authorize an officer to sign specific documents, agreements and instruments on behalf of the Company provided that the name of such authorized officer and a description of the documents, agreements or instruments that such officer may sign will be provided in writing by the Senior or Group Vice President to the Secretary of the Company prior to such execution becoming effective."

This Power of Attorney is signed by Larry Kasten, Vice President, who has been authorized pursuant to the above resolution to execute power of attorneys on behalf of each of the CNA Companies.

This Power of Attorney is signed and sealed by facsimile under and by the authority of the following Resolution adopted by the Board of Directors of each of the above Companies by unanimous written consent dated the 25th day of April, 2012:

"Whereas, the bylaws of the Company or specific resolution of the Board of Directors has authorized various officers (the "Authorized Officers") to execute various policies, bonds, undertakings and other obligatory instruments of like nature; and

Whereas, from time to time, the signature of the Authorized Officers, in addition to being provided in original, hard copy format, may be provided via facsimile or otherwise in an electronic format (collectively, "Electronic Signatures"); Now therefore be it resolved: that the Electronic Signature of any Authorized Officer shall be valid and binding on the Company."

This Power of Attorney may be signed by digital signature and sealed by a digital or otherwise electronic-formatted corporate seal under and by the authority of the following Resolution adopted by the Board of Directors of each of the above CNA Companies by unanimous written consent dated the 27th day of April, 2022:

"RESOLVED: That it is in the best interest of the Company to periodically ratify and confirm any corporate documents signed by digital signatures and to ratify and confirm the use of a digital or otherwise electronic-formatted corporate seal, each to be considered the act and deed of the Company."

Go to www.cnasurety.com > Owner / Obligee Services > Validate Bond Coverage, if you want to verify bond authenticity.

JUDYCON-01 KWATSON

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY) 6/23/2025

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER Acrisure Southeast Partners Insurance Services, LLC 1317 Citizens Blvd Leesburg, FL 34748	CONTACT NAME: Kimberly Watson PHONE (A/C, No, Ext): (859) 254-1836 FAX (A/C, No): E-MAIL ADDRESS: kiwatson@acrisure.com
INSURED Judy Construction Company 103 South Church St P.O. Box 457 Cynthiana, KY 41031	INSURER(S) AFFORDING COVERAGE — NAIC # INSURER A : The Phoenix Insurance Company — 25623 INSURER B : Travelers Property Casualty Company of America — 25674 INSURER C : AGC Associated General Contractors of America Self Insurance Fu INSURER D : INSURER E : INSURER F :

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	X COMMERCIAL GENERAL LIABILITY CLAIMS-MADE [X] OCCUR X EBL GEN'L AGGREGATE LIMIT APPLIES PER: POLICY [X] PRO-JECT [ ] LOC X OTHER PD Ded $2,500	X	X	DT-CO-4W659489-PHX-25	4/30/2025	4/30/2026	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG	$ 1,000,000 $ 500,000 $ 15,000 $ 1,000,000 $ 2,000,000 $ 2,000,000
B	AUTOMOBILE LIABILITY X ANY AUTO OWNED AUTOS ONLY [ ] SCHEDULED AUTOS X HIRED AUTOS ONLY [X] NON-OWNED AUTOS ONLY	X	X	810-4W659674-25-26-G	4/30/2025	4/30/2026	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident)	$ 1,000,000 $ $ $
B	X UMBRELLA LIAB [X] OCCUR EXCESS LIAB [ ] CLAIMS-MADE DED [X] RETENTION $ 10,000			CUP-4W660790-25-26	4/30/2025	4/30/2026	EACH OCCURRENCE AGGREGATE	$ 10,000,000 $ 10,000,000
C	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) Y/N [N] N/A If yes, describe under DESCRIPTION OF OPERATIONS below			17755	1/1/2025	1/1/2026	PER STATUTE [ ] OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	$ 4,500,000 $ 4,500,000 $ 4,500,000
B	Builders Risk			QT-630-4W660685-TIL-25	4/30/2025	4/30/2026	Limit	25,000,000
B	Special/Earthquake			QT-630-4W660685-TIL-25	4/30/2025	4/30/2026	Deductible	5,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

Project: East Hickman Pump Station Expansion and Rehabilitation Design Phase 2 Wastewater System Improvements, Bid No. 65-2025. LFUCG is an additional insured per written contract regarding general and auto liability, the general liability is primary and non-contributory, and the coverage includes products and completed operations. Umbrella is follow form. Policies contain 30-day notice of cancellation endorsements. Waiver of subrogation per written contract and as permitted by law on the coverage indication above.

CERTIFICATE HOLDER	CANCELLATION
Lexington-Fayette Urban County Government Office of the Director of Central Purchasing 200 East Main Street, Room 338 Lexington, KY 40507	SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS. AUTHORIZED REPRESENTATIVE

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SECTION 00700
GENERAL CONDITIONS

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This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly by

ACEC
American Council of Engineering Companies

ASCE American Society of Civil Engineers

National Society of Professional Engineers
Professional Engineers in Private Practice

AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASSOCIATED GENERAL CONTRACTORS OF AMERICA

AMERICAN SOCIETY OF CIVIL ENGINEERS

PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE
A Practice Division of the
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Endorsed by

CONSTRUCTION SPECIFICATIONS INSTITUTE

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These General Conditions have been prepared for use with the Suggested Forms of Agreement Between Owner and Contractor (EJCDC C-520 or C-525, 2007 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other. Comments concerning their usage are contained in the Narrative Guide to the EJCDC Construction Documents (EJCDC C-001, 2007 Edition). For guidance in the preparation of Supplementary Conditions, see Guide to the Preparation of Supplementary Conditions (EJCDC C-800, 2007 Edition).

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.

3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Asbestos*—Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

5. *Bid*—The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

6. *Bidder*—The individual or entity who submits a Bid directly to Owner.

7. *Bidding Documents*—The Bidding Requirements and the proposed Contract Documents (including all Addenda).

8. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and the Bid Form with any supplements.

9. *Change Order*—A document recommended by Engineer which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

10. *Claim*—A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.

11. *Contract*—The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

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12. *Contract Documents*—Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.

13. *Contract Price*—The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).

14. *Contract Times*—The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any; (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.

15. *Contractor*—The individual or entity with whom Owner has entered into the Agreement.

16. *Cost of the Work*—See Paragraph 11.01 for definition.

17. *Drawings*—That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.

18. *Effective Date of the Agreement*—The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

19. *Engineer*—The individual or entity named as such in the Agreement.

20. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.

21. *General Requirements*—Sections of Division 1 of the Specifications.

22. *Hazardous Environmental Condition*—The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto.

23. *Hazardous Waste*—The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

24. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

25. *Liens*—Charges, security interests, or encumbrances upon Project funds, real property, or personal property.

26. *Milestone*—A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

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27. *Notice of Award*—The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.

28. *Notice to Proceed*—A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.

29. *Owner*—The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.

30. *PCBs*—Polychlorinated biphenyls.

31. *Petroleum*—Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.

32. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.

33. *Project*—The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.

34. *Project Manual*—The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.

35. *Radioactive Material*—Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

36. *Resident Project Representative*—The authorized representative of Engineer who may be assigned to the Site or any part thereof.

37. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

38. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.

39. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

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40. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.

41. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.

42. *Specifications*—That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.

43. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.

44. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

45. *Successful Bidder*—The Bidder submitting a responsive Bid to whom Owner makes an award.

46. *Supplementary Conditions*—That part of the Contract Documents which amends or supplements these General Conditions.

47. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or Subcontractor.

48. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

49. *Unit Price Work*—Work to be paid for on the basis of unit prices.

50. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

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51. *Work Change Directive*—A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Engineer ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

1.02 *Terminology*

A. The words and terms discussed in Paragraph 1.02.B through F are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives:*

1. The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.

C. *Day:*

1. The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective:*

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

a. does not conform to the Contract Documents; or

b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

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c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

E. *Furnish, Install, Perform, Provide:*

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, "provide" is implied.

F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

B. *Evidence of Insurance:* Before any Work at the Site is started, Contractor and Owner shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Contractor and Owner respectively are required to purchase and maintain in accordance with Article 5.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor up to ten printed or hard copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction.

2.03 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the

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Agreement. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

2.04 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

2.05 *Before Starting Construction*

A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.06 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit instructions, receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.07 *Initial Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete

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and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result will be provided whether or not specifically called for, at no additional cost to Owner.

C. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in Article 9.

3.02 *Reference Standards*

A. Standards, Specifications, Codes, Laws, and Regulations

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of

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the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies:*

1. *Contractor's Review of Contract Documents Before Starting Work*: Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor discovers, or has actual knowledge of, and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.

2. *Contractor's Review of Contract Documents During Performance of Work*: If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation , (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies:*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

a. the provisions of any standard, specification, manual, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference in the Contract Documents); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.

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B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:

1. A Field Order;

2. Engineer's approval of a Shop Drawing or Sample (subject to the provisions of Paragraph 6.17.D.3); or

3. Engineer's written interpretation or clarification.

3.05 *Reuse of Documents*

A. Contractor and any Subcontractor or Supplier shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions; or

2. reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.06 *Electronic Data*

A. Unless otherwise stated in the Supplementary Conditions, the data furnished by Owner or Engineer to Contractor, or by Contractor to Owner or Engineer, that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.

C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

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ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

4.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 *Subsurface and Physical Conditions*

A. *Reports and Drawings:* The Supplementary Conditions identify:

1. those reports known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site; and

2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

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4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed either:

1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or

2. is of such a nature as to require a change in the Contract Documents; or

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. *Engineer's Review*: After receipt of written notice as required by Paragraph 4.03.A, Engineer will promptly review the pertinent condition, determine the necessity of Owner's obtaining additional exploration or tests with respect thereto, and advise Owner in writing (with a copy to Contractor) of Engineer's findings and conclusions.

C. *Possible Price and Times Adjustments:*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and

b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:

a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or

b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and

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contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or

c. Contractor failed to give the written notice as required by Paragraph 4.03.A.

3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, neither Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data provided by others; and

2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

a. reviewing and checking all such information and data;

b. locating all Underground Facilities shown or indicated in the Contract Documents;

c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and

d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated:*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the

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consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

2. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

4.05 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.06 *Hazardous Environmental Condition at Site*

A. *Reports and Drawings:* The Supplementary Conditions identify those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at the Site.

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.

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C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.

D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 4.06.E.

E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered written notice to Contractor: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.

F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.

G. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.G shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

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H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.H shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

I. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 – BONDS AND INSURANCE

5.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish performance and payment bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.

B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed each bond.

C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.

5.02 *Licensed Sureties and Insurers*

A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also

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meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.03 *Certificates of Insurance*

A. Contractor shall deliver to Owner, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.

B. Owner shall deliver to Contractor, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Contractor or any other additional insured) which Owner is required to purchase and maintain.

C. Failure of Owner to demand such certificates or other evidence of Contractor's full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.

D. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor.

E. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner in the Contract Documents.

5.04 *Contractor's Insurance*

A. Contractor shall purchase and maintain such insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;

2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;

3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;

4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:

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a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or

b. by any other person for any other reason;

5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and

6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

B. The policies of insurance required by this Paragraph 5.04 shall:

1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, be written on an occurrence basis, include as additional insureds (subject to any customary exclusion regarding professional liability) Owner and Engineer, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;

2. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;

3. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;

4. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);

5. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and

6. include completed operations coverage:

a. Such insurance shall remain in effect for two years after final payment.

b. Contractor shall furnish Owner and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.

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5.05 *Owner's Liability Insurance*

A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

5.06 *Property Insurance*

A. Unless otherwise provided in the Supplementary Conditions, Owner shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee;

2. be written on a Builder's Risk "all-risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage (other than that caused by flood), and such other perils or causes of loss as may be specifically required by the Supplementary Conditions.

3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);

4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer;

5. allow for partial utilization of the Work by Owner;

6. include testing and startup; and

7. be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with 30 days written notice to each other loss payee to whom a certificate of insurance has been issued.

B. Owner shall purchase and maintain such equipment breakdown insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors,

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members, partners, employees, agents, consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee.

C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other loss payee to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with Paragraph 5.07.

D. Owner shall not be responsible for purchasing and maintaining any property insurance specified in this Paragraph 5.06 to protect the interests of Contractor, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by Contractor, Subcontractors, or others suffering any such loss, and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

E. If Contractor requests in writing that other special insurance be included in the property insurance policies provided under this Paragraph 5.06, Owner shall, if possible, include such insurance, and the cost thereof will be charged to Contractor by appropriate Change Order. Prior to commencement of the Work at the Site, Owner shall in writing advise Contractor whether or not such other insurance has been procured by Owner.

5.07 *Waiver of Rights*

A. Owner and Contractor intend that all policies purchased in accordance with Paragraph 5.06 will protect Owner, Contractor, Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or loss payees thereunder. Owner and Contractor waive all rights against each other and their respective officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner as trustee or otherwise payable under any policy so issued.

B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for:

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1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial utilization pursuant to Paragraph 14.05, after Substantial Completion pursuant to Paragraph 14.04, or after final payment pursuant to Paragraph 14.07.

C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them.

5.08 *Receipt and Application of Insurance Proceeds*

A. Any insured loss under the policies of insurance required by Paragraph 5.06 will be adjusted with Owner and made payable to Owner as fiduciary for the loss payees, as their interests may appear, subject to the requirements of any applicable mortgage clause and of Paragraph 5.08.B. Owner shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order.

B. Owner as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to Owner's exercise of this power. If such objection be made, Owner as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, Owner as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, Owner as fiduciary shall give bond for the proper performance of such duties.

5.09 *Acceptance of Bonds and Insurance; Option to Replace*

A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01.B. Owner and Contractor shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent bonds or insurance to protect such other party's

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interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

A. If Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to Paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6 – CONTRACTOR'S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of Owner or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

6.02 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner's written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.

6.03 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

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B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

6.05 *Substitutes and "Or-Equals"*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to Engineer for review under the circumstances described below.

1. *"Or-Equal" Items:* If in Engineer's sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an "or-equal" item, in which case review and approval of the proposed item may, in Engineer's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that:

1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

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2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole; and

3) it has a proven record of performance and availability of responsive service.

b. Contractor certifies that, if approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

2. *Substitute Items:*

a. If in Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.

b. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.

c. The requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented by the General Requirements, and as Engineer may decide is appropriate under the circumstances.

d. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

1) shall certify that the proposed substitute item will:

a) perform adequately the functions and achieve the results called for by the general design,

b) be similar in substance to that specified, and

c) be suited to the same use as that specified;

2) will state:

a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time,

b) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and

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c) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;

3) will identify:

a) all variations of the proposed substitute item from that specified, and

b) available engineering, sales, maintenance, repair, and replacement services; and

4) shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.

B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those provided in Paragraph 6.05.A.2.

C. *Engineer's Evaluation:* Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until Engineer's review is complete, which will be evidenced by a Change Order in the case of a substitute and an approved Shop Drawing for an "or equal." Engineer will advise Contractor in writing of any negative determination.

D. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

E. *Engineer's Cost Reimbursement*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

F. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

6.06 *Concerning Subcontractors, Suppliers, and Others*

A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor shall not be

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required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.

B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective Work.

C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other individual or entity; nor

2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.

E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.

F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

G. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as a loss payee on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner,

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Contractor, Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

6.07 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 *Permits*

A. Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

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6.09 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

6.10 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

6.11 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas:*

1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.

2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.

3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought

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by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

B. *Removal of Debris During Performance of the Work:* During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to Engineer for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to Engineer for Owner.

6.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

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B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

E. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

F. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 *Safety Representative*

A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

6.16 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are

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required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

6.17 *Shop Drawings and Samples*

A. Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as Engineer may require.

1. *Shop Drawings:*

a. Submit number of copies specified in the General Requirements.

b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.

2. *Samples:*

a. Submit number of Samples specified in the Specifications.

b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.

B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Submittal Procedures:*

1. Before submitting each Shop Drawing or Sample, Contractor shall have:

a. reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

c. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

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d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.

3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

D. *Engineer's Review:*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

3. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

E. *Resubmittal Procedures:*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

6.18 *Continuing the Work*

A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any

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disputes or disagreements, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing.

6.19 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on representation of Contractor's warranty and guarantee.

B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;

2. recommendation by Engineer or payment by Owner of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. use or occupancy of the Work or any part thereof by Owner;

5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;

6. any inspection, test, or approval by others; or

7. any correction of defective Work by Owner.

6.20 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the

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extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable .

B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:

1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

6.21 *Delegation of Professional Design Services*

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.

B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.

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D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

ARTICLE 7 – OTHER WORK AT THE SITE

7.01 *Related Work at Site*

A. Owner may perform other work related to the Project at the Site with Owner's employees, or through other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:

1. written notice thereof will be given to Contractor prior to starting any such other work; and

2. if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.

B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.

C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

7.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:

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1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;

2. the specific matters to be covered by such authority and responsibility will be itemized; and

3. the extent of such authority and responsibilities will be provided.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

7.03 *Legal Relationships*

A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.

B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's wrongful actions or inactions.

C. Contractor shall be liable to Owner and any other contractor under direct contract to Owner for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's wrongful action or inactions.

ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

8.02 *Replacement of Engineer*

A. In case of termination of the employment of Engineer, Owner shall appoint an engineer to whom Contractor makes no reasonable objection, whose status under the Contract Documents shall be that of the former Engineer.

8.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

8.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.

8.05 *Lands and Easements; Reports and Tests*

A. Owner's duties with respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of reports of explorations and

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tests of subsurface conditions and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

8.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

8.07 *Change Orders*

A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

8.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

8.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

8.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

8.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents.

8.12 *Compliance with Safety Program*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed pursuant to Paragraph 6.13.D.

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents.

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9.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

9.03 *Project Representative*

A. If Owner and Engineer agree, Engineer will furnish a Resident Project Representative to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 *Authorized Variations in Work*

A. Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who shall perform the Work involved promptly. If Owner or Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

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9.05 *Rejecting Defective Work*

A. Engineer will have authority to reject Work which Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.06 *Shop Drawings, Change Orders and Payments*

A. In connection with Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.

B. In connection with Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.

C. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.

D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

9.07 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Paragraph 10.05.

9.08 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 30 days of the event giving rise to the question.

B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believes that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.

C. Engineer's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.

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D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.09 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to the Resident Project Representative, if any, and assistants, if any.

9.10 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Engineer has been informed pursuant to Paragraph 6.13.D.

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

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B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.

10.02 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.D.

10.03 *Execution of Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:

1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;

2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and

3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

10.04 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

10.05 *Claims*

A. *Engineer's Decision Required*: All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.

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B. *Notice:* Written notice stating the general nature of each Claim shall be delivered by the claimant to Engineer and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data shall be delivered to the Engineer and the other party to the Contract within 60 days after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Times shall be prepared in accordance with the provisions of Paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to Engineer and the claimant within 30 days after receipt of the claimant's last submittal (unless Engineer allows additional time).

C. *Engineer's Action*: Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:

1. deny the Claim in whole or in part;

2. approve the Claim; or

3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.

D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.

E. Engineer's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.

F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

ARTICLE 11 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

11.01 *Cost of the Work*

A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing

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in the locality of the Project, shall not include any of the costs itemized in Paragraph 11.01.B, and shall include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.

5. Supplemental costs including the following:

    a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

    b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

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c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.

B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

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3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A.

C. *Contractor's Fee:* When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.

D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

11.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances:*

1. Contractor agrees that:

a. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

b. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

C. *Contingency Allowance:*

1. Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

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11.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if:

1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

2. there is no corresponding adjustment with respect to any other item of Work; and

3. Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or

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3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).

C. *Contractor's Fee:* The Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;

b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent;

c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 12.01.C.2.a and 12.01.C.2.b is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;

d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;

e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and

f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

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12.03 *Delays*

A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. Delays beyond the control of Contractor shall include, but not be limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.

B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.C.

D. Owner, Engineer, and their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 *Notice of Defects*

A. Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. Defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspection, and

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testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

13.03 *Tests and Inspections*

A. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

B. Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;

2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in Paragraph 13.04.C; and

3. as otherwise specifically provided in the Contract Documents.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.

E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation.

F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.

13.04 *Uncovering Work*

A. If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.

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B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.

C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.

D. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

13.05 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 *Correction or Removal of Defective Work*

A. Promptly after receipt of written notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).

B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

13.07 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract

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Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. repair such defective land or areas; or

2. correct such defective Work; or

3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

13.08 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, Engineer) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness) and for the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's

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recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

13.09 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct, or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.

C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

A. The Schedule of Values established as provided in Paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

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14.02 *Progress Payments*

A. *Applications for Payments:*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

B. *Review of Applications:*

1. Engineer will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and any other qualifications stated in the recommendation); and

   c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

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3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

    a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or

    b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

    a. to supervise, direct, or control the Work, or

    b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

    c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or

    d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or

    e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:

    a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;

    b. the Contract Price has been reduced by Change Orders;

    c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or

    d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

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C. *Payment Becomes Due:*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D) become due, and when due will be paid by Owner to Contractor.

D. *Reduction in Payment:*

1. Owner may refuse to make payment of the full amount recommended by Engineer because:

   a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;

   b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;

   c. there are other items entitling Owner to a set-off against the amount recommended; or

   d. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.

2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor remedies the reasons for such action.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1 and subject to interest as provided in the Agreement.

14.03 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

14.04 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion.

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B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the tentative certificate to Owner, notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will, within said 14 days, execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of delivery of the tentative certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.

E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the tentative list.

14.05 *Partial Utilization*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 14.04.A through D for that part of the Work.

2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

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3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

14.06 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 *Final Payment*

A. *Application for Payment:*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.6;

   b. consent of the surety, if any, to final payment;

   c. a list of all Claims against Owner that Contractor believes are unsettled; and

   d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid

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or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

B. *Engineer's Review of Application and Acceptance:*

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Payment Becomes Due:*

1. Thirty days after the presentation to Owner of the Application for Payment and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and will be paid by Owner to Contractor.

14.08 *Final Completion Delayed*

A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Engineer so confirms, Owner shall, upon receipt of Contractor's final Application for Payment (for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Engineer with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

14.09 *Waiver of Claims*

A. The making and acceptance of final payment will constitute:

1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees

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specified therein, or from Contractor's continuing obligations under the Contract Documents; and

2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes a Claim therefor as provided in Paragraph 10.05.

15.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);

2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;

3. Contractor's repeated disregard of the authority of Engineer; or

4. Contractor's violation in any substantial way of any provisions of the Contract Documents.

B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor:

1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion);

2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere; and

3. complete the Work as Owner may deem expedient.

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C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.

E. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.

F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B and 15.02.C.

15.03 *Owner May Terminate For Convenience*

A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

3. all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and

4. reasonable expenses directly attributable to termination.

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B. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this Paragraph.

ARTICLE 16 – DISPUTE RESOLUTION

16.01 *Methods and Procedures*

A. Either Owner or Contractor may request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract. Timely submission of the request shall stay the effect of Paragraph 10.05.E.

B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.

C. If the Claim is not resolved by mediation, Engineer's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:

1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions; or

2. agrees with the other party to submit the Claim to another dispute resolution process; or

3. gives written notice to the other party of the intent to submit the Claim to a court of competent jurisdiction.

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ARTICLE 17 – MISCELLANEOUS

17.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended; or

2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 *Computation of Times*

A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents. The provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

17.05 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

17.06 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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SECTION 00800

SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (EJCDC C-700) (2007 Edition) and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 Defined Terms

1.01.A.12 Replace in its entirety with the following:

"12. Contract Documents – The Contract Documents establish the rights and obligations of the parties and include the Agreement, Addenda (which pertain to the Contract Documents), Contractor's Bid (including documentation accompanying the Bid and any post Bid documentation submitted prior to the Notice of Award) when attached as an exhibit to the Agreement, the Notice to Proceed, the Bonds, these General Conditions, the Supplementary Conditions, the Specifications and the Drawings as the same are more specifically identified in the Agreement, together with all Written Amendments, Change Orders, Work Change Directives, Field Orders, and Engineer's written interpretations and clarifications issued on or after the Effective Date of the Agreement. Approved Shop Drawings and the reports and drawings of subsurface and physical conditions are not Contract Documents. Only printed or Hardcopies of the items listed in this paragraph are Contract Documents. Files in electronic format of text, data, graphics, and the like that may be furnished by Owner to Contractor are not Contract Documents".

1.01.A.44 First sentence, change: "in the opinion of the Engineer", to "in the opinion of Engineer and Owner".

1.02 Terminology

Delete 1.02.E and replace with the following:

1.02.E The words "furnish", "furnish and install", "install", and "provide" or words with similar meaning shall be interpreted, unless otherwise specifically stated, to mean "furnish and install complete in place and ready for service".

Add the following:

1.02.G The terms used in these Supplementary Conditions which are defined in the Standard General Conditions of the Construction Contract (EJCDC C-700, (2007 Edition) have the meanings assigned to them in the General Conditions.

ARTICLE 2 – PRELIMINARY MATTERS

Add the following:

2.00 Execution of Agreement

2.00.A At least six (6) counterparts of the Agreement will be executed and delivered by the Contractor to the OWNER within fifteen (15) days of the Notice of Award and receipt of the Contract Documents by the Contractor for execution; and OWNER will execute and deliver one counterpart to Contractor within ten (10) days of receipt of the executed Agreement from Contractor.

2.01 Delivery of Bonds and Evidence of Insurance

2.01.B Replace "Before any Work at the Site is started, Contractor and Owner shall each deliver to the other" with "When Contractor delivers the executed counterparts of the Agreement to the Owner, Contractor shall deliver to the Owner", and replace "and Owner respectively are" with "is".

2.02 Copies of Documents

2.02A Revise as follows:

Owner shall furnish to Contractor up to ~~ten~~ three printed or hard copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction.

2.03 Commencement of Contract Times; Notice to Proceed:

2.03.A Delete in its entirety and substitute the following:

2.03.A The Contract Time will commence to run on the day indicated in the Notice to Proceed; but in no event will the Contract Time commence to run later than the ninetieth day after the day of Bid opening or the thirtieth day after the effective date of the Agreement. By mutual consent of the parties to the Contract, these time limits may be changed.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING AND REUSE

3.01 Intent

Add the following:

3.01.D It is the intent of the Specification and Contract Documents to obtain an operable Project. Equipment, components, systems, etc., therein shall be made operable by the Contractor.

3.01.E The Contract Drawings may be supplemented from time to time with additional Drawings by the Engineer as may be required to illustrate the work or, as the work progresses, with additional Drawings, by the Contractor, subject to the approval of the Engineer. Supplementary Drawings, when issued by the Engineer or by the Contractor, after approval by the Engineer, shall be furnished

in sufficient quantity to all those who, in the opinion of the Engineer, are affected by such Drawings.

3.03 Reporting and Resolving Discrepancies

Add the following:

3.03.B.2 In resolving such conflicts, errors and discrepancies, the Contract Documents shall be given precedence in the following order:

a. Agreement
b. Field and Change Orders
c. Addenda
d. Special Conditions
e. Instruction to Bidders
f. General Conditions
g. Project Specifications and Drawings
h. LFUCG standard specifications and standard details

Figure dimensions on drawings shall govern over scale dimensions and detailed Drawings shall govern over general Drawings.

ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS.

4.02 Subsurface and Physical Conditions

4.02.A Delete: "the Supplementary Conditions", and substitute "Section 00320 – Geotechnical Data".

4.02.B Second sentence, delete: "Supplementary Conditions" and substitute "Specifications and Contract Drawings".

4.04 Underground Facilities

Add the following:

4.04.B.3 The Owner, Engineer, and Engineer's Consultants shall not be liable to Contractor for any claims, costs, losses or damages incurred or sustained by Contractor on or in connection with any other project or anticipated project.

4.06 Hazardous Environmental Condition at Site

4.06.A First sentence, delete "Supplementary Conditions" and substitute "Section 00300 – Information Available To Bidders."

4.06.B Second sentence, delete "Supplementary Conditions: and substitute "Specifications and Contract Drawings."

4.06.G First sentence, insert "Kentucky" between "by" and "Laws".

Add the following at the end of this section: "The parties understand and acknowledge that no Kentucky case, statute, or Constitutional provision authorizes a local government to indemnify a contractor and that this contract provision may be unenforceable.

ARTICLE 5 – BONDS AND INSURANCE

Delete Article 5 in its entirety and substitute the following:

5.01 Performance and Payment Bonds

5.01A Concurrent with execution of the Agreement and within fifteen (15) days of the Notice of Award, the successful Contractor shall procure, execute and deliver to the OWNER and maintain, at his own cost and expense, the following bonds in the forms attached, of a surety company approved by the State of Kentucky as a Surety:

5.01.B Performance Bond – in an amount not less than 100% of the total amount payable to the Contractor by the terms of the Contract as security for the faithful performance of the work. Bond must be valid until one (1) year after the date of issuance of the Certificate of Substantial Completion.

5.01.C Payment Bond – in an amount not less than 100% of the total amount payable to the Contractor by the terms of the Contract as security for the payment of all persons performing labor and furnishing material in connection with the work. Bond must be valid until one (1) year after date of issuance of the Certificate of Substantial Completion.

5.01.D All Bonds signed by an agent must be accompanied by a certified copy of the authority to act.

5.01.E If the Surety on any Bond furnished by the Contractor is declared bankrupt or becomes insolvent or its right to do business in the State of Kentucky is revoked, the Contractor shall within five (5) days thereafter substitute another Bond or Surety, both of which shall be acceptable to the OWNER.

5.02 Insurance Requirements

See Section 00600 – Bonds and Certificates for Insurance Requirements.

5.03 Contractor's Liability Insurance

See Section 00600 – Bonds and Certificates for Insurance Requirements.

5.04 Indemnification Agreement

See Section 00600 – Bonds and Certificates for Indemnification.

ARTICLE 6 – CONTRACTOR'S RESPONSIBILITIES

6.06 Concerning Subcontractors, Suppliers and Others

6.06.B First sentence, delete: "If the Supplementary Conditions", and substitute "The Bid Form". The seventh line, delete "Supplementary Conditions", and substitute "Bid Form".

6.06.G Delete in its entirety and substitute the following:

6.06.G All work performed for Contractor by a Subcontractor shall be pursuant to an appropriate agreement between the Contractor and Subcontractor. The Subcontractor shall not commence work until Contractor has obtained all insurance as required by Paragraphs 5.02 through 5.03 inclusive.

6.07 Patent Fees and Royalties

6.07 Delete 6.07.A, 6.07.B, and 6.07.C in their entirety and substitute the following:

6.07.A Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work of any invention, design, process, products or device which is the subject of patent rights or copyrights held by others. Contractor shall indemnify and hold harmless OWNER and Engineer, and anyone directly or indirectly employed by either of them from and against all claims, damages, losses and expenses, including attorney's fees, arising out of any infringement of patent rights or copyrights incident to the use in the performance of the Work or furnished by him in fulfillment of the requirements of this Contract. In the event of any claim or action by law on account of such patents or fees, it is agreed that the OWNER may retain out of the monies which are, or which may become due the Contractor under this Contract, a sum of money sufficient to protect itself against loss, and to retain the same until said claims are paid or are satisfactorily adjusted.

6.08 Permits

6.08.A Third sentence of paragraph delete, "or if there are no Bids.....to the Work.", and substitute "and the Contractor shall pay all charges of utility owners for connections to the Work."

6.09 Laws and Regulations

6.09.B Delete 6.09B in its entirety and substitute the following:

6.09.B If Contractor observes that the Specifications or Drawings are at variance with any Laws or Regulations, he shall give Engineer prompt written notice thereof. If Contractor performs any Work knowing it to be contrary to such Laws or Regulations, and without such notice to Engineer, he shall bear all costs arising therefrom. The Contractor shall, at all times, observe and comply with and shall cause all his agents and employees and all his Subcontractors to observe and comply with all such existing Laws or Regulations, and shall protect and indemnify the OWNER and the Engineer and the municipalities in which work is being performed, and their officers and agents against any claim, civil penalty, fine or liability arising from or based on the violation of any such Law or Regulation, whether by himself or his employees or any of his Subcontractors.

6.13 Safety and Protection

6.13.B First sentence, after "CONTRACTOR" add the following:

", subject to provisions 6.09.B,"

6.19 Contractor's General Warranty and Guarantee

6.19.A After the first sentence of Section 6.19.A add the following:
"All materials or equipment delivered to the site shall be accompanied by certificates, signed by an authorized officer of the supplier, and notarized guaranteeing that the materials or equipment conform to specification requirements, Such certificates shall be immediately turned over to the Engineer. Materials or equipment delivered to the site without such certificates will be subject to rejection. The warranty and guarantee period shall be for a period of one (1) year, or such longer period as may be prescribed by Law, from the date of Substantial Completion."

6.20 Indemnification

6.20.A First sentence, after "...claims, costs" add the following:

", civil penalties, fines,"

6.20.C Add the following:

6.30.C.3 Nothing in the Contract Documents shall create or give to third parties any claim or right of action against the Contractor, the OWNER or the Engineer beyond such as may legally exist irrespective of the Contract.

ARTICLE 7 – OTHER WORK AT THE SITE

7.02 Coordination

Delete in its entirety.

7.03 Legal Relationships

7.03.B Delete "Owner and".

7.03.C Delete "Owner and".

ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.02 Replacement of Engineer

8.02.A Delete in its entirety.

8.06 Insurance

8.06.A Delete in its entirety.

8.11 Evidence of Financial Arrangements

8.11.A Delete in its entirety.

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

9.01 OWNER'S Representative

9.01.A Delete in its entirety and substitute the following:

9.01.A Engineer will be the OWNER'S representative during the construction period, and his instructions shall be carried into effect promptly and efficiently.

9.03 Project Representative

Add the following:

9.03.B The Resident Project Representative will serve as the Engineer's liaison with the Contractor, working principally through the Contractor's resident superintendent to assist him in understanding the intent of the Contract Documents.

9.03.C The Resident Project Representative shall conduct on-site observations of the work in progress to confirm that the work is proceeding in accordance with the Contract Documents. He will verify that tests, equipment and systems start-ups and operating maintenance instructions are conducted as required by the Contract Documents. He will have the authority to disapprove or reject defective work in accordance with Article 13.

9.09 Limitations on Engineer's Authority and Responsibilities

Add the following:

9.09.F Except upon written instructions of the Engineer, the Resident Project Representative:

1. Shall not authorize any deviation from the Contract Documents or approve any substitute materials or equipment.

2. Shall not exceed limitations of Engineer's authority as set forth in the Contract Documents.

3. Shall not undertake any of the responsibilities of Contractor, Subcontractors, or Contractor's superintendent, or expedite the Work.

4. Shall not advise on or issue directions relative to any aspect of the means, methods, techniques, sequences or procedures of construction unless such is specifically called for in the Contract.

5. Shall not advise on or issue directions as to safety precautions and programs in connection with the Work.

ARTICLE 11 – COST OF THE WORK; ALLOWANCES, UNIT PRICE WORK

11.01 Cost of the Work

11.01.A Last sentence, following "...in Paragraph 11.01.B," insert the following:

"or claims for extra cost shall be considered based on an escalation of labor costs throughout the period of the Contract,"

11.01.A.2 Add the following at the end of the paragraph:

"No claims for extra cost shall be considered based on an escalation of material costs throughout the period of the Contract."

11.01.A.3 Delete second sentence "If required...be acceptable."

11.01.A.4 Delete in its entirety.

11.01.A.5.a Delete in its entirety.

11.01.A.5.c Add the following before last sentence of paragraph:

"These rates shall include all fuel, lubricants, insurance, etc. Equipment rental charges shall not exceed the prorated monthly rental rates listed in the current edition of the 'Compilation of Rental Rates for Construction Equipment' as published by the Associated Equipment Distributors. Charges per hour shall be determined by dividing the monthly rates by 176."

11.01.A.5.f Delete in its entirety.

11.01.A.5.g Delete in its entirety.

11.01.A.5.h Delete in its entirety.

11.03 Unit Price of Work:

11.03.D.1 Delete "materially and significantly", and insert "by more than plus or minus twenty percent (20%)".

ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 Change of Contract Price

12.01.A Add the following after the last sentence:

Section 01025 shall be given precedence over section 00700 regarding changes in contract price.

12.03 Delays

12.03.B Delete in its entirety and substitute the following:

12.03.B Delays beyond the control of the Contractor, as provided in paragraph 12.03.A, shall not entitle the Contractor to obtain additional project overhead costs unless such delays extend the Project as described below:

1. beyond the original Contract Times,

2. beyond the Contract Times for which the overhead costs have been previously approved, or

3. beyond Contract Times that are extended as a result of delays described in 12.03.C.

For the purpose of this paragraph, overhead costs shall be the supplemental costs defined in 11.01.A.5, paragraphs a, b, c, g, h and i. The Contractor's bid shall include all overhead costs as necessary to be on the Project for the original Contract Times.

12.03.C Add the following after the last sentence:

If the Contractor and the Owner cannot agree upon an equitable adjustment in the Contract Times, delays described in this Paragraph 12.03.C shall be determined as follows:

1. Contractor shall obtain weather history for the most recent five (5) years (minimum) preceding the Bid date. Weather history shall be obtained from the National Oceanic & Atmospheric Administration (NOAA) or other source approved by the Engineer. Historical weather shall be based on data from the weather reporting station closest to the project site.

2. For delays to be considered that are associated with an abnormal amount of rain, the Contractor shall use the weather history to calculate an average number of days that rainfall exceeded 0.1-inches for the period (month, quarter, year, etc.) in question. The average value calculated shall be rounded up to the next full day. A time extension may be considered equal to the number of days, above the calculated average, that the period in question experienced rainfall in excess of 0.1-inches. A Contract Time extension will not be considered for rain amounts less than 0.1-inches.

3. For daily rain amounts in excess of 1-inch, a time extension of one day beyond the number of days calculated as described above may be considered.

4. For delays associated with other abnormal weather events, the weather history shall be used to calculate an average number of days for the type of weather considered to be the cause of a delay. (Calculation of the average number of days shall be as described above.) Where the Contractor can demonstrate that the abnormal weather event has impaired his ability to

perform work, beyond the day of the abnormal event, to perform site maintenance as necessary to restore the site to a workable condition may be considered.

ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.03 Tests and Inspections

13.03.B Delete in its entirety and substitute the following:

13.03.B Contractor shall employ and pay for inspections and testing services specifically noted as such in the Contract.

13.03.C Delete in its entirety and substitute the following:

13.03.C If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any Work to be specifically inspected, tested, or approved by some public body, Contractor shall assume full responsibility therefore, pay all costs in connection therewith and furnish Engineer the required certificates of inspection, testing or approval.

Add the following:

13.03.G The OWNER reserves the right to independently perform at its own expense, laboratory tests on random samples of material or performance tests on equipment delivered to the site. These tests if made will be conducted in accordance with the appropriate referenced standards or Specification requirements. The entire shipment represented by a given sample, samples or piece of equipment may be rejected based on the failure of samples or pieces of equipment to meet specified test requirements. All rejected materials or equipment shall be removed from the site, whether stored or installed in the Work, and the required replacement shall be made, all at no additional cost to the OWNER.

13.05 OWNER May Stop the Work:

13.05A First sentence, after "...conform to the Contract Documents", insert "or if the Work interferes with the operation of the existing facility".

13.06 Correction or Removal of Defective Work

Add the following:

13.06.C At any time during the progress of the Work and up to the date of final acceptance, the Engineer shall have the right to reject any work which does not conform to the requirements of the Contract Documents, even though such work has been previously inspected and paid for. Any omissions or failure on the part of the Engineer to disapprove or reject any Work or materials at the time of inspection shall not be construed as an acceptance of any defective work or materials.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 Schedule of Values

Add the following:

14.01.B The Contractor shall submit for the Engineer's approval, a complete breakdown of all Lump Sum Items in the Proposal. This breakdown, modified as directed by the Engineer, will be used as a basis for preparing estimates and establishing progress payments.

14.02 Progress Payments

14.02.A.3 Delete in its entirety and replace with the following:

14.02.A.3 Progress payment request shall include the percentage of the total amount of the Contract which has been completed from initiation of construction of the Project to and including the last day of the preceding month, or other mutually agreed upon day of the month accompanied by such data and supporting evidence as OWNER or Engineer may require.

Add the following:

14.02.A.4 Forms to be used shall be prepared by the Contractor and submitted to the Engineer for approval.

14.02.A.5 At the option of the OWNER, partial payment up to the estimated value, less retainage, may be allowed for any materials and equipment not incorporated in the Work, pursuant to the following conditions:

a. Equipment or materials stored on the site shall be properly stored, protected and maintained.

b. For any partial payment, the Contractor shall submit, with his monthly progress payment from each material or equipment manufacturer, bills or invoices indicating actual material cost.

c. Contractor shall submit evidence that he has paid for materials or equipment stored and for which the Engineer has authorized partial payment and previous progress payments, prior to submission to the next monthly payment request. (See example letter at the end of this Section 00800).

14.02.A.6 The OWNER will retain ten percent (10%) of the amount of each such estimate until the monetary value of the Work completed under the Contract, including any amendment thereto, equals fifty percent (50%) of the total monetary value of the Contract. After fifty percent (50%) of the monetary value of Work is completed under the Contract, including any amendment thereto, as evidenced by approved Partial Payment Requests exclusive of stored materials, and in the opinion of the OWNER, satisfactory progress is being made, the OWNER may adjust future partial payment so that five percent (5%) of the amount of the Contract, including any amendment thereof, is retained.

14.02.A.7 If the OWNER determines it is appropriate to reduce retainage, the method used for such adjustment shall be to fix retainage at five percent (5%) of the amount of the Contract, including any amendment thereto,(when the work is 50% complete) and to pay all subsequent Partial Payment Requests to the full approved amount. The intent of such an adjustment is to gradually reduce retainage to five percent (5%) of the amount of the Contract, including any amendment thereto, when the Work is one hundred percent (100%) complete.

14.02.A.8 The OWNER may reinstate up to ten percent (10%) retainage if it is determined that the Contractor is not making satisfactory progress or there is other specific cause for retainage.

14.02.B.1 Review of Applications:

First sentence delete "10 days", insert "30 days".

14.02.C.1 Payment Becomes Due:

First sentence delete "Ten days" and insert "Thirty Days".

14.02.D.3 Delete in its entirety.

14.04 Substantial Completion

14.04 Delete paragraphs A, B, C, and D in their entirety and substitute the following:

14.04.A Contractor may, in writing to OWNER and Engineer, certify that the entire Project is substantially complete and request that Engineer issue a certificate of Substantial Completion. Within a reasonable time thereafter, OWNER, Contractor and Engineer shall inspect the Project to determine the status of completion. If Engineer and OWNER do not consider the Project substantially complete, Engineer will notify Contractor in writing giving his reasons, therefore. If Engineer and OWNER consider the Project substantially complete, Engineer will prepare and deliver to OWNER a tentative certificate of Substantial Completion and the responsibilities between OWNER and Contractor for maintenance, heat and utilities. There shall be attached to the certificate a tentative list of items to be completed or corrected before Final Completion, and the certificate shall fix the time within which such items shall be completed or corrected, said time to be within Contract Time. No warranties associated with the Project shall start until issuance of the certificate of Substantial Completion.

14.04.B In accordance with KRS 371.410, Substantial Completion is the point at which, as certified in writing by OWNER, a project is at the level of completion, in strict compliance with the contract, where:

1. Necessary approval by public regulatory authorities has been given.
2. The Owner has received all required warranties and documentation; and
3. The Owner may enjoy beneficial use or occupancy and may use, operate, and maintain the project in all respects, for its intended purpose.

14.05 Partial Utilization

14.05.A Delete in its entirety and substitute the following:

14.05.A Partial Utilization is also referred to as "Beneficial Occupancy" and "In Service Date". Partial Utilization (Beneficial Occupancy) will occur before Substantial Completion of entire Project. Prior to Substantial Completion of the entire Project, OWNER may request Contractor to permit them to use a specified part of the Project which they believe they may use without significant interference with construction of the other parts of the Project. Prior to requesting Beneficial Occupancy all testing shall be complete and passed, all training shall be complete, and that part of the Project shall be operational for its functional design. If Contractor agrees, Contractor shall certify to OWNER and Engineer that said part of the Project has achieved Beneficial Occupancy and request the Engineer to issue a memorandum declaring Beneficial Occupancy for that part of the Project. Within a reasonable time thereafter, OWNER, Contractor, and Engineer shall inspect that part of the Project to determine its status of completion. If Engineer and OWNER do not consider that it has achieved Beneficial Occupancy, Engineer will notify Contractor in writing giving his reasons therefor. If Engineer and OWNER consider that part of the Project to have reached Beneficial Occupancy, Engineer will execute and deliver to OWNER and Contractor a memorandum to that effect, fixing the date of Beneficial Occupancy and the responsibility between OWNER and Contractor for maintenance, heat, and utilities, as it pertains to that part of the Project.

14.05.B Equipment Warranties will not begin until after successful start-up, training, and acceptance by Owner for Substantial Completion of the entire Project. Any manufacturer's request to initiate warranty period earlier than Owner's acceptance will not be valid.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 Owner May Suspend Work

Add the following:

15.01.B Should the OWNER suspend Work due to repeated unsafe Work conducted by the Contractor, which is confirmed by subsequent inspection by OSHA, the Contractor shall not be allowed any adjustment in Contract Price or extension of Contract Time attributed to the delay.

15.02 Owner May Terminate for Cause

15.02.A.2 Add the following to the end of first sentence after "jurisdiction":

"(including those governing employee safety)"

15.02D Delete in its entirety.

Add the following:

15.05 Assignment of Contract

15.05 Contractor shall not assign, transfer, convey or otherwise dispose of the Contract, or of his legal right, title, or interest in or to the same or to any part thereof, without the prior written consent of the OWNER. Contractor shall not assign by power of attorney or otherwise any monies due him and payable under this Contract without the prior written consent of the OWNER. Such consent, if given, will in no way relieve the Contractor from any of the obligations of this Contract. OWNER shall not be bound to abide by or observe the requirements of any such assignment.

ARTICLE 16 – DISPUTE RESOLUTION

16.01 Methods and Procedures

16.01.A Replace the first sentence with the following:

"If required by applicable laws and regulations, and not specifically excluded elsewhere, either OWNER or Contractor may request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding."

ARTICLE 17 – MISCELLANEOUS

17.01 Giving Notice

Add the following:

17.01.B No oral statement of any person whomsoever shall in any manner or degree modify or otherwise affect the terms of this Contract. Any notice to the Contractor, form OWNER and Engineer, relative to any part of this Contract shall be in writing.

Add the following:

17.07 Claims for Injury or Damage

17.07.A Should OWNER or Contractor suffer injury or damage to person or property because of any error, omission or act of the other party or of any of the other party's employees or agents or others for whose acts the other party is legally liable, claim will be made in writing to the other party within a reasonable time of the first observance of such injury or damage. The provisions of this paragraph 17.07 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or repose.

17.08 Non-Discrimination in Employment

17.08.A The Contractor shall comply with the following requirements prohibiting discrimination:

17.08.A.1 That no person (as defined in KRS 344.010) shall Bid on Lexington-Fayette Urban County Government Construction projects or bid to furnish materials or supplies to the Lexington-Fayette Urban County Government, if, within six months prior to the time of opening of Bids, said person shall have been found, by declamatory

judgment action in Fayette Circuit Court, to be presently engaging in an unlawful practice, as hereinafter defined. Such declamatory judgment action may be brought by an aggrieved individual or upon an allegation that an effort at conciliation pursuant to KRS 344.200 has been attempted and failed, by the Lexington-Fayette County Human Rights Commission.

17.08.A.2 That it is an unlawful practice for any employer:

a. to fail or refuse to hire, or to discharge any individual or otherwise to discriminate against an individual, with respect to his compensation, terms, conditions, or privileges of employment, because of such individual's race, color, religion, sex, age, or national origin; or

b. to limit, segregate or classify his employees in any way which would deprive or tend to deprive an individual of employment opportunities or otherwise adversely affect his status as an employee because of such individual's sex, race, color, religion, age, or national origin.

17.08.A.3 That it is unlawful practice for an employer, labor organization, or joint-labor management committee controlling apprenticeship or other training or retraining, including on-the-job training programs to discriminate against an individual because of his race, color, religion, sex, age, or national origin in admission to, or employment in, any program established to provide apprenticeship or other training.

17.08.A.4 That a copy of the LFUCG Ordinance shall be available for viewing at the Lexington-Fayette Urban County Government offices.

17.09 Temporary Street Closing or Blockage

17.09.A The Contractor will notify the Engineer, Owner, and LFUCG Division of Traffic Engineering at least 72 hours prior to making any temporary street closing or blockage. This will permit orderly notification to all concerned public agencies.

17.10 Percentage of Work Performed by Prime Contractor

17.10.A The Contractor shall perform on site, and with its own organization, Work equivalent to at least fifty percent (50%) of the total amount of Work to be performed under the Contract. This percentage may be reduced by a supplemental agreement to this Contract if, during performing the Work, the Contractor requests a reduction, and the Engineer determines that the reduction would be to the advantage of the OWNER.

17.11 Clean-Up

17.11.A Clean-up shall progress, to the greatest degree practicable, throughout the course of the Work. The Work will not be considered as completed, and final payment will not be made, until the right-of-way and all ground occupied or affected by the Contractor in connection with the Work has been cleared of all rubbish, equipment, excess materials, temporary structures, and weeds. Rubbish and all waste materials of whatever nature shall be disposed of, off the project site, in an

acceptable manner. All property, both public and private, which has been damaged in the prosecution of the Work, shall be restored in an acceptable manner. All areas shall be draining, and all drainage-ways shall be left unobstructed, and in such a condition that drift will not collect, or scour be induced.

17.12 General

17.12.A The duties and obligations imposed by the Contract Documents and the rights and remedies available hereunder to the parties hereto, and, in particular but without limitation, the warranties, guarantees and obligations imposed upon Contractor, and all of the rights and remedies available to OWNER and Engineer, are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee or by other provisions of the Contract Documents, and the provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right and remedy to which they apply. All representations, warranties and guarantees made in the Contract Documents will survive final payment and termination or completion of the Agreement.

17.13 Debris Disposal

17.13.A For all LFUCG projects any fill, trash, construction demolition debris, yard waste, dirt or debris of any kind that is removed from the project site must be disposed of in accordance with local, state, and federal regulations. The disposal site or facility must be approved in advance by the LFUCG and disposal documentation is required. The Contractor will be responsible for payment of any fines associated with improper disposal of material removed from the project site.

17.14 Maintenance of Traffic

17.14.A Traffic shall be maintained on state and LFUCG highways and streets at all times during construction. For all work that impacts traffic, the Contractor shall obtain a traffic permit at least two (2) working days in advance from the Division of Traffic Engineering

(859) 258-3489.

17.14.B It shall be the Contractor's responsibility to notify LFUCG Police Department's Safety Officer (859) 258-3600 prior to performing any construction work, which might interfere with traffic or compromise the public safety.

Add the following:

ARTICLE 18 – LIQUIDATED DAMAGES FOR FAILURE TO COMPLETE WORK ON TIME

18.01 Liquidated Damages

18.01.A If the Contractor shall fail to complete the Work within the Contract Time, or extension of time granted by the OWNER in accordance with Article 12, then the Contractor will pay to the OWNER the amount for liquidated damages as specified

in the Contract for each calendar day that the Contractor shall be in default after the time stipulated in the Contract Documents.

(Reference Section 00800, Article 14.02.A.5.c)

*****PUT ON CONTRACTOR'S LETTERHEAD*****

DATE: _____

TO: OWNER: _____

ADDRESS: _____

_____

_____

RE: Project Title: East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2
Lexington Fayette Urban County Government
Lexington, Kentucky
LFUCG Bid No.: _____

We hereby certify that the labor and materials listed on this request for payment have been used in the construction of this work, or that all materials included in this request for payment and not yet incorporated into the construction are now on the site or stored at an approved location with proper insurance to protect these stored materials; and that all lawful charges for labor, materials etc., covered by previous Certificates of Payment have been paid and that all other lawful charges on which this request for payment is based have been paid for in full or will be paid for in full from the funds received in payment of this request within ten (10) calendar days from receipt of this partial payment from the OWNER.

CONTRACTOR: _____

BY: _____

TIME: _____

State of: _____

County of: _____

Sworn to and subscribed before me this _____day of _____,

20____.

_____

Notary Public (Seal)

My Commission Expires:

END OF SECTION

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SECTION 00810
SUPPLEMENTAL GENERAL CONDITIONS FOR CLEAN WATER STATE REVOLVING FUND

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SUPPLEMENTAL GENERAL CONDITIONS

FOR

CLEAN WATER STATE REVOLVING FUND

DRINKING WATER STATE REVOLVING FUND

(Drinking Water and Wastewater)

Project Name: East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2

Project Number: 50029-013

The attached instructions and regulations as listed below shall be incorporated into the Specifications and comprise Special Conditions.

	Attachment No.
SRF Special Provisions	**1**
KRS Chapter 45A Kentucky Model Procurement Code	**2**
Equal Employment Opportunity (EEO) Documents:	
Notice of Requirement for Affirmative Action	**3**
Construction Contract Specifications	**4**
EEO Goals for Region 4 Economic Areas	**5**
Check List of EEO Documentation for Bidders	**6**
Employer Information Report EEO-1 (SF 100)	**7**
Labor Standards Provisions for Federally Assisted Construction	**8**
Certifications:	
Debarment, Suspension and Other Responsibility Matters	**9**
Anti-lobbying	**10**
Disadvantaged Business Enterprise (DBE) Program	**11**
Bonds and Insurance	**12**
Storm Water General Permit	**13**
Davis-Bacon Wage Rate Requirements	**14**
American Iron and Steel Requirement	**15**

SRF SPECIAL PROVISIONS

(a) Line crossings of all roads and streets shall be done in accordance with the Kentucky Transportation Cabinet requirements as may be set forth in the Special Conditions.

(b) Construction is to be carried out so as to prevent by-passing of flows during construction unless a schedule has been approved by the State or EPA, whichever is applicable. Siltation and soil erosion must be minimized during construction. All construction projects with surface disturbance of more than 1 acre during the period of construction must have a KPDES Storm Water General Permit. The permit can be found at this webpage.

If you have any questions regarding the completion of this form call the Surface Water Permits Branch at (502) 564-3410.

(c) Restore disturbed areas to original or better condition.

(d) Use of Chemicals: All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, must show approval of either DOW or EPA. Use of all such chemicals and disposal of residues shall be in conformance with instructions on the manufacturer's label.

(e) The construction of the project, including the letting of contracts in connection therewith, shall conform to the applicable requirements of state, territorial, and local laws and ordinances to the extent that such requirements do not conflict with Federal laws and this subchapter.

(f) The owner shall provide and maintain competent and adequate supervision and inspection.

(g) The Kentucky Infrastructure Authority and Kentucky Division of Water shall have access to the site and the project work at all times.

(h) In the event Archaeological materials (arrowheads, stone tools, stone axes, prehistoric and historic pottery, bottles, foundations, Civil War artifacts, and other types of artifacts) are uncovered during the construction of this project, work is to immediately cease at the location and the Kentucky Heritage Council shall be contacted. The telephone number is (502) 564-7005. Construction shall commence at this location until a written release is received from the Kentucky Heritage Council. Failure to report a find could result in legal action.

(i) This procurement will be subject to DOW Procurement Guidance including the Davis-Bacon Act.

(j) Reasonable care shall be taken during construction to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed of those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing.

(k) No wastewater bypassing will occur during construction unless a schedule has been approved by the Kentucky Division of Water.

(l) Change orders to the construction contract (if required) must be negotiated pursuant to DOW/KIA Procurement Guidance for Construction and Equipment Contracts.

Attachment Number 2

KRS CHAPTER 45A
KENTUCKY MODEL PROCUREMENT CODE

45A.075 Methods of awarding state contracts.
Except as otherwise authorized by law, all state contracts shall be awarded by:
(1) Competitive sealed bidding, pursuant to KRS 45A.080; or
(2) Competitive negotiation, pursuant to KRS 45A.085 and 45A.090 or 45A.180; or
(3) Noncompetitive negotiation, pursuant to KRS 45A.095; or
(4) Small purchase procedures, pursuant to KRS 45A.100.
Effective: June 24, 2003
History: Amended 2003 Ky. Acts ch. 98, sec. 4, effective June 24, 2003. -- Created 1978 Ky. Acts ch. 110, sec. 16, effective January 1, 1979.

45A.080 Competitive sealed bidding.
(1) Contracts exceeding the amount provided by KRS 45A.100 shall be awarded by competitive sealed bidding, which may include the use of a reverse auction, unless it is determined in writing that this method is not practicable. Factors to be considered in determining whether competitive sealed bidding is not practicable shall include:
(a) Whether specifications can be prepared that permit award on the basis of best value; and
(b) The available sources, the time and place of performance, and other relevant circumstances as are appropriate for the use of competitive sealed bidding.
(2) The invitation for bids shall state that awards shall be made on the basis of best value. In any contract which is awarded under an invitation to bid which requires delivery by a specified date and imposes a penalty for late delivery, if the delivery is late, the contractor shall be given the opportunity to present evidence that the cause of the delay was beyond his control. If it is the opinion of the purchasing officer that there is sufficient justification for delayed delivery, the purchasing officer may adjust or waive any penalty that is provided for in the contract.
(3) Adequate public notice of the invitation for bids and any reverse auction shall be given a sufficient time prior to the date set forth for the opening of bids or beginning of the reverse auction. The notice may include posting on the Internet or publication in a newspaper or newspapers of general circulation in the state as determined by the secretary of the Finance and Administration Cabinet not less than seven (7) days before the date set for the opening of the bids and any reverse auction. The provisions of this subsection shall also apply to price contracts and purchase contracts of state institutions of higher education.
(4) Bids shall be opened publicly or entered through a reverse auction at the time and place designated in the invitation for bids. At the time the bids are opened, or the reverse auction has ended, the purchasing agency shall announce the agency's engineer's estimate, if applicable, and make it a part of the agency records pertaining to the letting of any contract for which bids were received. Each written or reverse auction bid, together with the name of the bidder and the agency's engineer's estimate, shall be recorded and be open to public inspection. Electronic bid opening and posting of the required information for public viewing shall satisfy the requirements of this subsection.
(5) The contract shall be awarded by written notice to the responsive and responsible bidder whose bid offers the best value.
(6) Correction or withdrawal of written or reverse auction bids shall be allowed only to the extent permitted by regulations issued by the secretary.
Effective: July 15, 2010
History: Amended 2010 Ky. Acts ch. 63, sec. 3, effective July 15, 2010. -- Amended 2000 Ky. Acts ch. 509, sec. 1, effective July 14, 2000. -- Amended 1998 Ky. Acts ch. 120, sec. 10, effective July 15, 1998. -- Amended 1997 (1st Extra. Sess.) Ky. Acts ch. 4, sec. 27, effective May 30, 1997. -- Amended 1996 Ky. Acts ch. 60, sec. 2, effective July 15, 1996. -- Amended 1994 Ky. Acts ch. 278, sec. 1, effective July 15, 1994. -- Amended 1982 Ky. Acts ch. 282, sec. 1, effective July 15, 1982. -- Amended 1979 (1st Extra. Sess.) Ky. Acts ch. 9, sec. 1, effective February 10, 1979. -- Created 1978 Ky. Acts ch. 110, sec. 17, effective January 1, 1979.

45A.085 Competitive negotiation.
(1) When, under administrative regulations promulgated by the secretary or under KRS 45A.180, the purchasing officer determines in writing that the use of competitive sealed bidding is not practicable, and except as provided in KRS 45A.095 and 45A.100, a contract may be awarded by competitive negotiation, which may include the use of a reverse auction.
(2) Adequate public notice of the request for proposals and any reverse auction shall be given in the same manner and circumstances as provided in KRS 45A.080(3).
(3) Contracts other than contracts for projects utilizing an alternative project delivery method under KRS 45A.180 may be competitively negotiated when it is determined in writing by the purchasing officer that the bids received by competitive sealed bidding either are unreasonable as to all or part of the requirements, or were not independently reached in open competition, and for which each competitive bidder has been notified of the intention to negotiate and is given reasonable opportunity to negotiate.
(4) Contracts for projects utilizing an alternative project delivery method shall be processed in accordance with KRS 45A.180.
(5) The request for proposals shall indicate the relative importance of price and other evaluation factors, and any reverse auction procedures.
(6) Award shall be made to the responsible and responsive offeror whose proposal is determined in writing to be the most advantageous to the Commonwealth, taking into consideration price and the evaluation factors set forth in the request for proposals and the reciprocal preference for resident bidders required under KRS 45A.494.
(7) Written or oral discussions shall be conducted with all responsible offerors who submit proposals determined in writing to be reasonably susceptible of being selected for award. Discussions shall not disclose any information derived from proposals submitted by competing offerors. Discussions need not be conducted:
(a) With respect to prices, where the prices are fixed by law, reverse auction, or administrative regulation, except that consideration shall be given to competitive terms and conditions;
(b) Where time of delivery or performance will not permit discussions; or
(c) Where it can be clearly demonstrated and documented from the existence of adequate competition or prior experience with the particular supply, service, or construction item, that acceptance of an initial offer without discussion would result in fair and reasonable best value procurement, and the request for proposals notifies all offerors of the possibility that award may be made on the basis of the initial offers.
Effective: July 15, 2010
History: Amended 2010 Ky. Acts ch. 63, sec. 4, effective July 15, 2010; and ch. 162, sec. 8, effective July 15, 2010. -- Amended 2003 Ky. Acts ch. 98, sec. 5, effective June 24, 2003. -- Amended 1997 (1st Extra. Sess.) Ky. Acts ch. 4, sec. 28, effective May 30, 1997. -- Amended 1979 (1st Extra. Sess.) Ky. Acts ch. 9, sec. 2, effective February 10, 1979. -- Created 1978 Ky. Acts ch. 110, sec. 18, effective January 1, 1979.

45A.090 Negotiation after competitive sealed bidding when all bids exceed available funds.
(1) In the event that all bids submitted pursuant to competitive sealed bidding under KRS 45A.080 result in bid prices in excess of the funds available for the purchase, and the chief purchasing officer determines in writing:
(a) That there are no additional funds available from any source so as to permit an award to the responsive and responsible bidder whose bid offers the best value; and
(b) The best interest of the state will not permit the delay attendant to a resolicitation under revised specifications, or for revised quantities, under competitive sealed bidding as provided in KRS 45A.080, then a negotiated award may be made as set forth in subsections (2) or (3) of this section.
(2) Where there is more than one (1) bidder, competitive negotiations pursuant to KRS 45A.085(3) shall be conducted with the three (3) (two (2) if there are only two (2)) bidders determined in writing to be the most responsive and responsible bidders, based on criteria contained in the bid invitation and the reciprocal preference for resident bidders under KRS 45A.494. Such competitive negotiations shall be conducted under the following restrictions:
(a) If discussions pertaining to the revision of the specifications or quantities are held with any potential offeror, all other potential offerors shall be afforded an opportunity to take part in such discussions; and

(b) A request for proposals, based upon revised specifications or quantities, shall be issued as promptly as possible, shall provide for an expeditious response to the revised requirements, and shall be awarded upon the basis of best value.
(3) Where, after competitive sealed bidding, it is determined in writing that there is only one (1) responsive and responsible bidder, a noncompetitive negotiated award may be made with such bidder in accordance with KRS 45A.095.
Effective: July 15, 2010
History: Amended 2010 Ky. Acts ch. 162, sec. 9, effective July 15, 2010. -- Amended 2003 Ky. Acts ch. 98, sec. 6, effective June 24, 2003. -- Amended 1997 (1st Extra. Sess.) Ky. Acts ch. 4, sec. 29, effective May 30, 1997. -- Created 1978 Ky. Acts ch. 110, sec. 19, effective January 1, 1979.

45A.095 Noncompetitive negotiation.
(1) A contract may be made by noncompetitive negotiation only for sole source purchases, or when competition is not feasible, as determined by the purchasing officer in writing prior to award, under administrative regulations promulgated by the secretary of the Finance and Administration Cabinet or the governing boards of universities operating under KRS Chapter 164A, or when emergency conditions exist. Sole source is a situation in which there is only one (1) known capable supplier of a commodity or service, occasioned by the unique nature of the requirement, the supplier, or market conditions. Insofar as it is practical, no less than three (3) suppliers shall be solicited to submit written or oral quotations whenever it is determined that competitive sealed bidding is not feasible. Award shall be made to the supplier offering the best value. The names of the suppliers submitting quotations and the date and amount of each quotation shall be placed in the procurement file and maintained as a public record. Competitive bids may not be required:
(a) For contractual services where no competition exists, such as telephone service, electrical energy, and other public utility services;
(b) Where rates are fixed by law or ordinance;
(c) For library books;
(d) For commercial items that are purchased for resale;
(e) For interests in real property;
(f) For visiting speakers, professors, expert witnesses, and performing artists;
(g) For personal service contracts executed pursuant to KRS 45A.690 to 45A.725; and
(h) For agricultural products in accordance with KRS 45A.645.
(2) The chief procurement officer, the head of a using agency, or a person authorized in writing as the designee of either officer may make or authorize others to make emergency procurements when an emergency condition exists.
(3) An emergency condition is a situation which creates a threat or impending threat to public health, welfare, or safety such as may arise by reason of fires, floods, tornadoes, other natural or man-caused disasters, epidemics, riots, enemy attack, sabotage, explosion, power failure, energy shortages, transportation emergencies, equipment failures, state or federal legislative mandates, or similar events. The existence of the emergency condition creates an immediate and serious need for services, construction, or items of tangible personal property that cannot be met through normal procurement methods and the lack of which would seriously threaten the functioning of government, the preservation or protection of property, or the health or safety of any person.
(4) The Finance and Administration Cabinet may negotiate directly for the purchase of contractual services, supplies, materials, or equipment in bona fide emergencies regardless of estimated costs. The existence of the emergency shall be fully explained, in writing, by the head of the agency for which the purchase is to be made. The explanation shall be approved by the secretary of the Finance and Administration Cabinet and shall include the name of the vendor receiving the contract along with any other price quotations and a written determination for selection of the vendor receiving the contract. This information shall be filed with the record of all such purchases and made available to the public. Where practical, standard specifications shall be followed in making emergency purchases. In any event, every effort should be made to effect a competitively established price for purchases made by the state.
Effective: July 15, 2002

History: Amended 2002 Ky. Acts ch. 344, sec. 9, effective July 15, 2002. -- Amended 1997 (1st Extra. Sess.) Ky. Acts ch. 4, sec. 30, effective May 30, 1997. -- Amended 1990 Ky. Acts ch. 496, sec. 4, effective July 13, 1990. -- Created 1978 Ky. Acts ch. 110, sec. 20, effective January 1, 1979

45A.100 Small purchases by state governmental bodies.

(1) Procurements may be made in accordance with small purchase administrative regulations promulgated by the secretary of the Finance and Administration Cabinet, pursuant to KRS Chapter 13A, as follows:

(a) Up to ten thousand dollars ($10,000) per project for construction and one thousand dollars ($1,000) for purchases by any state governmental body, except for those state administrative bodies specified in paragraph (b) of this subsection; and

(b) Up to forty thousand dollars ($40,000) per project for construction or purchases by the Finance and Administration Cabinet, state institutions of higher education, and the legislative branch of government.

(2) Procurement requirements shall not be artificially divided so as to constitute a small purchase under this section. Reverse auctions may be used for small purchase procurements. At least every two (2) years, the secretary shall review the prevailing costs of labor and materials and may make recommendations to the next regular session of the General Assembly for the revision of the then current maximum small purchase amount as justified by intervening changes in the cost of labor and materials.

(3) The secretary of the Finance and Administration Cabinet may grant to any state agency with a justifiable need a delegation of small purchasing authority which exceeds the agency's small purchase limit provided in subsection (1) of this section. Delegations of small purchasing authority shall be granted or revoked by the secretary of the Finance and Administration Cabinet, in accordance with administrative regulations promulgated by the cabinet pursuant to KRS Chapter 13A. These administrative regulations shall establish, at a minimum, the criteria for granting and revoking delegations of small purchasing authority, including the requesting agency's past compliance with purchasing regulations, the level of training of the agency's purchasing staff, and the extent to which the agency utilizes the Kentucky Automated Purchasing System. The administrative regulations may permit the secretary of the Finance and Administration Cabinet to delegate small purchase procurements up to the maximum amount specified in subsection (1)(b) of this section.

Effective: July 15, 2010

History: Amended 2010 Ky. Acts ch. 63, sec. 5, effective July 15, 2010. -- Amended 2002 Ky. Acts ch. 320, sec. 2, effective July 15, 2002. -- Amended 2000 Ky. Acts ch. 225, sec. 1, effective July 14, 2000. -- Amended 1996 Ky. Acts ch. 60, sec. 1, effective July 15, 1996. -- Amended 1994 Ky. Acts ch. 323, sec. 1, effective July 15, 1994. -- Amended 1990 Ky. Acts ch. 496, sec. 5, effective July 13, 1990. -- Amended 1986 Ky. Acts ch. 384, sec. 1, effective July 15, 1986. -- Amended 1984 Ky. Acts ch. 384, sec. 1, effective July 13, 1984. -- Amended 1982 Ky. Acts ch. 282, sec. 2, effective July 15, 1982. -- Amended 1980 Ky. Acts ch. 242, sec. 1, effective July 15, 1980; and ch. 250, sec. 19, effective April 9, 1980. -- Created 1978 Ky. Acts ch. 110, sec. 21, effective January 1, 1979.

Attachment Number 3

NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246)

The following excerpts are from 45 FR 65984 (October 3, 1980):

The minority and female goals apply to Federal and federally assisted construction contractors and subcontractors which have covered contracts. The goals are expressed as a percentage of the total hours worked by such a covered or subcontractor's entire onsite construction workforce, which is working on any construction site within a relevant area. The goal applies to each construction craft and trade in the contractor's entire workforce in the relevant area including those employees working on private non-federally involved projects.

Until further notice, the following goals for minority utilization in each construction craft and trade shall be included in all Federal or federally assisted construction contracts and subcontracts in excess of $10,000 to be performed in the respective geographic area. The goals are applicable to each nonexempt contractor's total onsite construction workforce, regardless of whether or not part of that workforce is performing work on a Federal, federally assisted or non-federally related project, contract or subcontract.

Construction contractors which are participating in an approved Hometown Plan (see 41 CFR 60-4.5) are required to comply with the goals of the Hometown Plan with regard to construction work they perform in the area covered by the Hometown Plan. With regard to all their other covered construction work, such contractors are required to comply as follows:

Goals for female participation in each trade.....6.9%
Goals for minority participation in each trade.....Insert goals for each year
(see Attachment Number 5)

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or Federally assisted) performed in the covered area.

The following excerpts are from 45 FR 65977 (October 3, 1980):

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals established for the geographical area where the contract resulting from this solicitation is to be performed. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor; employer identification number; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the contract is to be performed.

As used in this Notice, and in the contract resulting from this solicitation, the covered area is (insert description of the geographical areas where the contract is to be performed giving the state, country, and city, if any).

Attachment Number 4

STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY CONSTRUCTION CONTRACT SPECIFICATIONS (EXECUTIVE ORDER 11246)

EEO Specifications

Following is the standard language, which must be incorporated into all solicitations for offers and bids on all Federal and Federally assisted construction contracts or subcontracts in excess of $10,000 to be performed in designated geographical areas:

1. As used in these specifications:

   (a) Covered Area means the geographical area described in the solicitation from which this contract resulted.

   (b) Director means Director, Office of Federal Contract Compliance Program, United States Department of Labor, or any person to whom the Director delegates authority;

   (c) Employer identification number means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.

   (d) Minority includes:

      (i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);

      (ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);

      (iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

      (iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the Contractor or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take a good faith efforts to achieve the Plan goals and timetables.

4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7-a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. The Contractor is expected to make substantially uniform progress toward its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the non-working training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

7. The Contractor shall take specific affirmative action to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensively as the following:

    a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

    b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the contractor or its unions have employment opportunities available, and maintain a record of the organizations responses.

    c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the contractor, this shall be documented in the file with the reason therefore, along with whatever additional actions the contractor may have taken.

    d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligation.

    e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources complied under 7-b above.

f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, lay-off, termination or other employment decisions including specific review of these items with on-site supervisory personnel such as Superintendents, General Foreman, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's workforce.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.

l. Conduct, at least annually, an inventory and evaluation of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that EEO policy and the Contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisor's adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations, which assist in fulfilling one or more of their affirmative actions obligations (7 a through p). The efforts of a contractor association, joint contractor-union, contractor-community, of other similar group of which the contractor is a member and participant may be asserted as fulfilling any one or more of its obligations under 7 a through p of these specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be defense for the Contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example: even though the Contractor has achieved its goal for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

10. The Contractor shall not use the goals and timetables for affirmative action standards to discriminate against any person because of race, color, religion, sex or national origin.

11. The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and executive Order 11246, as amended.

13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.

14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation, if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

Attachment Number 5

EEO GOALS FOR ECONOMIC AREAS IN REGION 4
SOURCE: APPENDIX B-80 IN 45 FR 65984 (OCTOBER 3, 1980)

Kentucky:

053 Knoxville, TN
SMSA Counties:
3840 Knoxville, TN 6.6
TN Anderson; TN Blount; TN Knox; TN Union.
Non-SMSA Counties 4.5
KY Bell; KY Harlan; KY Knox; KY Laurel; KY McCreary; KY Wayne; KY Whitley; TN Campbell; TN Claiborne; TN Cocke; TN Cumberland; TN Fentress; TN Grainger, TN Hamblen; TN Jefferson; TN Loudon; TN Morgan; TN Roane; TN Scott; TN Sevier.

054 Nashville, TN:
SMSA Counties:
1660 Clarksville - Hopkinsville, TN - KY 18.2
KY Christian; TN Montgomery.
5360 Nashville - Davidson, TN 15.8
TN Cheatham, TN Davidson; TN Dickson; TN Robertson; TN Rutherford; TN Sumner; TN Williamson; TN Wilson.
Non-SMSA Counties 12.0
KY Allen; KY Barren; KY Butler; KY Clinton; KY Cumberland; KY Edmonson; KY Logan; KY Metcalfe; KY Monroe; KY Simpson; KY Todd; KY Trigg; KY Warren; TN Bedford; TN Cannon; TN Clay; TN Coffee; TN DeKalb; TN Franklin; TN Giles; TN Hickman; TN Houston; TN Humphreys; TN Jackson; TN Lawrence; TN Lewis; TN Macon; TN Marshall; TN Maury; TN Moore; TN Overton; TN Perry; TN Pickett; TN Putnam; TN Smith; TN Stewart; TN Trousdale; TN Van Buren; TN Warren; TN Wayne; TN White.

056 Paducah, KY:
Non-SMSA Counties 5.2
IL Hardin; IL Massac; IL Pope; KY Ballard; KY Caldwell; KY Calloway. KY Carlisle; KY Crittenden; KY Fulton; KY Graves; KY Hickman; KY Livingston; KY Lyon. KY McCracken; KY Marshall.

057 Louisville, KY:
SMSA Counties:
4520 Louisville, KY-IN 11.2
IN Clark; IN Floyd; KY Bullitt; KY Jefferson; KY Oldham.
Non-SMSA Counties 9.6
IN Crawford; IN Harrison; IN Jefferson; IN Orange; IN Scott; IN Washington; KY Breckinridge; KY Grayson; KY Hardin; KY Hart; KY Henry; KY Larue; KY Marion; KY Meade; KY Nelson; KY Shelby; KY Spencer; KY Trimble; KY Washington.

058 Lexington, KY
SMSA Counties
4280 Lexington-Fayette, KY 10.8
KY Bourbon; KY Clark; KY Fayette; KY Jessamine; KY Scott; KY Woodford.
Non-SMSA Counties 7.0
KY Adair KY Anderson; KY Bath; KY Boyle; KY Breathitt; KY Casey; KY Clay; KY Estill; KY Franklin; KY Garrard; KY Green; KY Harrison; KY Jackson; KY Knott; KY Lee; KY Leslie; KY Letcher; KY Lincoln; KY Madison; KY Magoffin; KY Menifee; KY Mercer; KY Montgomery; KY Morgan. KY Nicholas; KY Owsley; KY Perry; KY Powell; KY Pulaski; KY Rockcastle; KY Russell; KY Taylor; KY Wolfe.
059 Huntington, WV:
SMSA Counties:
3400 Huntington - Ashland, WV-KY-OH 2.9
KY Boyd; KY Greenup; OH Lawrence; WV Cabell; WV Wayne.
Non-SMSA Counties 2.5
KY Carter; KY Elliott; KY Floyd; KY Johnson; KY Lawrence; KY Martin; KY Pike; KY Rowan; OH Gallia; WV Lincoln; WV Logan; WV Mason; WV Mingo.
067 Cincinnati, OH:
SMSA Counties:
1640 Cincinnati, OH-KY-IN 11.0
IN Dearborn; KY Boone; KY Campbell; KY Kenton; OH Clermont; OH Hamilton; OH Warren.
3200 Hamilton - Middletown, OH 5.0
OH Butler.
Non-SMSA Counties 9.2
IN Franklin; IN Ohio; IN Ripley; IN Switzerland; KY Bracken; KY Carroll; KY Fleming; KY Gallatin; KY Grant; KY Lewis; KY Mason; KY Owen; KY Pendleton; KY Robertson; OH Adams; OH Brown; OH Clinton; OH Highland.
080 Evansville, IN:
SMSA Counties
2440 Evansville, IN-KY 4.8
IN Gibson; IN Posey; IN Vanderburgh; IN Warrick; KY Henderson.
5990 Owensboro, KY 4.7
KY Daviess.
Non-SMSA Counties 3.5
IL Edwards; IL Gallatin; IL Hamilton; IL Lawrence; IL Saline; IL Wabash; IL White; IN Dubois; IN Knox; IN Perry; IN Pike; IN Spencer; KY Hancock; KY Hopkins; KY McLean; KY Muhlenberg; KY Ohio; KY Union; KY Webster.

Attachment Number 6

CHECK LIST OF EEO DOCUMENTATION FOR BIDDERS ON GRANT/LOAN CONSTRUCTION (EXECUTIVE ORDER 11246 AS AMENDED)

The low, responsive responsible bidder must forward the following items, in duplicate, to the owner no later than ten (10) days after bid opening. The owner shall have one (1) copy available for inspection by the Office of Federal Contracts Compliance (OFCC) within 14 days after the bid opening. More information can be found on the OFCC webpage.

1. Project Number. Project Location. Type of Construction.

2. Proof of registration with the Joint Reporting Commission. (See Attachment Number 7.)

3. Copy of Affirmative Action Plan of contractor. Indicate company official responsible for EEO.

4. List of current construction contracts, with dollar amount. List contracting Federal Agency, if applicable.

5. Statistics concerning company percent workforce, permanent and temporary, by sex, race, trade, handicapped, and age. 40 CFR Part 7.

6. List of employment sources for project in question. If union sources are utilized, indicate percentage of minority membership within the union crafts.

7. Anticipated employment needs for this project, by sex, race and trade, with estimate of minority participation in specific trades.

8. List of subcontractors (name, address and telephone) with dollar amount and duration of subcontract. Subcontractor contracts over $10,000 must submit items 1- 7. The following information must be provided for all supplier contracts regardless of contract size: name of company, contact person, address, telephone number, dollar value of the contract, and a list of the materials to be supplied to the prime contractor.

9. List of any subcontract work yet to be committed with estimate of dollar amount and duration of contract.

10. Contract Price. Duration of prime contract.

11. DBE Documents - See special instructions regarding use of Minority, and Women Owned, and Small Businesses.

Attachment Number 7

EMPLOYER INFORMATION REPORT EEO-1

Under the direction of the US Equal Employment Opportunity Commission, the Joint Reporting Committee is responsible for the full-length, multi-phase processing of employment statistics collected on the Employer Information Report EEO-1. This report, also termed Standard Form 100, details the sex and race/ethnic composition of an employer's work force by job category.

The Employer Information EEO-1 survey is conducted annually under the authority of Public Law 88-352, Title VII of the Civil Rights Act of 1964, as amended by the Equal Employment Opportunity Act of 1972. All employers with 15 or more employees are covered by Public Law 88-352 and are required to keep employment records as specified by Commission regulations. Based on the number of employees and federal contract activities, certain large employers are required to file an EEO-1 Report on an annual basis.

The EEO-1 Report must be filed by:

(A) All private employers who are: (1) subject to Title VII of the Civil Rights Act of 1964 (as amended by the Equal Employment Opportunity Act of 1972) with 100 or more employees EXCLUDING State and local governments, primary and secondary school systems, institutions of higher education, Indian tribes and tax-exempt private memberships clubs other than labor organizations; OR (2) subject to Title VII who have fewer than 100 employees if the company is owned or affiliated with another company, or there is centralized ownership, control or management (such as central control of personnel policies and labor relations) so that the group legally constitutes a single enterprise and the entire enterprise employs a total of 100 or more employees.

(B) All federal contractors (private employers), who: (1) are not exempt as provided for by 41 CFR 60-1.5, (2) have 50 or more employees, and (a) are prime contractors or first-tier subcontractors, and have a contract, subcontract, or purchase order amounting to $50,000 or more; or (b) serve as depository of Government funds in any amount, or (c) is a financial institution which is an issuing an paying agent for U.S. Savings Bonds and Notes.

Only those establishments located in the District of Columbia and the 50 states are required to submit the EEO-1 Report. No Reports should be filed for establishments in Puerto Rico, the Virgin Islands or other American Protectorates.

When filing for the EEO-1 Report for the first time, go to the U.S. Equal Employment Opportunity Commission webpage and select "First Time Filers". Fill out the electronic questionnaire to enter your company into Joint Reporting Committee (JRC) system. Once you have completed the registration process, you will be contacted on how to proceed with the EEO-1 Report. If you have previously registered with the JRC, follow their instructions to update your information.

Attachment Number 8

LABOR STANDARDS PROVISIONS FOR FEDERALLY ASSISTED CONSTRUCTION

Labor standards provisions applicable to contracts covering federally financed and assisted construction (29 CFR 5.5, Contract Provisions and Related Matters) that apply to EPA State Revolving Fund loans are:

(a)(4)(iii) *Equal employment opportunity.* The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

(a)(5) *Compliance with Copeland Act requirements.* The contractor shall comply with the requirements of 29 CFR Part 3, which are incorporated by reference in this contract.

(a)(6) *Subcontracts.* The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5 (a)(1) through (10) and such other clauses as the U.S. Environmental Protection Agency may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(a)(7) *Contract termination: debarment.* A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(b) *Contractor Work Hours and Safety Standards Act.* The Administrator, EPA, shall cause or require the contracting officer to insert the following clauses set forth in paragraphs (b)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by §5.5(a) or §4.6 of part 4 of this title. As used in this paragraph, the terms *laborers* and *mechanics* include watchmen and guards.

(b)(1) *Overtime requirements.* No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(b)(2) *Violation; liability for unpaid wages; liquidated damages.* In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for unliquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of $27 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.

(3) *Withholding for unpaid wages and liquidated damages.* The U.S. Environmental Protection Agency shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime

contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) *Subcontracts.* The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (b)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (4) of this section.

(c) In addition to the clauses contained in paragraph (b), in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in section §5.1, the Administrator of EPA shall cause or require the contracting officer to insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Administrator of EPA shall cause or require the contracting officer to insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the U.S. Environmental Protection Agency and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job. (Approved by the Office of Management and Budget under OMB control numbers 1215-0140 and 1215-0017.)

CERTIFICATIONS

Debarred Firms

All prime Construction Contractors shall certify that Subcontractors have not and will not be awarded to any firm that is currently on the EPA Master List of Debarred, Suspended and Voluntarily Excluded Persons in accordance with the provisions of 40 CFR 32.500(c). Debarment action is taken against a firm for noncompliance with Federal Law.

All bidders shall complete the attached certification (Attachment Number 9) and submit to the owner with the bid proposal.

Anti-lobbying Certification

All prime Construction Contractors must certify (Attachment Number 10) that no appropriated funds were or will be expended for the purpose of lobbying the Executive or Legislative Branches of the Federal Government or Federal Agency concerning this contract (contract in excess of $100,000). If the Contractor has made or agreed to make payment to influence any member of Congress in regard to award of this contract, a Disclosure Form must be completed and submitted to the owner with the bid proposal.

All prime Contractors must require all Subcontractors to submit the certification, which must also be submitted to the owner.

EPA Form 5700-49 **Attachment Number 9**

CERTIFICATION REGARDING DEBARMENT, SUSPENSION AND OTHER RESPONSIBILITY MATTERS

The prospective participant certifies to the best of its knowledge and belief that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

(b) Have not within a three year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or Local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.

I understand that a false statement on this certification may be grounds for rejection of this proposal or termination of the award. In addition, under 18 USC Sec. 1001, a false statement may result in a fine of up to $10,000 or imprisonment for up to 5 years, or both.

_____

Typed Name & Title of Authorized Representative

_____

Signature of Authorized Representative Date

_____ I am unable to certify to the above statements. My explanation is attached.

Attachment Number 10

CERTIFICATION REGARDING LOBBYING
CERTIFICATION FOR CONTRACTS, GRANTS, LOANS, AND COOPERATIVE AGREEMENTS

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including subcontracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

_____

Typed Name & Title of Authorized Representative

_____

Signature of Authorized Representative Date

_____ I am unable to certify to the above statements. My explanation is attached.

Attachment Number 11

EPA DISADVANTAGED BUSINESS ENTERPRISE PROGRAM

EPA's Disadvantaged Business Enterprise Program rule applies to contract procurement actions funded in part by EPA assistance agreements awarded after May 27, 2008. The rule is found at Federal regulation Title 40, Part 33. Specific responsibilities are highlighted below.

Loan recipient responsibilities:

- Include in each contract with a primary contractor the following term and condition:

  "The contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the contractor to carry out these requirements is a material breach of this contract which may result in the termination of this contract." (*Appendix A to Part 33—Term and Condition)*

- Employ the six Good Faith Efforts during prime contractor procurement (§33.301).

- Require the prime contractor to comply with the following prime contractor requirements of Title 40 Part 33:

  - To pay its subcontractor for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the recipient (§33.302(a)).

  - To notify recipient in writing prior to any termination of a DBE subcontractor for convenience by the prime contractor (§33.302(b)).

  - To employ the six Good Faith Efforts described in §33.301 if soliciting a replacement subcontractor after a DBE subcontractor fails to complete work under the subcontract for any reason (§33.302(c)).

  - To employ the six Good Faith Efforts described in §33.301 even if the prime contractor has achieved its fair share objectives under subpart D of Part 33 (§33.302(d)).

  - To provide EPA Form 6100-2 – *DBE Program Subcontractor Participation Form* to all DBE subcontractors (§33.302(e)). **NOTE: this requirement has been suspended.**

  - To submit EPA Forms 6100-3 – *DBE Program Subcontractor Performance Form* and 6100-4 *DBE Program Subcontractor Utilization Form* as part of the bid package or proposal (§33.302(f) and (g)). **NOTE: this requirement has been suspended.**

  - To employ the six Good Faith Efforts steps in paragraphs (a) through (f) of §33.301 while procuring any subcontracts (§33.302(i)).

- Conduct an Availability Analysis and negotiate fair share objectives with EPA (§33.401), or adopt the fair share objectives of the oversight state agency revolving loan fund for comparable infrastructure (§33.405(b)(3)).

- Maintain all records documenting its compliance with the requirements of Title 40 Part 33, including documentation of its, and its prime contractors', good faith efforts (§33.501(a)).

- Create and maintain a bidders list and require the prime contractor to create and maintain a bidders list (§33.501(b)). This list must include all firms that bid or quote on prime contracts, or bid or quote subcontracts, including both MBE/WBEs and non-MBE/WBEs. This list must be kept until the project period for the identified loan has ended. The following information must be obtained from all prime and subcontractors:

  (a) Entity's name with point of contact,
  (b) Entity's mailing address, telephone number, and email address,
  (c) The procurement on which the entity bid or quoted, and when, and,
  (d) Entity's status as an MBE/WBE or non-MBE/WBE.

Prime Contractor Responsibilities:

- Include in each contract with a subcontractor the following term and condition:

  "The contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the contractor to carry out these requirements is a material breach of this contract which may result in the termination of this contract." (*Appendix A to Part 33—Term and Condition)*

- Employ the six Good Faith Efforts during subcontractor procurement (§33.301).

- Pay subcontractors for satisfactory performance no more than 30 days from receipt of payment from the recipient (§33.302(a)).

- Notify recipient in writing prior to termination of a DBE subcontractor for convenience (§33.302(b)).

- Employ the six Good Faith Efforts described in §33.301 if soliciting a replacement subcontractor after a DBE subcontractor fails to complete work under the subcontract for any reason. (§33.302(c)).

- Employ the six Good Faith Efforts described in §33.301 even if the fair share objectives have been achieved under subpart D of Part 33 (§33.302(d)).

- Provide EPA Forms 6100-2 – *DBE Program Subcontractor Participation Form* and 6100-3 – *DBE Program Subcontractor Performance Form* to each DBE subcontractor prior to opening of the subcontractor's bid or proposal (§33.302(e) and (f)). **NOTE: this requirement has been suspended.**

- Complete EPA Form 6100-4 – *DBE Program Subcontractor Utilization Form* (§33.302(g)). **NOTE: this requirement has been suspended.**

- Submit to recipient with the bid package or proposal the completed EPA Form 6100-4, plus an EPA Form 6100-3 for each DBE subcontractor used in the bid or proposal (§33.302(f) and (g)). **NOTE: this requirement has been suspended.**

- Maintain all records documenting its compliance with the requirements of Title 40 Part 33, including documentation of its, and its subcontractors', good faith efforts (§33.501(a)).

- Create and maintain a bidders list and require the subcontractor to create and maintain a bidders list (§33.501(b)). This list must include all firms that bid or quote on subcontracts, including both

MBE/WBEs and non-MBE/WBEs. This list must be kept until the project period for the identified loan has ended. The following information must be obtained from all subcontractors:

(a) Entity's name with point of contact,
(b) Entity's mailing address, telephone number, and email address,
(c) The procurement on which the entity bid or quoted, and when, and,
(d) Entity's status as an MBE/WBE or non-MBE/WBE.

Subcontractor Responsibilities:

- May submit EPA Form 6100-2 – *DBE Program Subcontractor Participation Form* directly to DOW Project Manager (§33.302(e)). **NOTE: this requirement has been suspended.**

- Must complete EPA Form 6100-3 – *DBE Program Subcontractor Performance Form* and submit it to the prime contractor soliciting services prior to the prime contractor opening bids or quotes. **NOTE: this requirement has been suspended.**

DISADVANTAGED BUSINESS ENTERPRISE PARTICIPATION POLICY

PROJECT NAME: East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2 **BID DATE:** _____

1. **Name, address and telephone number of contact person on all DBE matters:**

   Prime Contractor's Name: _____
   Contact Person: _____
   Address: _____
   Phone: _____
   Cell Phone: _____
   Email: _____
   Total Contract Amount: _____

2. **Total dollar amount/percent of contract of MBE participation:** _____

3. **Total dollar amount/percent of contract of WBE participation:** _____

4. **Are certifications* for each MBE/WBE/DBE subcontractor enclosed; if no, please explain:** ☐ Yes ☐ No _____

5. **Are MBE/WBE/DBE subcontracts or letters of intent signed by both parties enclosed; if no, please explain:** ☐ Yes ☐ No _____

6. **List of MBE Subcontractors:**

   Name: _____
   Contact Person: _____
   Address: _____
   Phone: _____
   Cell Phone: _____
   Email: _____
   Type of Contract: _____
   Work to be Done: _____
   Amount: _____

7. **List of WBE Subcontractors:**

   Name: _____
   Contact Person: _____
   Address: _____
   Phone: _____
   Cell Phone: _____
   Email: _____
   Type of Contract: _____
   Work to be Done: _____
   Amount: _____

Attach Additional Sheets, If Necessary

*Self-certification: Self certification of MBE/WBE/DBE firms will NOT be accepted as a valid form of certification of MBE/WBE/DBE status.

8. Information and documentation concerning efforts taken to comply with EPA's "six good faith efforts"

(i). Ensure DBE construction firms or material suppliers are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities; including placing DBEs on solicitation lists and soliciting them whenever they are potential sources. A good source for a list of DBEs is the Kentucky Transportation's Certified DBE Directory webpage.

☐ The prime contractor certifies that a solicitation list of qualified DBE vendors was developed for current and future solicitations. *Submit a copy of the list as documentation.*

(ii). Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process; including, whenever possible, posting solicitation for bids or proposals for a sufficient amount of time as to receive a competitive bid or proposal pool.

☐ The prime contractor certifies that every opportunity was provided to a number of DBEs to encourage their participation in the competitive process and that an adequate amount of time was provided for response. Must do at least one of the below.

a. List each DBE construction firm or material supplier to which a solicitation was attempted. *Submit copies of letters, emails, faxes, telecommunication logs, certified mail receipts, returned envelopes, certified mail return receipts, etc. as documentation.*

Company name and phone number: _____
Area of work expertise: _____
Date of any follow-ups and person spoke to: _____

b. Advertisements, if applicable: List each publication in which an announcement or notification was placed. *Submit original advertisement or a copy of the advertisement with an affidavit of publication for each announcement as documentation.*

Name of publication: _____
Date(s) of advertisement: _____
Specific subcontract areas announced: _____

c. Other, if applicable: List each notification method in which an announcement or outreach was used; list serve, public meeting, etc. *Submit applicable information to document effort.*

Method of notification: _____
Date(s) of notification: _____

(iii). Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs; including dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.

☐ The prime contractor certifies that the project was broken into its basic elements (i.e., dirt hauling, landscaping, painting, pipe installation, material supplies, etc.) and that a determination was made whether it's economically feasible to bid the elements separately and that the analysis of this effort was documented with a short memo to the project file.

(iv). Establishing delivery schedules, where the requirement permits, which encourage participation by small and minority business, and women's business enterprises.

☐ The prime contractor certifies that they established delivery schedules which would allow DBEs to participate in the project and the effort was documented with a short memo to the project file.

(v). Use the services and assistance of the Small Business Administration (SBA). The easiest way to utilize their services is to visit the SBA webpage and use the electronic tools available there or you may send the nearest SBA office a certified letter that generally describes the solicitation, the dates it will be open, the types of vendors you are seeking and applicable Standard Industrial Classification (SIC) or North American Industry Classification System (NAIC) codes if known. Or, you may use the services and assistance of the Kentucky Procurement Technical Assistance Center (PTAC) **and** the Kentucky Department of Transportation (KDOT). The easiest way to utilize the services of Kentucky PTAC and KDOT is to send an email to kyptacinfo@kstc.com and Melvin.Bynes2@ky.gov and generally describe the solicitation, the dates it will be open, the types of vendors you are seeking and applicable SIC or NAIC codes if known.

☐ The prime contractor certifies that the assistance of the SBA or PTAC **and** KDOT was utilized. *Submit pages printed off the SBA websites which evidence efforts to register a solicitation on the site or submit copies of the letter sent and certified mail receipt as documentation; or submit copies of emails sent to PTAC and DOT as documentation.*

(vi). If a Prime contractor awards any subcontracts, require the subcontractor to take the steps in numbers (i) through (v) above.

☐ The prime contractor certifies that subcontractors used for this project will be required to follow the steps of the "six good faith efforts" as listed above.

9. Signature and date:

To the best of my knowledge and belief, all "six good faith efforts" have been met and the information contained in this document is true and correct; the document has been duly authorized by the legal representative.

_____ _____

Signature Print name and title

_____

Date

BIDDER'S LIST FORM

OWNER: _____ **LOAN NO:** _____

PROJECT TITLE: _____ **BID DATE:** _____

Instructions:

1. Per 40 CFR §33.501(b), this list must include all firms that were solicited for participation, bid on, or quoted for a prime contract or subcontract under EPA assisted projects, includes both DBE's and non DBE's.
2. SRF loan participants must keep the Bidder's List until the project period for the identified loan has ended and no funds are remaining.
3. This list must be submitted to DOW in the ATA Package. Contract Award Approval cannot be given until this form has been received by DOW.
4. The following information must be obtained from all prime and subcontractors. Please complete the form below:

ENTITY'S NAME	MAILING ADDRESS	CONTACT PERSON	PHONE#	E-MAIL ADDRESS	M/WBE?

Attachment Number 12

BONDS AND INSURANCE

The minimum requirements shall be as follows:

Bonding requirements for contracts of $100,000 or less are contained in 40 CFR 31.36(h).

Bond requirements for contracts in excess of $100,000 are:

- Bid guarantee equivalent to five percent of the bid price. The bid guarantee shall consist of a firm commitment such as a certified check or bid bond submitted with the bid;
- Performance bond equal to 100 percent of the contract price, and
- Payment bond equal to 100 percent of the contract price. Bonds must be obtained from companies holding Certificates of Authority as acceptable sureties, issued by the U.S. Treasury.

Insurance requirements are contained in the General Conditions of the contract. In addition to the other required insurance, the owner or the contractor, as appropriate, must acquire any flood insurance made available by the Federal Emergency Management Agency as required by 44 CFR Parts 59-79, if construction will take place in a flood hazard area identified by the Federal Emergency Management Agency. The owner's requirements on Flood Insurance are contained in the Special Conditions Section of the Contracts Documents.

Attachment Number 13

STORM WATER GENERAL PERMIT

All construction projects with surface disturbance of more than 1 acre during the period of construction must have a KPDES Storm Water General Permit. The permit can be found at this webpage.

If you have any questions regarding the completion of this form call the Surface Water Permits Branch, at (502) 564-3410.

Attachment Number 14

DAVIS-BACON WAGE RATE REQUIREMENTS

CWSRF: The recipient agrees to include in all agreements to provide assistance for the construction of treatment works carried out in whole or in part with such assistance made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.), or with such assistance made available under section 205(m) of that Act (33 U.S.C. 1285(m)), or both, a term and condition requiring compliance with the requirements of section 513 of that Act (33 U.S.C. 1372) in all procurement contracts and sub-grants, and require that loan recipients, procurement contractors and sub-grantees include such a term and condition in subcontracts and other lower tiered transactions. All contracts and subcontracts for the construction of treatment works carried out in whole or in part with assistance made available as stated herein shall insert in full in any contract in excess of $2,000 the contract clauses as set forth below titled "Wage Rate Requirements Under The Consolidated and Further Continuing Appropriations Act, 2013 (P.L. 113-6)". This term and condition applies to all agreements to provide assistance under the authorities referenced herein, whether in the form of a loan, bond purchase, grant, or any other vehicle to provide financing for a project, where such agreements are executed on or after October 30, 2009.

DWSRF: The recipient agrees to include in all agreements to provide assistance for any construction project carried out in whole or in part with such assistance made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j-12), a term and condition requiring compliance with the requirements of section 1450(e) of the Safe Drinking Water Act (42 U.S.C.300j-9(e)) in all procurement contracts and sub-grants, and require that loan recipients, procurement contractors and sub-grantees include such a term and condition in subcontracts and other lower tiered transactions. All contracts and subcontracts for any construction project carried out in whole or in part with assistance made available as stated herein shall insert in full in any contract in excess of $2,000 the contract clauses as set forth below entitled "Wage Rate Requirements Under The Consolidated and Further Continuing Appropriations Act, 2013 (P.L. 113-6)". This term and condition applies to all agreements to provide assistance under the authorities referenced herein, whether in the form of a loan, bond purchase, grant, or any other vehicle to provide financing for a project, where such agreements are executed on or after October 30, 2009.

Wage Rate Requirements under the Consolidated and Further Continuing Appropriations Act, 2013 (P.L. 113-6)

Preamble

With respect to the Clean Water and Safe Drinking Water State Revolving Funds, EPA provides capitalization grants to each State which in turn provides subgrants or loans to eligible entities within the State. Typically, the subrecipients are municipal or other local governmental entities that manage the funds. For these types of recipients, the provisions set forth under Roman Numeral I, below, shall apply. Although EPA and the State remain responsible for ensuring subrecipients' compliance with the wage rate requirements set forth herein, those subrecipients shall have the primary responsibility to maintain payroll records as described in Section 3(ii)(A), below and for compliance as described in Section I-5.

Occasionally, the subrecipient may be a private for profit or not for profit entity. For these types of recipients, the provisions set forth in Roman Numeral II, below, shall apply. Although EPA and the State remain responsible for ensuring subrecipients' compliance with the wage rate requirements set forth herein, those subrecipients shall have the primary responsibility to maintain payroll records as described in Section II-3(ii)(A), below and for compliance as described in Section II-5.

I. Requirements under the Consolidated and Further Continuing Appropriations Act, 2013 (P.L. 113-6) for Subrecipients that are Governmental Entities:

The following terms and conditions specify how recipients will assist EPA in meeting its Davis-Bacon (DB) responsibilities when DB applies to EPA awards of financial assistance under the FY 2013 Continuing Resolution with respect to State recipients and subrecipients that are governmental entities. If a subrecipient has questions regarding when DB applies, obtaining the correct DB wage determinations, DB provisions, or compliance monitoring, it may contact the State recipient. The recipient or subrecipient may also obtain additional guidance from Department of Labor's webpage.

1. Applicability of the Davis- Bacon (DB) prevailing wage requirements.

Under the FY 2013 Continuing Resolution, DB prevailing wage requirements apply to the construction, alteration, and repair of treatment works carried out in whole or in part with assistance made available by a State water pollution control revolving fund and to any construction project carried out in whole or in part by assistance made available by a drinking water treatment revolving loan fund. If a subrecipient encounters a unique situation at a site that presents uncertainties regarding DB applicability, the subrecipient must discuss the situation with the recipient State before authorizing work on that site.

2. Obtaining Wage Determinations.

(a) Subrecipients shall obtain the wage determination for the locality in which a covered activity subject to DB will take place prior to issuing requests for bids, proposals, quotes or other methods for soliciting contracts (solicitation) for activities subject to DB. These wage determinations shall be incorporated into solicitations and any subsequent contracts. Prime contracts must contain a provision requiring that subcontractors follow the wage determination incorporated into the prime contract.

(i) While the solicitation remains open, the subrecipient shall monitor the General Services Administration website weekly to ensure that the wage determination contained in the solicitation remains current. The subrecipients shall amend the solicitation if DOL issues a modification more than 10 days prior to the closing date (i.e. bid opening) for the solicitation. If DOL modifies or supersedes the applicable wage determination less than 10 days prior to the closing date, the subrecipients may request a finding from the State recipient that there is not a reasonable time to notify interested contractors of the modification of the wage determination. The State recipient will provide a report of its findings to the subrecipient.

(ii) If the subrecipient does not award the contract within 90 days of the closure of the solicitation, any modifications or supersedes DOL makes to the wage determination contained in the solicitation shall be effective unless the State recipient, at the request of the subrecipient, obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv). The subrecipient shall monitor the General Services Administration website on a weekly basis if it does not award the contract within 90 days of closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

(b) If the subrecipient carries out activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a solicitation, the subrecipient shall insert the appropriate DOL wage determination from the General Services Administration website into the ordering instrument.

(c) Subrecipients shall review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.

(d) As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to a subrecipient's contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the subrecipient has failed to incorporate a wage determination or has used a wage

determination that clearly does not apply to the contract or ordering instrument. If this occurs, the subrecipient shall either terminate the contract or ordering instrument and issue a revised solicitation or ordering instrument or incorporate DOL's wage determination retroactive to the beginning of the contract or ordering instrument by change order. The subrecipient's contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.

3. Contract and Subcontract provisions.

(a) The Recipient shall insure that the subrecipient(s) shall insert in full in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a treatment work under the CWSRF or a construction project under the DWSRF financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1 or the FY 2013 Continuing Resolution, the following clauses:

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

Subrecipients may obtain wage determinations from the U.S. Department of Labor's General Services Administration website.

(ii)(A) The subrecipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The State award official shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the subrecipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the subrecipient (s) to the State award official. The State award official will transmit the request, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the subrecipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The request shall be sent to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, provided, that the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding. The subrecipient(s), shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the subrecipient, that is, the entity that receives the sub-grant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the subrecipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division's webpage or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the subrecipient(s) for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the subrecipient(s).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under §5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under §5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for

the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may by appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and Subrecipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

4. Contract Provision for Contracts in Excess of $100,000.

(a) Contract Work Hours and Safety Standards Act. The subrecipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by Item 3, above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (a)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (a)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The subrecipient, upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (a)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a)(1) through (4) of this section.

(b) In addition to the clauses contained in Item 3, above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Subrecipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Subrecipient shall insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

5. Compliance Verification.

(a) The subrecipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. The subrecipient must use Standard Form 1445 (SF 1445) or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are available from EPA on request.

(b) The subrecipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. Subrecipients must conduct more frequent interviews if the initial interviews or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. Subrecipients shall immediately conduct necessary interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence.

(c) The subrecipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The subrecipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable, the subrecipient should spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract. Subrecipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. In addition, during the examinations the subrecipient shall verify evidence of fringe benefit plans and payments thereunder by contractors and subcontractors who claim credit for fringe benefit contributions.

(d) The subrecipient shall periodically review contractors and subcontractors use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

(e) Subrecipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office.

II. Requirements under the Consolidated and Further Continuing Appropriations Act, 2013 (P.L. 113-6) for Subrecipients that are not Governmental Agencies

The following terms and conditions specify how recipients will assist EPA in meeting its DB responsibilities when DB applies to EPA awards of financial assistance under the FY2013 Continuing Resolution with respect to subrecipients that are not governmental entities. If a subrecipient has questions regarding when DB applies, obtaining the correct DB wage determinations, DB provisions, or compliance monitoring, it may contact the State recipient for guidance. The recipient or subrecipient may also obtain additional guidance from DOL's webpage.

Under these terms and conditions, the subrecipient must submit its proposed DB wage determinations to the State recipient for approval prior to including the wage determination in any solicitation, contract task orders, work assignments, or similar instruments to existing contractors.

1. Applicability of the Davis- Bacon (DB) prevailing wage requirements.

Under the FY 2013 Continuing Resolution, Davis-Bacon prevailing wage requirements apply to the construction, alteration, and repair of treatment works carried out in whole or in part with assistance made available by a State water pollution control revolving fund and to any construction project carried out in whole or in part by assistance made available by a drinking water treatment revolving loan fund. If a subrecipient encounters a unique situation at a site that presents uncertainties regarding DB applicability, the subrecipient must discuss the situation with the recipient State before authorizing work on that site.

2. Obtaining Wage Determinations.

(a) Subrecipients must obtain proposed wage determinations for specific localities from the U.S. Department of Labor's General Services Administration website. After the Subrecipient obtains its proposed wage determination, it must submit the wage determination to (insert contact information for State recipient DB point of contact for wage determination) for approval prior to inserting the wage determination into a solicitation, contract or issuing task orders, work assignments or similar instruments to existing contractors (ordering instruments unless subsequently directed otherwise by the State recipient Award Official).

(b) Subrecipients shall obtain the wage determination for the locality in which a covered activity subject to DB will take place prior to issuing requests for bids, proposals, quotes or other methods for soliciting contracts (solicitation) for activities subject to DB. These wage determinations shall be incorporated into solicitations and any subsequent contracts. Prime contracts must contain a provision requiring that subcontractors follow the wage determination incorporated into the prime contract.

(i) While the solicitation remains open, the subrecipient shall monitor the U.S. Department of Labor's General Services Administration website on a weekly basis to ensure that the wage determination contained in the solicitation remains current. The subrecipients shall amend the solicitation if DOL issues a modification more than 10 days prior to the closing date (i.e. bid opening) for the solicitation. If DOL modifies or supersedes the applicable wage determination less than 10 days prior to the closing date, the subrecipients may request a finding from the State recipient that there is not a reasonable time to notify interested contractors of the modification of the wage determination. The State recipient will provide a report of its findings to the subrecipient.

(ii) If the subrecipient does not award the contract within 90 days of the closure of the solicitation, any modifications or supersedes DOL makes to the wage determination contained in the solicitation shall be effective unless the State recipient, at the request of the subrecipient, obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv). The subrecipient shall monitor the U.S. Department of Labor's General Services Administration website on a weekly basis if it does not award the contract within 90 days of closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

(c) If the subrecipient carries out activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a solicitation, the subrecipient shall insert the appropriate DOL wage determination from the U.S. Department of Labor's General Services Administration website into the ordering instrument.

(c) Subrecipients shall review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.

(d) As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to a subrecipient's contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the subrecipient has failed to incorporate a wage determination or has used a wage determination that clearly does not apply to the contract or ordering instrument. If this occurs, the subrecipient shall either terminate the contract or ordering instrument and issue a revised solicitation or ordering instrument or incorporate DOL's wage determination retroactive to the beginning of the contract

or ordering instrument by change order. The subrecipient's contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.

3. Contract and Subcontract provisions.

(a) The Recipient shall insure that the subrecipient(s) shall insert in full in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a treatment work under the CWSRF or a construction project under the DWSRF financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1 or the FY 2013 Continuing Resolution, the following clauses:

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work, will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

Subrecipients may obtain wage determinations from the U.S. Department of Labor's General Services Administration website.

(ii)(A) The subrecipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The State award official shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the subrecipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the subrecipient(s) to the State award official. The State award official will transmit the report, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the and the subrecipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request, and the local wage determination, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The request shall be sent to the EPA Regional Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding. The subrecipient(s) shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the

site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the subrecipient, that is, the entity that receives the sub-grant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the subrecipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division's webpage or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the subrecipient(s) for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the subrecipient(s).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and

Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may by appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and Subrecipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

4. Contract Provision for Contracts in Excess of $100,000.

(a) Contract Work Hours and Safety Standards Act. The subrecipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act.

These clauses shall be inserted in addition to the clauses required by Item 3, above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The subrecipient shall upon the request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (a)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (b)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (4) of this section.

(c) In addition to the clauses contained in Item 3, above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Subrecipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Subrecipient shall insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

5. Compliance Verification.

(a) The subrecipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. The subrecipient must use Standard Form 1445 (SF 1445) or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are available from EPA on request.

(b) The subrecipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. Subrecipients must conduct more frequent interviews if the initial interviews or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. Subrecipients shall immediately conduct necessary interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence.

(c) The subrecipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The subrecipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable the subrecipient should spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract. Subrecipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. In addition, during the examinations the subrecipient shall verify evidence of fringe benefit plans and payments thereunder by contractors and subcontractors who claim credit for fringe benefit contributions.

(d) The subrecipient shall periodically review contractors and subcontractors use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

(e) Subrecipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office or its successor site.

Attachment Number 15

AMERICAN IRON AND STEEL REQUIREMENT

The Contractor acknowledges to and for the benefit of the _____ ("Purchaser") and the State of Kentucky (the "State") that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel;" that requires all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided by the Contactor pursuant to this Agreement.

The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser).

While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

Sample Certification

The following information is provided as a sample letter of step certification for AIS compliance. Documentation must be provided on company letterhead.

Date

Company Name
Company Address
City, State Zip

Subject: American Iron and Steel Step Certification for Project (XXXXXXXXXX)

I, (company representative), certify that the (melting, bending, coating, galvanizing, cutting, etc.) process for (manufacturing or fabricating) the following products and/or materials shipped or provided for the subject project is in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

Item, Products and/or Materials:

1. Xxxx
2. Xxxx
3. Xxxx

Such process took place at the following location:

_____

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative

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SECTION 00890 (ADD #1)

PERMITS

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

A. The attached permits and conditions included therein shall be included and part of the Contract Documents. The Contractor shall be aware of and conform to all listed conditions and requirements as part of the approved permit documents.

PART 2 – PRODUCTS

2.01 APPLICABLE PERMITS (INCLUDED IN THE PROJECT. SEE ATTACHED)

A. eClearinghouse Correspondences

B. KDOW – Construction Permit

See the attached approved KDOW Construction Permit for the project. Any statements and/or requirements stated within this permit are considered incidental to the Contract. ***(ADD #1)***

END OF SECTION

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ANDY BESHEAR
GOVERNOR

JACQUELINE COLEMAN
LT. GOVERNOR

TOURISM, ARTS AND HERITAGE CABINET
KENTUCKY HERITAGE COUNCIL
THE STATE HISTORIC PRESERVATION OFFICE
410 HIGH STREET
FRANKFORT, KENTUCKY 40601
(502) 564-7005
www.heritage.ky.gov

LINDY CASEBIER
SECRETARY

CRAIG A. POTTS
EXECUTIVE DIRECTOR &
STATE HISTORIC PRESERVATION OFFICER

October 3, 2024

Haly Hennigan
Hazen & Sawyer
230 Lexington Green Circle, Ste. 520
Lexington, KY 40503

Re: **East Hickman Pump Station Expansion & Rehab Project, Lexington, Fayette Co., KY**

Dear Ms. Hennigan:

Our review indicates that the proposed project will not impact any properties or sites that are listed in or eligible for the National Register of Historic Places. The proposed project should not require cultural resource survey. We would concur with a finding of *No Historic Properties Affected.*

In the unlikely event that human remains are found during construction for this project, work should cease immediately, and the county coroner and the Kentucky Heritage Council should be contacted. Should project plans change or there be any future concerns or questions regarding cultural resources in the vicinity of this project area, please do not hesitate to contact Nicole Konkol via email at nicole.konkol@ky.gov.

Sincerely,

Craig A. Potts,
Executive Director and
State Historic Preservation Officer

CP:nk KHC #242189

Andy Beshear
Governor

OFFICE OF THE GOVERNOR
DEPARTMENT FOR LOCAL GOVERNMENT
100 AIRPORT ROAD, THIRD FLOOR
FRANKFORT, KENTUCKY 40601
PHONE (502) 573-2382, F 227-8691
dlg.ky.gov

Matt Sawyers
Commissioner

October 1, 2024

Mrs. Tiffany Rank
Lexington Fayette Urban County Government
301 Lisle Industrial Ave
Lexington, KY 40511

RE: LFUCG-East Hickman Pump Station Expansion and Rehabilitation
SX21067015
SAI# KY202409091418
CFDA# 21.019

Dear Mrs. Rank:

The Kentucky State e-Clearinghouse is the official designated Single Point of Contact (SPOC) for the Commonwealth pursuant to Presidential Executive Order 12372 and supported by Kentucky Statutes KRS 45.031. The primary function of the SPOC is to streamline the review process for the applicant and the funding agency. This process helps in vocalizing the statutory and regulatory requirements. Information in the form of comments, if any, will be attached to this correspondence.

This proposal has been reviewed by the appropriate state agencies in the e-Clearinghouse for conflicts with state or local plans, goals, and objectives. After receiving this letter, you should make it available to the funding agency and continue with the application process for that agency. This e-Clearinghouse SPOC letter signifies only that the project has followed the state reviewing requirements and is neither a commitment of funds from this agency, nor any other state or federal agency. Please remember if any federal reviews are required, the applicant must follow through with those federal agencies.

The results of this review are valid for **one year** from the date of this letter. If the project is not submitted to the funding agency or not approved within one year after the completion of this review, the applicant can request an extension through the **information request function**. If the project changes in any way after the review, the applicant must reapply through the e-Clearinghouse for a new review. There are no exceptions.

If you have any questions regarding this letter or the review process, please contact the e-Clearinghouse office at (502) 573-2382.

Sincerely,

Cindy Seip,
Program Coordinator/SPOC
Kentucky State e-Clearinghouse
Attachment

TEAM KENTUCKY

An Equal Opportunity Employer M/F/D

Bluegrass Area Development District
Kelly Rode

The review was based upon the information that was provided by the applicant through the clearinghouse for this project. The project does not appear to conflict with the mission and goals of the Bluegrass Area Development District.

Department for Environmental Protection
Louanna Aldridge

Carole Catalfo - Endorse with Comments SAI# KY202409091418 – Fayette County; LFUCG-East Hickman Pump Station Expansion and Rehabilitation

The proposed project is subject to Division of Water (DOW) jurisdiction because the following are or appear to be involved: sewer lines and appurtenances; floodplain construction; groundwater protection. Prior approval must be obtained from the DOW before construction can begin. The applicant must cite the State Application Identifier (SAI # KY202409091418) when submitting plans and specifications.

PROJECT DESCRIPTION: The East Hickman Pump Station Phase 2 project (EHPS2) is an identified Remedial Measures Program (RMP) project within LFUCG's Consent Degree (CD) program mandated by EPA. The Phase two project builds on the in operation Phase 1 pump station and 6 MG wet weather storage tank facility. The EHPS2 project includes upgrades/replacement of the facilities pumps and controls to meet full development of LFUCG's Capacity Assurance Program (CAP) Consultant's projections, installation of a new odor control system providing odor control protection for the new EH 36-inch force main, installation of two new communicators within the pump station building to assist shredding material within the sanitary flow into smaller particles protecting the pumps from damage and clogging, modifications to the existing controls and SCADA system allowing for historical flow data capture, etc. Expansion and rehabilitation of the East Hickman pump station increasing the pumping capacity from 12,000 gallons per minute (GPM) to 20,000 GPM to better accommodate wet weather flows and planned redirection of flow within the sanitary sewer system. This upgrade should eliminate an average of 11 sanitary sewer overflows (SSO's) per year.

Division of Water

Water Quality Branch
Comment: Best management practices should be utilized to reduce runoff from project activities into nearby waters.
Questions should be directed to Andrea Fredenburg, (502) 782-6950, Andrea.Fredenburg@ky.gov.

Field Operations Branch
Comment: Endorse.
Questions should be directed to Daniel Fraley, (606) 782-8794, Daniel.Fraley@ky.gov.

Watershed Management Branch
Water Supply Section:
Comment: This proposed project is not within a designated Source Water Protection Area.
Questions should be directed to Chip Zimmer at (502) 782-7141, Edward.Zimmer@ky.gov.

Groundwater Section:
Comment: The proposed work is endorsed by the Groundwater Section of the Watershed Management Branch. However, the proposed work is located in an area with a high potential for karst development where groundwater is susceptible to direct contamination from surface activities. It is our recommendation that proposed work be made aware of the requirements of 401 KAR 5:037 and the need to develop a Groundwater Protection Plan (GPP) for the protection of groundwater resources within that area.
Questions should be directed to Bronson McQueen at (502) 782-6036, Bronson.McQueen@ky.gov.

Water Resources Branch
Floodplain Management Section:
Comment: Construction conducted in the 1% annual chance Special Flood Hazard Area requires floodplain permitting from the Division of Water, Water Resources Branch and the local community.

Floodplain Maps

You can check https://watermaps.ky.gov/RiskPortal/ to determine if your site is located in the 1% chance floodplain (shown in Blue or Blue /Red on the map). The 1% chance floodplain was formerly called the 100-year floodplain. You can use the search bar in the top right corner of the page to find your location using either a Latitude & Longitude, street address, or community name. A User's Guide link is available in the upper left-hand side of the page. If you would like additional assistance determining if you are located in the floodplain, contact your community's local floodplain coordinator. Community contact information is provided at:
https://eec.ky.gov/Environmental-Protection/Water/FloodDrought/Documents/FloodplainCoordinatorsList.pdf.

If your site is in the 1% annual chance floodplain a stream construction permit from the Division of Water and Floodplain permit from your local community is required prior to construction.

Floodplain Permits

The Floodplain General Permit FPGP covers projects that have little potential to impact regulatory base flood elevation. The FPGP does have conditions, requirements, and exclusions listed so be sure your project can meet all these prior to the start of development. The most common activities covered by the GP include:
- Underground utilities only with no ground surface elevation changes, where stream crossings, if any, are completed by directional boring; or
- Installation of utility poles; or
- Installation of fences that do not obstruct water flow; or
- Stream obstruction removals of items such as woody debris from near bridges and culverts.

A second Floodplain General Permit (FPGP UNSUB) covers additions or repairs to an existing structure where the cost of repairs/upgrade is less than 50% of the structure value per the local county Property Valuation Administrator or Certified Residential or General Real Property Appraiser.

Both GPs available for covered projects do not require prior public notice or application to the Division prior to construction. Exclusions to the GPs include work in or along an outstanding state resource water (OSRW) or other special use water, if an Individual 401 WQC required for the development, and development of structures or dams. The Floodplain GPs can be downloaded at:
https://eec.ky.gov/Environmental-Protection/Water/FloodDrought/Pages/UnderstandYourFloodHazards.aspx.

If your site is in the floodplain and the GPs do not apply, an Individual Permit is required from the Division of Water for any proposed development. On the application, you must provide accurate latitude/longitude and an aerial map (maps from the Riskmap link above or Google maps are acceptable) in lieu of a topo map. The map must show where structures or crossing will be placed, and if fill or cut/fill is being done, draw the full extents of the fill on the aerial map. For the project description, describe what you plan to do to complete the project, how much (if any) fill will be brought into the floodplain, or how much material will be moved from or redistributed within the floodplain.

For structures, describe the structure, provide the size and type of foundation (slab on grade, elevated, crawl space). For culverts, describe how much material will be brought in and what type, how high above current surface elevation will the material be placed, especially in low lying areas where the roadway would impede flow. Include the number of culverts pipes used and description (length, diameter and material). For a bridge, describe how the bridge abutments will be installed, the thickness of the bridge deck and the height of the lowest point of the bridge over the ordinary high water mark (plant line on the shoreline) and height of the bottom of the bridge deck above the bottom of the creek channel.

If you are replacing a bridge or culvert, describe how the new installation will compare to the old- if the new installation will have a larger opening or pipes, will have more or less fill for the installation, indicate that on the application description.

Other Permits
Anytime you need a state floodplain permit, and you live in a community that participates in the NFIP, a local permit is also required. Find the contact information your local floodplain manager at:
https://eec.ky.gov/Environmental-Protection/Water/FloodDrought/Documents/FloodplainCoordinatorsList.pdf.

Your local floodplain manager can help you with the state permit, as well as help you with the local permit and to understand the floodplain requirements.

If you are working below the top of the bank, within a stream channel, or within wetlands, a 404 permit from the US Army Corps of Engineers and 401 Water Quality Certification may also be required. Our Water Quality Certification section will review the application to determine if 401/404 permitting is needed. For information on permitting procedures or for other information, visit:
https://eec.ky.gov/Environmental-Protection/Water/PermitCert/WQ401Cert/Pages/Apply-for-Certification.aspx.
Questions should be directed to Shawn Hokanson at (502) 782-6977, Shawn.Hokanson@ky.gov.

Water Quality Certification Section:
Comment: If the activity requires a federal permit due to activities in or near Waters of the U.S., a Clean Water Act Section 401 Water Quality Certification from the DOW may be required for this project.
Questions should be directed to the Water Quality Certification Section, (502) 564-3410, 401WQC@ky.gov.

Surface Water Permits Branch
Permit Support Section:
Comment: If the construction area disturbed is equal to or greater than 1 acre, the applicant will need to apply for a Kentucky Pollutant Discharge Elimination System (KPDES) stormwater discharge permit.
Questions should be directed to the Permit Support Section, (502) 564-3410, SWPBsupport@ky.gov.

Water Infrastructure Branch
Engineering Section:
Comment: Prior to the start of construction, plans and specifications that have been signed, stamped and dated by a Licensed Professional Engineer shall be submitted to the Division of Water for review and approval.
Questions should be directed to Terry Humphries, Engineering Section, at (502) 782-6983, Terry.Humphries@ky.gov.

Municipal Planning Section:
Comment: No concerns.
Questions should be directed to Lori Dials at (502) 782-6937, Lori.Dials@ky.gov.

Natalie Bruner - Endorse with Comments The East Hickman Pump Station Phase 2 project (EHPS2) is an identified Remedial Measures Program (RMP) project within LFUCG's Consent Decree (CD) program mandated by EPA. The Phase two project builds on the in-operation Phase 1 pump station and 6 MG wet weather storage tank facility. The EHPS2 project includes upgrades/replacement of the facilities pumps and controls to meet full development of LFUCG's Capacity Assurance Program (CAP) Consultant's projections, installation of a new odor control system providing odor control protection for the new EH 36-inch force main, installation of two new communicators within the pump station building to assist shredding material within the sanitary flow into smaller particles protecting the pumps from damage and clogging, modifications to the existing controls and Supervisory Control and Data Acquisition (SCADA) system allowing for historical flow data capture, etc. Expansion and rehabilitation of the East Hickman pump station increasing the pumping capacity from 12,000 gallons per minute (GPM) to 20,000 GPM to better accommodate wet weather flows and planned redirection of flow within the sanitary sewer system. This upgrade should eliminate an average of 11 sanitary sewer overflows (SSO's) per year.

Lexington –Fayette Urban County Government owns the West Hickman Wastewater Treatment Plant (WWTP). The facility is covered under Kentucky Pollutant Discharge Elimination System (KPDES) Permit # KY0021504. Violations were issued for Dissolved Oxygen, Phosphorus, improper operation and maintenance, Total Suspended Solids, and Fecal Coliform Bacteria. West Hickman WWTP was referred to the Kentucky Division of Enforcement in September 2023. A Demand Letter (DL) was issued in April 2024 and a penalty of $4,000 was paid in May 2024. The case was closed in June 2024.
The Kentucky Division of Enforcement endorses this project.

Department of Housing Buildings and Construction
Don Newberry

The Department of Housing Buildings and Construction, Division of Building Code Enforcement, has no comments concerning this proposed project.

Division of Water
Andrea Fredenburg

Best management practices should be utilized to reduce runoff from project activities into nearby waters.

Division of Water
Terry Humphries

Prior to the start of construction, plans and specifications that have been signed, stamped and dated by a Licensed Professional Engineer shall be submitted to the Division of Water for review and approval.

DOW
Daniel Fraley

Endorse

Kentucky Department of Fish & Wildlife
Emily Lawson

Due to the location and nature of the project, Kentucky Department of Fish & Wildlife Resources (KDFWR) does not have specific concerns regarding federal or state-listed threatened / endangered species, designated critical habitat, wildlife management areas, or other properties managed by KDFWR. The following recommendations are provided as general guidance for waterline/wastewater projects submitted to KDFWR for review. In general, impacts to fish and wildlife resources might be avoided and minimized by following the guidance provided below:

- KDFWR recommends that erosion control measures be developed and implemented prior to construction to reduce siltation into waterways located within/near the project area. Such erosion control measures may include, but are not limited to silt fences, staked straw bales, brush barriers, sediment basins, and diversion ditches. Erosion control measures will need to be inspected regularly and repaired as needed. If blanket-style matting is used for erosion control, please avoid using the nylon monofilament netting as it can entangle and kill wildlife. An alternative blanket style control is organic coir matting, which degrades naturally and provides excellent soil protection and moisture retention for seed germination—as well as controlling erosion runoff without unnecessarily impacting wildlife.

- Development/excavation in streams should be done during low flow periods to minimize disturbances. When crossing a stream, the pipe should be laid perpendicular to the stream bank to minimize the direct impacts to the streambed (rather than parallel). Perpendicular alignments help reduce short-term and long-term effects to streams. KDFWR recommends that all instream disturbances be returned to a stable condition upon completion of stream pipeline crossing.

• Avoid using wet concrete near waterways. Please refer to the KY Division of Water for recommended best management practices regarding concrete use near streams. Uncured (wet) concrete released into streams and waterways causes significant fish kills. If concrete is required, prevent its release into streams by using pre-formed concrete structures or separating work areas from stream water by coffer dam or other method. Construction water that contains concrete slurry should not be released into streams. It can be pumped into a containment in an upland area away from stream water to safely dispose of it or it can be aspirated with carbon dioxide to make it non-toxic.

• USFWS Coordination for compliance with the Endangered Species Act: Please coordinate with the US Fish and Wildlife Service for compliance with the Endangered Species Act and for specific recommendations to minimize adverse effects to listed species (if the project is federally funded or near known occurrences of listed species). The USFWS may have seasonal requirements for removing trees, especially those greater than 3" in diameter-at-breast height. Limiting the removal of these trees to the period between October 15th through March 31st will minimize impacts to many species of bats, several of which are listed as threatened or endangered on the federal Endangered Species Act.

Thank you for coordinating with KDFWR. Please contact Emily Lawson at 502-892-4472 or emilym.lawson@ky.gov if you have further questions or require additional information.

Kentucky Division of Water
Shawn Hokanson
Construction conducted in the 1% annual chance Special Flood Hazard Area requires floodplain permitting from the Division of Water, Water Resources Branch and the local community.

Floodplain Maps

You can check https://watermaps.ky.gov/RiskPortal/ to determine if your site is located in the 1% chance floodplain (shown in Blue or Blue /Red on the map). The 1% chance floodplain was formerly called the 100-year floodplain. You can use the search bar in the top right corner of the page to find your location using either a Latitude & Longitude, street address, or community name. A User's Guide link is available in the upper left-hand side of the page. If you would like additional assistance determining if you are located in the floodplain, contact your community's local floodplain coordinator. Community contact information is provided at:
https://eec.ky.gov/Environmental-Protection/Water/FloodDrought/Documents/FloodplainCoordinatorsList.pdf.

If your site is in the 1% annual chance floodplain a stream construction permit from the Division of Water and Floodplain permit from your local community is required prior to construction.

Floodplain Permits

The Floodplain General Permit FPGP covers projects that have little potential to impact regulatory base flood elevation. The FPGP does have conditions, requirements, and exclusions listed so be sure your project can meet all these prior to the start of development. The most common activities covered by the GP include:
- Underground utilities only with no ground surface elevation changes, where stream crossings, if any, are completed by directional boring; or
- Installation of utility poles; or
- Installation of fences that do not obstruct water flow; or
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https://eec.ky.gov/Environmental-Protection/Water/FloodDrought/Pages/UnderstandYourFloodHazards.aspx.

If your site is in the floodplain and the GPs do not apply, an Individual Permit is required from the Division of Water for any proposed development. On the application, you must provide accurate latitude/longitude and an aerial map (maps from the Riskmap link above or Google maps are acceptable) in lieu of a topo map. The map must show where structures or crossing will be placed, and if fill or cut/fill is being done, draw the full extents of the fill on the aerial map. For the project description, describe what you plan to do to complete the project, how much (if any) fill will be brought into the floodplain, or how much material will be moved from or redistributed within the floodplain.

For structures, describe the structure, provide the size and type of foundation (slab on grade, elevated, crawl space). For culverts, describe how much material will be brought in and what type, how high above current surface elevation will the material be placed, especially in low lying areas where the roadway would impede flow. Include the number of culverts pipes used and description (length, diameter and material). For a bridge, describe how the bridge abutments will be installed, the thickness of the bridge deck and the height of the lowest point of the bridge over the ordinary high water mark (plant line on the shoreline) and height of the bottom of the bridge deck above the bottom of the creek channel. If you are replacing a bridge or culvert, describe how the new installation will compare to the old- if the new installation will have a larger opening or pipes, will have more or less fill for the installation, indicate that on the application description.

Other Permits
Anytime you need a state floodplain permit, and you live in a community that participates in the NFIP, a local permit is also required. Find the contact information your local floodplain manager at:
https://eec.ky.gov/Environmental-Protection/Water/FloodDrought/Documents/FloodplainCoordinatorsList.pdf.

Your local floodplain manager can help you with the state permit, as well as help you with the local permit and to understand the floodplain requirements.

If you are working below the top of the bank, within a stream channel, or within wetlands, a 404 permit from the US Army Corps of Engineers and 401 Water Quality Certification may also be required. Our Water Quality Certification section will review the application to determine if 401/404 permitting is needed. For information on permitting procedures or for other information, visit:
https://eec.ky.gov/Environmental-Protection/Water/PermitCert/WQ401Cert/Pages/Apply-for-Certification.aspx.

Kentucky Division of Water
Bronson McQueen

The proposed work is endorsed by the Groundwater Section of the Watershed Management Branch. However, the proposed work is located in an area with a high potential for karst development where groundwater is susceptible to direct contamination from surface activities. It is our recommendation that proposed work be made aware of the requirements of 401 KAR 5:037 and the need to develop a Groundwater Protection Plan (GPP) for the protection of groundwater resources within that area.

Kentucky Infrastructure Authority
Don Schierer

This project was reviewed in the WRIS Portal by KIA staff. Requested ADD update the Project Schedule, Surveyed household counts, and CW specific components.

Kentucky Public Service Commission
Jason Green

The PSC Staff's review and comments concerning the project signify only that the documents provided in support of the project appear sufficient to meet the state application requirements set forth in KRS 45:031. The PSC Staff's review and comments on projects in the eClearinghouse are for informational purposes only. Nothing stated herein is binding on the PSC, nor should be interpreted as fulfilling any statutory or regulatory requirement applicable to the project in any proceeding before the PSC.

KY Division of Water
Lori Dials

No concerns.

KY Division of Water
Chip Zimmer

This proposed project is not within a designated Source Water Protection Area.

KY Heritage Council
Yvonne Sherrick

To receive a review from the KY Heritage Council/State Historical Preservation Office (SHPO) you must follow the instructions located on their website at https://heritage.ky.gov/compliance/Pages/overview.aspx. There you will find the required documents for the Section 106 Review and Compliance for 36 CFR Part 800. This Section 106 submission process to SHPO will assist applicants and agencies in providing the appropriate level of information to receive comments from SHPO. If you have any questions please contact Yvonne Sherrick, via email at yvonne.sherrick@ky.gov..

Please note: If your project is funded through Transportation Alternative (TAP), Transportation Enhancements (TE), Congestion, Mitigation, Air Quality (CMAQ), or Safe Routes to School (SRTS) you will need to send this information to Michael Jones, Historic Preservation Program Administrator with the Kentucky Transportation Cabinet via email to MichaelR.Jones2@ky.gov or hard copy to Michael Jones, Office of Local Programs, KY Transportation Cabinet, 200 Mero Street Frankfort, KY 40622. Do not send materials directly to SHPO if your project involves funding from these four sources as it will cause delays in the review process. Michael Jones will consult directly with the SHPO on projects with these funding sources to complete the Section 106 review.

KYTC - District 7
Casey Smith

In the event construction activities encroach upon state maintained right of way, it will be necessary to obtain a standard encroachment permit. This endorsement does not imply the acceptance or approval to any permits that are required from KYTC. Permit requests and questions may be directed to: Robert Baker, District 7 Highway Dept. Permits Engineer, 800 Newtown Court, Lexington, KY 40511 (859.246.2355 / roberta.baker@ky.gov). Reviewed by Casey Smith, District 7 Planning / 859.246.2355 / casey.smith@ky.gov. This review was based on the information provided through e-Clearinghouse.

Andy Beshear
GOVERNOR

ENERGY AND ENVIRONMENT CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION
300 Sower Boulevard
Frankfort, Kentucky 40601
Phone: (502) 564-2150
Fax: 502-564-4245

Rebecca W. Goodman
SECRETARY

Anthony R. Hatton
COMMISSIONER

May 21, 2025

Charles H Martin
125 Lisle Industrial Ave Ste 180
Lexington, KY 40511

Re: East Hickman PS Expan & Rehab Ph 2
Jessamine County, Kentucky
Lexington West Hickman WWTP
Activity ID #: 2295, APE20250007
Receiving Treatment Plant KPDES #: KY0021504

Dear Mr. Martin:

We have reviewed the plans and specifications for the above referenced project. The plans include the construction of four new dry weather submersible pumps capable of 4480 gpm at 139 ft TDH, installation of two new grinders, and approximately 30-inch wetwell connector pipe. This is to advise that plans and specifications for the above referenced project are APPROVED with respect to sanitary features of design, as of this date with the requirements contained in the attached construction permit.

If we can be of any further assistance or should you wish to discuss this correspondence, please do not hesitate to contact Tony Butera at 502-782-5899.

Sincerely,

KM

Ken Melton, P.E.
Supervisor, Clean Water Engineering Section
Signed by: Ken Melton
Water Infrastructure Branch
Division of Water

KM / TB
Enclosures
c: Jessamine County Health Department
Hazen & Sawyer
Division of Plumbing
LFUCG

Sewer Line Construction
Lexington West Hickman WWTP
Facility Requirements

Activity ID No.:APE20250007

GACT0000000194 (East Hickman PS Expan and Rehab Ph 2) Four new dry weather submersible pumps capable of 4480 gpm at 139 ft TDH, installation of two new grinders, and approximately 30-inch wetwell connector pipe:

Submittal/Action Requirements:

Condition No.	Condition
S-1	When this project is completed, the applicant shall: submit written certification: Due 30 calendar days after Completion of Construction to the Division of Water that the facilities have been constructed and tested in accordance with the approved plans and specifications and the approval conditions. Such certification shall be signed by a registered professional engineer. Failure to certify may result in penalty assessment and/or future approvals being withheld. [401 KAR 5:005 Section 24(2)]

Narrative Requirements:

Condition No.	Condition
T-1	The plans and specifications submitted for the project are approved by the Department of Environmental Protection as to sanitary features, subject to the requirements contained within the permit. [401 KAR 5:005 Section 24(3)]
T-2	Authority to construct these sewers is hereby granted. This approval is issued under the provisions of KRS Chapter 224.10-100 (19) regulations promulgated pursuant thereto. Issuance of this permit does not relieve the permittee from the responsibility of obtaining any permits or licenses required by this cabinet and other state, federal, and local agencies. [401 KAR 5:005 Section 24(3)(c)2]
T-3	A permit to construct a facility shall be effective and valid for twenty-four (24) months upon issuance unless otherwise conditioned. If construction has not commenced within twenty-four (24) months following a permit's issuance, a new permit shall be obtained before construction may begin. [401 KAR 5:005 Section 24(1)]
T-4	The permit is issued to the applicant, and the permittee shall remain the responsible party for compliance with all applicable statutes and administrative regulations until a notarized applicable change in ownership certification is submitted and the transfer of ownership is acknowledged by the cabinet. [401 KAR 5:005 Section 28(1)]
T-5	The issuance of a permit by the cabinet does not convey any property rights of any kind or any exclusive privilege. [401 KAR 5:005 Section 24(5)]
T-6	There shall be no deviations from the plans and specifications submitted with the application or the conditions specified, unless authorized in writing by the cabinet. [401 KAR 5:005 Section 24(3)(b)1]

GACT0000000194 (East Hickman PS Expan and Rehab Ph 2) Four new dry weather submersible pumps capable of 4480 gpm at 139 ft TDH, installation of two new grinders, and approximately 30-inch wetwell connector pipe:

Narrative Requirements:

Condition No.	Condition
T-7	For subfluvial pipe crossings, a floodplain construction permit will not be required pursuant to KRS 151.250, if the following requirements of 401 KAR 4:050 Section 2 are met: 1) During the construction of the crossing, no material may be placed in the stream or in the flood plain of the stream to form construction pads, coffer dams, access roads, etc., unless prior approval has been obtained from the cabinet. 2) The trench shall be backfilled as closely as possible to the original contour. All excess material from construction of the trench shall be disposed of outside of the flood plain, unless the applicant has received prior approval from the cabinet to fill within the flood plain. 3) For subfluvial crossings of erodible channels, there shall be at least thirty (30) inches of clear cover above the top of the pipe or conduit at all points. 4) For subfluvial crossings of nonerodible channels, there shall be at least six (6) inches of clear cover above the top of the pipe or conduit at all points, and the pipe or conduit shall be encased on all sides by at least six (6) inches of concrete. 5) The weight of a pipe and its contents during normal operating conditions at all points must exceed that of an equal volume of water, or the applicant must provide the division with sufficient information to show that the pipe and joints have sufficient strength. Contact the Floodplain Management Section of the Surface Water Permits Branch at (502) 564-3410 with any question on these requirements. [KRS 151.250 & 401 KAR 4:060]
T-8	If any portion of the sewer project will be constructed in or along a stream or wetland, contact the Water Quality Certification Section, located within the Water Quality Branch, at 502-564-3410, to determine if a 401 certification will be required. [KRS 224.16-050]
T-9	Facilities shall be designed and constructed in accordance with the "Recommended Standards for Wastewater Facilities" of the Great Lakes-Upper Mississippi River Board of State Public Health and Environmental Managers, commonly referred to as "Ten States' Standards", 2014 edition. [401 KAR 5:005 Section 7(1)(a)]
T-10	Gravity sewer lines and force mains shall be designed and constructed to give mean velocities, when flowing full, of not less than two (2) feet per second. Velocity calculations shall incorporate roughness coefficients pursuant to 401 KAR 5:005 Section 8(8). [401 KAR 5:005 Section 8(8)]
T-11	An audible and visible alarm shall be provided at any proposed wastewater pump station. [Ten States (WW) 46]
T-12	All proposed pump station wetwells shall be sized such that, based on the average flow, the time to fill the wetwell from the pump-off elevation to the pump-on elevation shall not exceed thirty (30) minutes. [401 KAR 5:005 Section 8(16)]

GACT0000000194 (East Hickman PS Expan and Rehab Ph 2) Four new dry weather submersible pumps capable of 4480 gpm at 139 ft TDH, installation of two new grinders, and approximately 30-inch wetwell connector pipe:

Narrative Requirements:

Condition No.	Condition
T-13	All pump stations shall provide a minimum of two (2) hours of detention time, based on the average design flow, above the high level alarm elevation or provide an alternate source of power with wetwell storage providing sufficient time for the alternate power source to be activated. [401 KAR 5:005 Section 8(18)]
T-14	Pumps and force mains handling raw wastewater shall be capable of passing spheres of at least three (3) inches in diameter. Pump suction and discharge openings, as well as sewer force main pipe, shall be a minimum of four (4) inches in diameter. The above requirements do not apply to grinder pump stations or force mains directly connected to grinder pump stations. [Ten States (WW) 42.33, 49.1]

SECTION 00910
ADDENDA

(Insert Addenda as they are issued.)

END OF SECTION

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MAYOR LINDA GORTON

LEXINGTON

TODD SLATIN
DIRECTOR
CENTRAL PURCHASING

ADDENDUM #1

Bid Number: **#65-2025**

Date: May 23, 2025

Subject: **EAST HICKMAN PUMP STATION EXPANSION AND REHABILITATION DESIGN – PHASE 2 WASTEWATER SYSTEM IMPROVEMENTS**

Address inquiries to:
Brian Marcum
brianm@lexingtonky.gov
(859) 258-3325

TO ALL PROSPECTIVE SUBMITTERS:

Please be advised of the following clarifications to the above referenced Bid:

1. **SPECIFICATIONS**

   A. SPECIFICATION SECTION 00100 – ADVERISEMENT FOR BIDS

   The time for the mandatory pre-bid meeting has been changed.

   "A mandatory pre-Bid meeting will be held at **10:30 AM** local time, **May 28, 2025, at 125 Lisle Industrial Avenue, Lexington, KY 40511.**"

   A non-mandatory site visit to the East Hickman Pump Station will follow 30 mins after the conclusion of the pre-bid meeting.

2. **SPECIFICATIONS**

   B. SPECIFICATION SECTION 00890 – PERMITS

   See the attached approved KDOW Construction Permit for the project. Any statements and/or requirements stated within this permit are considered incidental to the Contract.

Todd Slatin, Director
Division of Central Purchasing

MAYOR LINDA GORTON

LEXINGTON

TODD SLATIN
DIRECTOR
CENTRAL PURCHASING

All other terms and conditions of the Bid and specifications are unchanged.
This letter should be signed, attached to and become a part of your Bid.

COMPANY NAME: _____

ADDRESS: _____

SIGNATURE OF BIDDER: _____

125 Lisle Industrial Ave., Suite 180, Lexington, KY 40511 / 859.425.2400 Phone / 859.254.7787 Fax / lexingtonky.gov

Andy Beshear
GOVERNOR

ENERGY AND ENVIRONMENT CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION
300 Sower Boulevard
Frankfort, Kentucky 40601
Phone: (502) 564-2150
Fax: 502-564-4245

Rebecca W. Goodman
SECRETARY

Anthony R. Hatton
COMMISSIONER

May 21, 2025

Charles H Martin
125 Lisle Industrial Ave Ste 180
Lexington, KY 40511

Re: East Hickman PS Expan & Rehab Ph 2
Jessamine County, Kentucky
Lexington West Hickman WWTP
Activity ID #: 2295, APE20250007
Receiving Treatment Plant KPDES #: KY0021504

Dear Mr. Martin:

We have reviewed the plans and specifications for the above referenced project. The plans include the construction of four new dry weather submersible pumps capable of 4480 gpm at 139 ft TDH, installation of two new grinders, and approximately 30-inch wetwell connector pipe. This is to advise that plans and specifications for the above referenced project are APPROVED with respect to sanitary features of design, as of this date with the requirements contained in the attached construction permit.

If we can be of any further assistance or should you wish to discuss this correspondence, please do not hesitate to contact Tony Butera at 502-782-5899.

Sincerely,

KM

Ken Melton, P.E.
Supervisor, Clean Water Engineering Section
Signed by: Ken Melton
Water Infrastructure Branch
Division of Water

KM / TB
Enclosures
c: Jessamine County Health Department
Hazen & Sawyer
Division of Plumbing
LFUCG

Sewer Line Construction
Lexington West Hickman WWTP
Facility Requirements

Activity ID No.:APE20250007

GACT0000000194 (East Hickman PS Expan and Rehab Ph 2) Four new dry weather submersible pumps capable of 4480 gpm at 139 ft TDH, installation of two new grinders, and approximately 30-inch wetwell connector pipe:

Submittal/Action Requirements:

Condition No.	Condition
S-1	When this project is completed, the applicant shall: submit written certification: Due 30 calendar days after Completion of Construction to the Division of Water that the facilities have been constructed and tested in accordance with the approved plans and specifications and the approval conditions. Such certification shall be signed by a registered professional engineer. Failure to certify may result in penalty assessment and/or future approvals being withheld. [401 KAR 5:005 Section 24(2)]

Narrative Requirements:

Condition No.	Condition
T-1	The plans and specifications submitted for the project are approved by the Department of Environmental Protection as to sanitary features, subject to the requirements contained within the permit. [401 KAR 5:005 Section 24(3)]
T-2	Authority to construct these sewers is hereby granted. This approval is issued under the provisions of KRS Chapter 224.10-100 (19) regulations promulgated pursuant thereto. Issuance of this permit does not relieve the permittee from the responsibility of obtaining any permits or licenses required by this cabinet and other state, federal, and local agencies. [401 KAR 5:005 Section 24(3)(c)2]
T-3	A permit to construct a facility shall be effective and valid for twenty-four (24) months upon issuance unless otherwise conditioned. If construction has not commenced within twenty-four (24) months following a permit's issuance, a new permit shall be obtained before construction may begin. [401 KAR 5:005 Section 24(1)]
T-4	The permit is issued to the applicant, and the permittee shall remain the responsible party for compliance with all applicable statutes and administrative regulations until a notarized applicable change in ownership certification is submitted and the transfer of ownership is acknowledged by the cabinet. [401 KAR 5:005 Section 28(1)]
T-5	The issuance of a permit by the cabinet does not convey any property rights of any kind or any exclusive privilege. [401 KAR 5:005 Section 24(5)]
T-6	There shall be no deviations from the plans and specifications submitted with the application or the conditions specified, unless authorized in writing by the cabinet. [401 KAR 5:005 Section 24(3)(b)1]

GACT0000000194 (East Hickman PS Expan and Rehab Ph 2) Four new dry weather submersible pumps capable of 4480 gpm at 139 ft TDH, installation of two new grinders, and approximately 30-inch wetwell connector pipe:

Narrative Requirements:

Condition No.	Condition
T-7	For subfluvial pipe crossings, a floodplain construction permit will not be required pursuant to KRS 151.250, if the following requirements of 401 KAR 4:050 Section 2 are met: 1) During the construction of the crossing, no material may be placed in the stream or in the flood plain of the stream to form construction pads, coffer dams, access roads, etc., unless prior approval has been obtained from the cabinet. 2) The trench shall be backfilled as closely as possible to the original contour. All excess material from construction of the trench shall be disposed of outside of the flood plain, unless the applicant has received prior approval from the cabinet to fill within the flood plain. 3) For subfluvial crossings of erodible channels, there shall be at least thirty (30) inches of clear cover above the top of the pipe or conduit at all points. 4) For subfluvial crossings of nonerodible channels, there shall be at least six (6) inches of clear cover above the top of the pipe or conduit at all points, and the pipe or conduit shall be encased on all sides by at least six (6) inches of concrete. 5) The weight of a pipe and its contents during normal operating conditions at all points must exceed that of an equal volume of water, or the applicant must provide the division with sufficient information to show that the pipe and joints have sufficient strength. Contact the Floodplain Management Section of the Surface Water Permits Branch at (502) 564-3410 with any question on these requirements. [KRS 151.250 & 401 KAR 4:060]
T-8	If any portion of the sewer project will be constructed in or along a stream or wetland, contact the Water Quality Certification Section, located within the Water Quality Branch, at 502-564-3410, to determine if a 401 certification will be required. [KRS 224.16-050]
T-9	Facilities shall be designed and constructed in accordance with the "Recommended Standards for Wastewater Facilities" of the Great Lakes-Upper Mississippi River Board of State Public Health and Environmental Managers, commonly referred to as "Ten States' Standards", 2014 edition. [401 KAR 5:005 Section 7(1)(a)]
T-10	Gravity sewer lines and force mains shall be designed and constructed to give mean velocities, when flowing full, of not less than two (2) feet per second. Velocity calculations shall incorporate roughness coefficients pursuant to 401 KAR 5:005 Section 8(8). [401 KAR 5:005 Section 8(8)]
T-11	An audible and visible alarm shall be provided at any proposed wastewater pump station. [Ten States (WW) 46]
T-12	All proposed pump station wetwells shall be sized such that, based on the average flow, the time to fill the wetwell from the pump-off elevation to the pump-on elevation shall not exceed thirty (30) minutes. [401 KAR 5:005 Section 8(16)]

GACT0000000194 (East Hickman PS Expan and Rehab Ph 2) Four new dry weather submersible pumps capable of 4480 gpm at 139 ft TDH, installation of two new grinders, and approximately 30-inch wetwell connector pipe:

Narrative Requirements:

Condition No.	Condition
T-13	All pump stations shall provide a minimum of two (2) hours of detention time, based on the average design flow, above the high level alarm elevation or provide an alternate source of power with wetwell storage providing sufficient time for the alternate power source to be activated. [401 KAR 5:005 Section 8(18)]
T-14	Pumps and force mains handling raw wastewater shall be capable of passing spheres of at least three (3) inches in diameter. Pump suction and discharge openings, as well as sewer force main pipe, shall be a minimum of four (4) inches in diameter. The above requirements do not apply to grinder pump stations or force mains directly connected to grinder pump stations. [Ten States (WW) 42.33, 49.1]

MAYOR LINDA GORTON

LEXINGTON

TODD SLATIN
DIRECTOR
CENTRAL PURCHASING

ADDENDUM #2

Bid Number: **#65-2025**

Date: June 2, 2025

Subject: East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2 Wastewater System Improvements

Address inquiries to:
Brian Marcum
brianm@lexingtonky.gov
(859) 258-3325

TO ALL PROSPECTIVE SUBMITTERS:

Please be advised of the following clarifications to the above referenced Bid:

1. BID QUESTIONS

	Questions	Answers
1.	There is a PLC control panel on this project. The specifications do not identify if the owner is responsible for the programming of the panel or if the programming is to be part of the bid. Please clarify.	There are modifications to an existing PLC panel, PLC-EHPS, on this project as indicated on the contract documents. PLC, OIT and HMI programming modification shall be included within the scope of this contract. Refer to network changes, I/O changes, sheet keynotes on the drawings as well as control descriptions listed as **"Revised"** under specification section 17480 for additional details.
2.	Over the past year, LFUCG has only accepted programming bids from (3) pre-approved systems integrators: Rawdon Myers, Inc., LOVO and AES. Will that be in place on this project bid?	The following three (3) System Integrators are LFUCG approved for this project work: 1. Rawdon Myers Inc. 2. LOVO Systems 3. AEES
3.	Per Section 11310, Article 1.03.A., Xylem/Flygt, KSB, and Grundfos are approved manufacturers of the Solids Handling Submersible Sewage Pumps. Per Section 00410 (Bid Form), Page 6, Xylem/Flygt is not listed as an approved manufacturer. Please verify the status of Xylem/Flygt.	Xylem/Flygt are listed in specification 11310-1.03 and will be included on the Equipment Manufacturer list as well. See the updated Bid Form 00410 included within this addendum.

4.	Will attendance at the mandatory pre-bid be required to bid the project? If so, will there be an opportunity to meet the engineer and LFUCG personnel on a separate occasion considering the late change to the time of the meeting?	Yes, attendance at the mandatory prebid was required to bid the project and no additional opportunities will be given.
5.	Can remaining wet weather pumps handle the flow into the station?	No, only the duty (dry weather) pumps being replaced can convey flow out of the pump station to the West Hickman WWTP. The wet weather pumps only pump to the wet weather storage tank (WWST) and the WWST drains back into the dry weather wet well.
6.	Do we have any photos or As-Builts of how much was excavated and what the backfill was around the pump station?	Please see the four (4) photos included in this addendum. We have presumed the connector pipe will be in rock.
7.	What is the flow rate of the pumps station?	Max flow of the station is 12,500 gpm. This is the design capacity of existing 3 pumps operating in parallel.

2. DRAWINGS

A. None.

3. SPECIFICATIONS

A. Specification Section 00410 – Bid Schedule
   a. In Specification Section 00410 under Article 1.04 Bid Schedule in the Equipment Manufacture List table, Xylem/Flygt has been added to the Base Bid Equipment Manufacturer column for Pumps.

MAYOR LINDA GORTON

LEXINGTON

TODD SLATIN
DIRECTOR
CENTRAL PURCHASING

4. CLARIFICATIONS

A. Prebid Meeting Summary and Sign In Sheet

B. MWDBE Participation GFE Outreach Plan Forms

C. East Hickman Pump Station – Phase 1
   a. See four (4) Daily Reports from the Phase 1 construction showing excavation and backfilling of the site.

Todd Slatin, Director
Division of Central Purchasing

All other terms and conditions of the Bid and specifications are unchanged.
This letter should be signed, attached to and become a part of your Bid.

COMPANY NAME: _____

ADDRESS: _____

SIGNATURE OF BIDDER: _____

SECTION 00410

BID FORM - KIA

EAST HICKMAN PUMP STATION EXPANSION AND REHABILITATION DESIGN – PHASE 2 WASTEWATER SYSTEM IMPROVEMENTS

Division of Water Quality
Lexington-Fayette Urban County Government

LFUCG Bid No. 65-2025

1.01 GENERAL

Place: Lexington, Kentucky Date: June 12, 2025

The following Bid Form shall be followed exactly in submitting a Bid for this Work.

This Bid Form Submitted by _____

_____
(Name and Address of Bidder)

(Hereinafter called "Bidder"), organized and existing under the laws of the State of _____,

doing business as _____
"a corporation," "a partnership", or an "individual" as applicable

To: Lexington-Fayette Urban County Government
(Hereinafter called "Owner"
Office of the Director of Central Purchasing
200 East Main Street, Room 338
Lexington, KY 40507

The Bidder, in compliance with your Advertisement for Bids for the **East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2 Wastewater System Improvements**; Lexington, Kentucky, having examined the Contract Documents including the Plans and Specifications with related documents, having examined the site for proposed Work, and being familiar with all of the conditions and any and all addendums surrounding the construction of the proposed Project, including the availability of materials and labor, hereby proposes to furnish all labor, materials, and supplies, and to construct the Project in accordance with the Contract Documents, within the time set forth therein, and at the [lump sum prices] stated hereinafter. These prices are to cover all expenses incurred in performing the Work required under the Contract Documents, of which this Bid is a part.

The Bidder hereby agrees to commence Work under this Contract on a date to be specified in a written "Notice to Proceed" of the Owner and to substantially complete the Project within **365** days, consecutive calendar days. Bidder further agrees to pay liquidated damages, the sum of Three Thousand Dollars and Zero Cents ($3,000.00) for each consecutive day thereafter. If the Contractor's delay or failure to complete the project within the allowable Contract time, the Contractor is responsible for damages caused by loss of project grant funding. See Specification Section 01170 – Special Conditions for additional information.

The Bidder hereby acknowledges receipt of the following addenda:

Addendum No. ____ Date _____; Addendum No. ____ Date _____

Addendum No. ____ Date _____; Addendum No. ____ Date _____

Addendum No. ____ Date _____; Addendum No. ____ Date _____

Addendum No. ____ Date _____; Addendum No. ____ Date _____

Insert above the number and the date of any Addendum issued and received. If none has been issued and received, the word "NONE" should be inserted.

1.02 LEGAL STATUS OF BIDDER

A. *A corporation duly organized and doing business under the laws of the State of _____, for whom _____, bearing the official title of _____, whose signature is affixed to this Bid is duly authorized to execute contracts.

B. *A Partnership, all of the members of which, with addresses are: (Designate general partners as such)

_____

_____

_____

_____

C. *An individual, whose signature is affixed to this Bid. (Print name)

_____

_____

* The Bidder shall fill out the appropriate form and strike out the other two.

1.03 BIDDERS AFFIDAVIT

Comes the Affiant, _____, and after being first duly sworn, states under penalty of perjury as follows:

A. His/her name is _____ and he/she is the individual submitting the Bid or is the authorized representative of _____, the entity submitting the Bid (hereinafter referred to as "Bidder").

B. Bidder will pay all taxes and fees, which are owed to the Lexington-Fayette Urban County Government at the time the Bid is submitted, prior to award of the Agreement and will maintain a "current" status in regard to those taxes and fees during the life of the Agreement.

C. Bidder will obtain a Lexington-Fayette Urban County Government business license, if applicable, prior to award of the Agreement.

D. Bidder has authorized the Division of Central Purchasing to verify the above-mentioned information with the Division of Revenue and to disclose to the Urban County Council that taxes and/or fees are delinquent or that a business license has not been obtained.

E. Bidder has not knowingly violated any provision of the campaign finance laws of the Commonwealth of Kentucky within the past five (5) years and the award of an Agreement to the Bidder will not violate any provision of the campaign finance laws of the Commonwealth.

F. Bidder has not knowingly violated any provision of Chapter 25 of the Lexington-Fayette Urban County Government Code of Ordinances, known as the "Ethics Act."

G. Bidder acknowledges that "knowingly" for purposes of this Affidavit means, with respect to conduct or to circumstances described by a statute or ordinance defining an offense, that a person is aware or should have been aware that his/her conduct is of that nature or that the circumstance exists.

Further, Affiant sayeth naught.

_____
Affiant Signature

STATE OF _____

COUNTY OF _____

The foregoing instrument was subscribed, sworn to and acknowledged before me by _____ on this the ____ day of _____, 20___.

_____ My commission expires: _____

NOTARY PUBLIC, STATE AT LARGE

1.04 BID SCHEDULE

A. The Bidder agrees to perform all the Work described in the Specifications and shown on the Plans for the following proposed lump sum and/or unit prices, if applicable, which shall include the furnishing of all labor, materials, supplies, equipment and/or vehicle usage, services, all items of cost, overhead, taxes (federal, state, local), and profit for the Contractor and any Subcontractor involved, within the time set forth herein. If unit prices are applicable, Bidder must make the extensions and additions showing the total amount of Bid. In all cases of discrepancies or math errors the amount written in for the unit price of an item shall govern.

B. If a discrepancy between the unit price and the item total exists, the unit price prevails except:

   If the unit price is illegible, omitted, or the same as the item total, item total prevails and the unit price is the quotient of the item total and the quantity.

   If the unit price and the item total are illegible or are omitted, the Bid may be determined nonresponsive. If a lump sum total price is illegible or is omitted, the Bid may be determined nonresponsive.

C. Preliminary indication all areas where potential ground modification strategies are anticipated or will be further explored by the Bidder upon award of the Contract.

D. For a lump sum based bid, the item total is the bid amount the Owner uses for bid comparison.

E. For a unit price based bid, the sum of the item totals is the bid amount the Owner uses for bid comparison.

F. The Bidder must indicate the base bid pipe material by circling the selected pipe material at the time of the submission of the Bid.

G. The Owner's decision on the bid amount is final.

BID SCHEDULE A – BASE BID

Item	Description	Qty	Unit	Unit Price	Item Price
1	Mobilization	1	LS		
2	Bonds and Insurance	1	LS		
3	General Requirements	1	LS		
4	Demobilization	1	LS		
5	Erosion and Sediment Control and Conformance with SWPPP	1	LS		
6	East Hickman Pump Station Phase 2 demolition, modifications, pump replacement, screen removal, grinder pump installation, crane hoist, wet well connector piping, operations and controls and all other work shown on the Contract Documents	1	LS		
TOTAL BID (Items 1 thru 6)					

TOTAL BID AMOUNT:

_____

_____**Dollars ($ _____)**

EQUIPMENT MANUFACTURER LIST

See completion requirement Notes 1 listed at the end of this section.

#	Equipment Item	Specification Section	Base Bid Equipment Manufacturer (circle one)
1	Pumps	11130	KSB Grundfos *Xylem/Flygt*[Add02]
2	Open Channel Grinders	11435	JWC Environmental, Inc. (Channel Monster Flex)
7	Level Transmitters	17749	MJK (Pressure)
8	SCADA PLC	17120	Allen Bradley ControlLogix
11	Disconnect Switches	16440	Eaton Schneider (Square D) General Electric Company Siemens
18	Custom Control Panels		ADGO, Inc.

Notes:

1. *Where more than one Base Bid equipment manufacturer is listed above, the Bidder has the option of including any of the listed manufacturers in the Base Bid.* ***The bidder must indicate the Base Bid equipment included in the Bid by circling the selected manufacturer at the time of the submission of the Bid.*** *The design has been completed using the first listed Base Bid equipment manufacturer (with exception on item No.1 pumps where both manufacturers were considered). Should the Bidder circle the second, third, or fourth Base Bid equipment, the Bidder, at no additional cost to the Owner, shall make any changes to structure, piping controls, electrical, instrumentation, architectural, mechanical, etc. that may be necessary to accommodate this equipment.*

Respectfully Submitted,

FIRM: _____

ADDRESS: _____

CITY/STATE/ZIP: _____

DATE: _____

BY: _____
(must be original signature)

TITLE: _____

PHONE: _____ FAX: _____
(area code, number & extension)

EMAIL ADDRESS: _____

OFFICIAL ADDRESS AND PHONE:

_____

_____

_____ (Seal if Bid is by Corporation)

By signing this form, you agree to all the terms and associated forms.

1.05 STATEMENT OF BIDDER'S QUALIFICATIONS

The following statement of the Bidder's qualifications is required to be filled in, executed, and submitted with the Bid:

A. Name of Bidder: _____

B. Permanent Place of Business: _____

C. When Organized: _____

D. Where Incorporated: _____

E. Financial Condition:

If specifically requested by the Owner, the apparent low Bidder is required to submit its latest three (3) years audited financial statements to the Owner's Division of Central Purchasing within seven (7) calendar days following the Bid opening.

F. In the event the Agreement is awarded to the undersigned, Performance, Payment, Erosion and Sediment Control, and Warranty bonds will be furnished by:

_____ (Surety)

Signed: _____ (Representative of Surety)

G. The following is a list of similar projects performed by the Bidder: (Attach separate sheet if necessary).

NAME	LOCATION	CONTRACT SUM

H. The Bidder has now under contract and bonded the following projects:

NAME	LOCATION	CONTRACT SUM

I. List Key Bidder Personnel who will work on this Project.

NAME	POSITION DESCRIPTION	NO. OF YEARS WITH BIDDER

J. MWDBE Participation on current bonded projects under contract:

SUBCONTRACTORS (LIST)	PROJECT (SPECIFIC TYPE)	MWDBE	% of WORK

(USE ADDITIONAL SHEETS IF NECESSARY)

K. We acknowledge that, if we are the apparent low Bidder, we may be required to submit to the Owner within seven (7) calendar days following the Bid Opening, a sworn statement regarding all office management and field management personnel. Additionally, if requested by the Owner, we will within seven (7) days following the request submit audited financial statements and loss history for insurance claims for the three (3) most recent years (or a lesser period if stipulated by the Owner)

1.06 LIST OF PROPOSED SUBCONTRACTORS

The following list of proposed subcontractors is required by the Owner to be executed, completed and submitted with the Bid Form. All subcontractors are subject to approval of the Lexington-Fayette Urban County Government. Failure to submit this list completely filled out may be cause for rejection of Bid.

BRANCH OF WORK** (List each major item)	SUBCONTRACTOR	MWDBE (yes/no)	% of WORK
1. _____	Name: _____	_____	_____
	Address: _____		
	_____		
2. _____	Name: _____	_____	_____
	Address: _____		
	_____		
3. _____	Name: _____	_____	_____
	Address: _____		
	_____		
4. _____	Name: _____	_____	_____
	Address: _____		
	_____		
5. _____	Name: _____	_____	_____
	Address: _____		
	_____		
6. _____	Name: _____	_____	_____
	Address: _____		
	_____		

** Such as: Grading, asphalt paving, concrete, seeding and protection, construction staking, etc.

1.07 AUTHENTICATION OF BID AND STATEMENT OF NON-COLLUSION AND NON-CONFLICT OF INTEREST

I hereby swear (or affirm) under the penalty for false swearing:

A. That I am the Bidder (if the Bidder is an individual), a partner of the Bidder (if the Bidder is a partnership), or an officer or employee of the Bidding corporation having authority to sign on its behalf (if the Bidder is a corporation);

B. That the attached Bid has been arrived at by the Bidder independently, and has been submitted without collusion with, and without any agreement, understanding or planned common course of action, with any other contractor, vendor of materials, supplies, equipment or services described in the Advertisement for Bid, designed to limit independent bidding or competition;

C. That the contents of the Bid or Bids have not been communicated by the Bidder or its employees or agents to any person not an employee or agent of the Bidder or its surety on any bond furnished, with the Bid or Bids, and will not be communicated to any such person, prior to the official opening of the Bid or Bids;

D. That the Bidder is legally entitled to enter into the contracts with the Lexington-Fayette Urban County Government, and is not in violation of any prohibited conflict of interest;

E. (Applicable to corporation only) That as a foreign corporation, we are registered with the Secretary of State, Commonwealth of Kentucky, and authorized to do business in the State_____ or, that as a domestic corporation, we are in good standing with the Secretary of State, Commonwealth of Kentucky_____. [Check the statement applicable.]

F. This offer is for ninety (90) calendar days from the date this Bid is opened. In submitting the above, it is expressly agreed that, upon proper acceptance by the Lexington-Fayette Urban County Government of any or all items Bid above, an Agreement shall thereby be created with respect to the items accepted.

G. That I have fully informed myself regarding the accuracy of the statements made in this statement.

H. That I certify that Subcontractors have not and will not be awarded to any firm(s) that have been debarred from noncompliance with the Federal Labor Standards, Title VI of the Civil Rights Act of 1964 As Amended, Executive Order 11246 As Amended or any other Federal Law.

_____ _____

Company Date Representative

1.08 STATEMENT OF EXPERIENCE

NAME OF INDIVIDUAL: _____

POSITION/TITLE: _____

STATEMENT OF EXPERIENCE: _____

_____

NAME OF INDIVIDUAL: _____

POSITION/TITLE: _____

STATEMENT OF EXPERIENCE: _____

_____

NAME OF INDIVIDUAL: _____

POSITION/TITLE: _____

STATEMENT OF EXPERIENCE: _____

_____

NAME OF INDIVIDUAL: _____

POSITION/TITLE: _____

STATEMENT OF EXPERIENCE: _____

_____

NAME OF INDIVIDUAL: _____

POSITION/TITLE: _____

STATEMENT OF EXPERIENCE: _____

_____

* Include all officers, office management, Affirmative Action officials, and field management personnel. Attach separate sheets if necessary.

1.09 EQUAL OPPORTUNITY AGREEMENT

The Law

* Title VII of the Civil Rights Act of 1964 (amended 1972) states that it is unlawful for an employer to discriminate in employment because of race, color, religion, sex, age (40-70 years) or national origin.

* Executive Order No. 11246 on Nondiscrimination under Federal contract prohibits employment discrimination by contractor and subcontractor doing business with the Federal Government or recipients of Federal funds. This order was later amended by Executive Order No. 11375 to prohibit discrimination on the basis of sex.

* Section 503 of the Rehabilitation Act of 1973 States:

  The Contractor will not discriminate against any employee or applicant for employment because of physical or mental handicap.

* Section 2012 of the Vietnam Era Veterans Readjustment Act of 1973 requires Affirmative Action on behalf of disabled veterans and veterans of the Vietnam Era by contractors having Federal Contracts.

* Section 206 (A) of Executive Order 12086, Consolidation of Contract Compliance Functions for Equal Employment Opportunity, states:

  The Secretary of Labor may investigate the employment practices of any Government contractor or sub-contractor to determine whether or not the contractual provisions specified in Section 202 of this order have been violated.

The Lexington-Fayette Urban County Government practices Equal Opportunity in recruiting, hiring and promoting. It is the Government's intent to affirmatively provide employment opportunities for those individuals who have previously not been allowed to enter into the mainstream of society. Because of its importance to the local Government, this policy carries the full endorsement of the Mayor, Commissioners, Directors, and all supervisory personnel. In following this commitment to Equal Employment Opportunity and because the Government is the benefactor of the Federal funds, it is both against the Urban County Government policy and illegal for the Government to let contracts to companies which knowingly or unknowingly practice discrimination in their employment practices. Violation of the above mentioned ordinances may cause an Agreement to be canceled and the contractor may be declared ineligible for future consideration.

Please sign this statement in the appropriate space acknowledging that you have read and understand the provisions contained herein. Return this document as part of your application packet.

Bidders

I/We agree to comply with the Civil Rights Laws listed above that govern employment rights of minorities, women, Vietnam veterans, handicapped, and aged persons.

_____ _____

Signature Name of Business

The Entity (regardless of whether construction Contractor, non-construction Contractor or supplier) agrees to provide equal opportunity in employment for all qualified persons, to prohibit discrimination in employment because of race, color, creed, national origin, sex or age, and to promote equal employment through a positive, continuing program from itself and each of its sub-contracting agents. This program of equal employment opportunity shall apply to every aspect of its employment policies and practices.

The Kentucky Equal Employment Opportunity Act of 1978 (KRS 45.560-45.640) requires that any county, city, town, school district, water district, hospital district, or other political subdivision of the state shall include in directly or indirectly publicly funded contracts for supplies, materials, services, or equipment hereinafter entered into the following provisions:

During the performance of this contract, the contractor agrees as follows:

(1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, age or national origin;

(2) The contractor will state in all solicitations or advertisements for employees placed by or on behalf of the contractors that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, age or national origin;

(3) The contractor will post notices in conspicuous places, available to employees and applicants for employment, setting forth the provisions of the non-discrimination clauses required by this section; and

(4) The contractor will send a notice to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding advising the labor union or workers' representative of the contractor's commitments under the nondiscrimination clauses.

The Act further provides:

KRS 45.610. Hiring minorities - Information required

(1) For the length of the contract, each contractor shall hire minorities from other sources within the drawing area, should the union with which he has collective bargaining agreements be unwilling to supply sufficient minorities to satisfy the agreed upon goals and timetable.

(2) Each contractor shall, for the length of the contract, furnish such information as required by KRS 45.560 to KRS 45.640 and by such rules, regulations and orders issued pursuant thereto and will permit access to all books and records pertaining to his employment practices and work sites by the contracting agency and the department for purposes of investigation to ascertain compliance with KRS 45.560 to 45.640 and such rules, regulations and orders issued pursuant thereto.

KRS 45.620. Action against contractor - Hiring of minority contractor or subcontractor

(1) If any contractor is found by the department to have engaged in an unlawful practice under this chapter during the course of performing under a contract or subcontract covered under KRS 45.560 to 45.640, the department shall so certify to the contracting

agency and such certification shall be binding upon the contracting agency unless it is reversed in the course of judicial review.

(2) If the contractor is found to have committed an unlawful practice under KRS 45.560 to 45.640, the contracting agency may cancel or terminate the contract, conditioned upon a program for future compliance approved by the contracting agency and the department. The contracting agency may declare such a contractor ineligible to bid on further contracts with that agency until such time as the contractor complies in full with the requirements of KRS 45.560 to 45.640.

(3) The equal employment provisions of KRS 45.560 to 45.640 may be met in part by a contractor by subcontracting to a minority contractor or subcontractor. For the provisions of KRS 45.560 to 45.640, a minority contractor or subcontractor shall mean a business that is owned and controlled by one or more persons disadvantaged by racial or ethnic circumstances.

KRS 45.630 Termination of existing employee not required, when

Any provision of KRS 45.560 to 45.640 notwithstanding, no contractor shall be required to terminate an existing employee upon proof that that employee was employed prior to the date of the contract.

KRS 45.640 Minimum skills

Nothing in KRS 45.560 to 45.640 shall require a contractor to hire anyone who fails to demonstrate the minimum skills required to perform a particular job.

In the case of an Agreement exceeding $250,000, the Contractor will be required within seven (7) days following the Bid Opening to furnish evidence that its work-force in Kentucky is representative of the available work-force in the area from which it draws employees, or to supply an Affirmative Action plan which will achieve such representation during the life of the Contract.

1.10 LFUCG MWDBE PARTICIPATION FORM

LEXINGTON

LFUCG Bid/RFP/Quote Reference No._____

The MWDBE and/or Veteran subcontractors listed have agreed to participate on this Bid/RFP/Quote. If any substitution is made or the total value of the Work is changed prior to or after the job is in progress, it is understood that those substitutions must be submitted to the Division of Procurement for approval immediately. **Failure to submit a completed form may cause rejection of the bid.**

MWBE Company, Name, Address, Phone, Email	DBE / MBE WBE / VOSB SDVOSB	Work to be Performed	Total Dollar Value of the Work	% Value of Total Contract
1.				
2.				
3.				
4.				

The undersigned company representative submits the above list of MDWBE firms to be used in accomplishing the work contained in this Bid/RFP/Quote. Any misrepresentation may result in the termination of the Contract and/or be subject to applicable Federal and State laws concerning false statements and false claims.

_____ _____

Company Company Representative

_____ _____

Date Title

1.11 LFUCG MWDBE SUBSTITUTION FORM

LFUCG Bid/RFP/Quote Reference No._____

The substituted MWDBE and/or Veteran subcontractors listed below have agreed to participate on this Bid/RFP/Quote. These substitutions were made prior to or after the job was in progress. These substitutions were made for reasons stated below and are now being submitted to the Division of Procurement for approval. By the authorized signature of a representative of our company, we understand that this information will be entered into our file for this project. **Note: Form required if a subcontractor is being substituted on a contract.**

SUBSTITUTED DBE/MBE/WBE/VOSB Company Name, Address, Phone, Email	DBE/MBE/WBE/ VOSB/SDVOSB Formally Contracted/ Name, Address, Phone, Email	Work to Be Performed	Reason for the Substitution	Total Dollar Value of the Work	% Value of Total Contract

The undersigned acknowledges that any misrepresentation may result in termination of the Contract and/or be subject to applicable Federal and State laws concerning false statements and false claims.

Company	Company Representative
Date	Title

ATTACHMENT A – SMALL AND DISADVANTAGED, MINORITY-, WOMEN-, AND VETERAN-OWNED BUSINESS OUTREACH PLAN

Proposer Name: _____ **Date:** _____

Project Name: _____ **Project Number:** _____

Contact Name: _____ **Telephone:** _____

Email: _____

The mission of the Minority Business Enterprise Program is to facilitate the full participation of disadvantaged businesses, minority-, women-, veteran-, and service-disabled veteran-owned businesses in the procurement process and to promote economic inclusion as a business imperative essential to the long -term economic viability of Lexington-Fayette Urban County Government.

To that end, small and disadvantaged businesses, including minority-, woman-, veteran-, and service-disabled veteran-owned businesses, must have an equal opportunity to be utilized in the performance of contracts with public funds spent from certain discretionary agreements. By submitting its offer, Bidder/Proposer certifies that it has taken, and if there are further opportunities will take, reasonable steps to ensure that small and disadvantaged businesses, including minority-, woman-, veteran-, and service-disabled veteran-owned businesses, are provided an equal opportunity to compete for and participate in the performance of any subcontracts resulting from this procurement.

The information submitted in response to this clause will not be considered in any scored evaluation. Failure to submit this form may cause the bid or proposal to be rejected.

Is the Bidder/ Proposer a certified firm? Yes ☐ No ☐

If yes, indicate all certification type(s):

DBE ☐ MBE ☐ WBE ☐ SBE ☐ VOSB/SDVOSB ☐

and supply a copy of the certificate and/or certification letter if not currently listed on the city's Minority Business Enterprise Program's (MBEP) certified list.

1. Include a list of firms that Bidder/ Proposer has had a contractual relationship with within the last two years that are minority-owned, woman-owned, veteran-owned or small businesses, regardless of their certification status.

Click or tap here to enter text.

2. Does Bidder/Proposer foresee any subcontracting opportunities for this procurement?

Yes ☐ No ☐

If no, please explain why in the field below. Do not complete the rest of this form and submit this first page with your bid and/or proposal. Click or tap here to enter text.

ATTACHMENT A – SMALL and DISADVANTAGED, MINORITY-, WOMEN-, and VETERAN-OWNED BUSINESS OUTREACH PLAN

If yes, please complete the following pages and submit all pages with your bid and/or proposal.

Describe the steps Bidder/Proposer took to solicit small and disadvantaged businesses, including MBEs, WBEs, VOSBs, and SDVOSBs, for subcontracting opportunities for this procurement.

3. Check the good faith and outreach efforts the Bidder/Proposer used to encourage the participation of small and disadvantaged businesses including, MBEs, WBEs, VOSBs and SDVOSBs:

☐ Bidder placed advertisements in search of prospective small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs for the solicitation.

☐ Bidder attended LFUCG Procurement Economic Inclusion Outreach event(s) within the past year.

☐ Bidder attended pre-bid and/or pre-proposal meetings for this solicitation.

☐ Bidder sponsored an Economic Inclusion Outreach event.

☐ Bidder requested a list of certified small, DBE, MBE, WBE, VOSB and/or SDVOSB subcontractors or suppliers from LFUCG.

☐ Bidder contacted organizations that work with small, DBE, MBE, WBE, VOSB and/or SDVOSB companies.

☐ Bidder sent written notices to certified small, DBE, MBE, WBE, VOSB and SDVOSB businesses.

☐ Bidder followed up to initial solicitations with interested small, DBE, MBE, WBE, VOSB and/or SDVOSB.

☐ Bidder provided small, DBE, MBE, WBE, VOSB and/or SDVOSB businesses interested in performing the solicited work with prompt access to the plans, specifications, scope of work, and requirements of the solicitation.

☐ Bidder made efforts to segment portions of the work to be performed by small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs, including dividing sub-bid/partnership opportunities into economically feasible units/parcels, to facilitate participation.

☐ Bidder negotiated in good faith with interested small, DBE, MBE, WBE, VOSB and/or SDVOSB businesses.

☐ Bidder provided adequate rationale for rejecting any small business', DBEs, MBEs, WBEs, VOSBs or SDVOSBs for lack of qualifications.

☐ Bidder offered assistance in obtaining bonding, insurance, financial, equipment, or other resources to small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs, in an effort to assist them in meeting project requirements.

☐ Bidder made efforts to expand the search for small businesses, DBEs MBEs, WBEs, VOSBs and/or SDVOSBs beyond the usual geographic boundaries.

☐ Bidder made other reasonable efforts to include small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs participation.

4. Bidder/Proposer must include documentation, including the date each effort was made, the medium through which each effort was made, and the outcome of each effort with this form, regardless of the level of small, DBE, MBE, WBE, VOSB and/or SDVOSB participation. Examples of required documentation include copies of email communications, copies of newspaper advertisements, or copies of quotations received from interested small businesses, DBEs, MBEs, WBEs, VOSBs or SDVOSBs.

Click or tap here to enter text.

For detailed information regarding outreach efforts that satisfy the MBE Program's requirements, please see "Documentation Required for Good Faith Efforts and Outreach Plans" page.

Note: The Bidder/Proposer must be willing to report the identity of each subcontractor and the value of each subcontract to MBEP if awarded a contract from this procurement.

Failure to submit the documentation requested may be cause for rejection of the bid. Bidders may include any other documentation deemed relevant to this requirement, which is subject to review by the MBE Liaison. Documentation of Good Faith and Outreach Efforts must be submitted with the bid, regardless of the proposed level of SBEs, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs participation in the procurement. If the Good Faith and Outreach Effort Form and associated documentation is not submitted with the bid response, the bid may be rejected.

The undersigned acknowledges that all information is accurate. Any misrepresentations may result in termination of the contract and/or be subject to applicable Federal and State laws concerning false statements and claims.

Company	**Company Representative**
Date	**Title**

1.12 EQUAL EMPLOYMENT OPPORTUNITY AFFIRMATIVE ACTION POLICY

It is the policy of _____
(Name of Bidder)

to assure that all applicants for employment and all employees are treated on a fair and equitable basis without regard to their race, religion, sex, color, handicap, natural origin or age.

Such action shall include employment, promotion, demotion, recruitment or recruitment advertising, layoff or termination, rates of pay and other forms of compensation, and selection for training, whether apprenticeship and/or on-the-job-training.

Furthermore, this company agrees to make special recruitment efforts to hire the protected class whenever feasible. This company also agrees to adhere to all applicable federal, state, and local laws relating to Equal Employment Opportunity for all individuals.

1.13 WORKFORCE ANALYSIS FORM

Name of Organization: _____

Categories	Total		White (not Hispanic or Latino)		Hispanic or Latino		Black or African-American (not Hispanic or Latino)		Native Hawaiian and other Pacific Islander (not Hispanic or Latino)		Asian (not Hispanic or Latino)		American Indian or Alaskan Native (not Hispanic or Latino)		Two or more races (not Hispanic or Latino)		Total	
			M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Administrators																		
Professionals																		
Superintendents																		
Supervisors																		
Foremen																		
Technicians																		
Protective Service																		
Para-Professionals																		
Office/Clerical																		
Skilled Craft																		
Service/Maintenance																		
Total																		

Prepared By: _____ Date ___/___/___

1.14 EVIDENCE OF INSURABILITY

LEXINGTON-FAYETTE UBAN COUNTY GOVERNMENT CONTRUCTION PROJECT

(Use separate form for each Agency or Brokerage agreeing to provide coverage)

Names Insured: _____

Address: _____

Project to be insured: _____

In lieu of obtaining certificates of insurance at this time, the undersigned agrees to provide the above Named Insured with the minimum coverage listed below. These are outlined in the Insurance and Risk Management of Section 00600 - Bonds and Certifications, including all requirements, and conditions:

Article Items	Coverage	Minimum Limits and Policy Requirements	Limits Provided to Insured	Name of Insurer	A.M. Best's	
					Code	Rating
1.05.D.1	CGL	$1,000,000/per occ., $2,000,000/aggregate or $2,000,000 combined single limit Requirements (a) through (e)				
1.05.D.1	Auto	Combined single $1,000,000/per occ. aggregate Requirements (a) through (c)				
1.05.D.1	WC	$ _____ Statutory				
1.05.D.1	Employer's Liability	$500,000				

Section 00600 includes required provisions, statements regarding insurance requirements, and the undersigned agrees to abide by all provisions for the coverage's checked above unless stated otherwise when submitting

_____ Agency or Brokerage

_____ Name of Authorized Representative

_____ Street Address

_____ Title

_____ City

_____ Authorized Signature

_____ Telephone Number

_____ Date

NOTE: Authorized signatures may be the agent's if agent has placed insurance through an agency agreement with the insurer. If insurance is brokered, authorized signature must be that of authorized representative of insurer.

IMPORTANT: CONTRACT MAY NOT BE AWARDED IF A COMPLETED AND SIGNED COPY OF THIS FORM FOR ALL COVERAGES LISTED ABOVE IS NOT PROVIDED.

1.15 DEBARRED FIRMS

PROJECT NAME: East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2 Wastewater System Improvements

LFUCG BID NO.: 65-2025

LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT
LEXINGTON, KY

All prime Contractors shall certify that Subcontractors have not and will not be awarded to any firms that has been debarred for noncompliance with the Federal Labor Standards, Title VI of the Civil Rights Act of 1964 As Amended, Executive Order 11246 As Amended or any other Federal Law.

All Bidders shall complete the Debarment Certification in duplicate and submit both copies to the Owner with the Bid Form. The Owner (grantee) shall transmit one copy to the Lexington-Fayette Urban County Government, Division of Community Development within fourteen (14) days after Bid opening.

The undersigned hereby certifies that the firm of _____ has not and will not award a subcontract, in connection with any Agreement award to it as the result of this bid, to any firm that has been debarred for noncompliance with the Federal Labor Standards, Title VI of the Civil Rights Act of 1964, Executive Order 11246 As Amended or any Federal Law.

_____
Name of Firm Submitting Bid

_____
Signature of Authorized Official

_____
Title

_____
Date

1.16 DEBARMENT CERTIFICATION

A. All Contractors/Subcontractors shall complete this certification.

B. The Contractor/Subcontractor certifies in accordance with Executive Order 12549 (Debarment and Suspension 2/18/86) that to the best of its knowledge and belief, that it and its principals:

1. Are not presently debarred, suspended, proposed for debarment, declared negligible, or voluntarily excluded from covered transactions or contract by any Federal department or agency for noncompliance with the Federal Labor Standards, Title VI of the Civil Rights Act of 1964 As Amended, Executive Order 11246 As Amended or any other Federal Law.

    a. Have not within a three year period preceding this Bid been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements or receiving stolen property;

    b. Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(a) of this certification; and

    c. Have not within a three (3) year period preceding this Bid has one or more public (Federal, State or local) transactions or contracts terminated for cause or default.

2. Where the Contractor is unable to certify to any of the statements in this certification, such prospective contractors shall attach an explanation to this certification form.

Firm Name: _____

Project: _____

Printed Name: _____

Title of Authorized Representative: _____

Signature: _____

Date: _____

1.17 CERTIFICATION REGARDING LOBBYING

Certification for Contracts, Grants, Loans, and Cooperative Agreements

A. The undersigned certifies, to the best of his or her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

3. The undersigned shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including subcontracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

B. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty for not less than $10,000 and not more than $100,000 for each such failure.

_____

Typed Name & Title of Authorized Representative

_____ _____

Signature of Authorized Representative Date

_____I am unable to certify to the above statements. My explanation is attached.

1.18 BID BOND

Bond Number: _____

KNOW ALL MEN BY THESE PRESENTS, that we _____

as principal (the "Principal") and _____

hereinto called Surety, are held and firmly bound unto

LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT
200 East Main Street, Third Floor
Lexington, Kentucky 40507

as obligee (the "Obligee"), in the penal sum of _____ dollars for the payment of which sum well and truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for

_____

NOW, THEREFORE, if the Obligee shall accept the bid of the Principal within the period specified therein, or, if no period be specified, within ninety (90) days after opening, and the Principal shall enter into a contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or contract documents, or in the event of the failure of the Principal to enter into such contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference in money not to exceed the penal sum hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void; otherwise to remain in full force and effect. In no event shall the liability hereunder exceed the penal sum thereof.

PROVIDED AND SUBJECT TO THE CONDITION PRECEDENT, that any claim by Obligee under this bond must be submitted in writing by registered mail, to the attention of the Surety Law Department at the address above, within 120 days of the date of this bond. Any suit under this bond must be instituted before the expiration of one (1) year from the date of this bond. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall apply.

Continued on next page.

DATED as of this _____ day of _____, 20_____.

WITNESS / ATTEST:

_____	_____
Principal (Secretary)	Principal
By: _____ (seal)	_____
	Name and Title

_____	_____
Surety (Secretary)	Surety
By: _____ (seal)	_____
	Name and Title

POWER OF ATTORNEY

(Attach to Bid Bond)

Hazen

Stantec

Prebid Meeting Summary

East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2 Wastewater System Improvements
LFUCG, Lexington, KY

LFUCG Bid No. 65-2025
Date: May 28, 2025

1. Introduction

- Owner: LFUCG DWQ
  - Charlie Martin, PE, Project Manager
  - Bob Peterson, PE, RMP Manager
  - Chris Dove, Pump Station Superintendent
  - Jody Scrivner, Administrative Specialist
- LFUCG Division of Purchasing
  - Brian Marcum, Procurement Officer Senior
  - Sherita Miller, MBE Liaison (virtual)
- Engineers:
  - Hazen and Sawyer
    - Kurt Zehnder, PE, Project Manager
    - Tyler Bridges, PE, Process Engineer
    - Odus Baker, RPR
  - Stantec
    - Bret Lavey, PE, Project Manager
    - Joe Percefull, Asst. Project Manager
- Stormwater Program Manager:
  - Tetra Tech
    - Abby Terry, EIT

- Please sign the Sign In Sheet before you leave the meeting.

2. Bidding Questions and Procedures

- LFUCG will only be accepting bids on-line through Ion Wave for this solicitation. Base bid and alternate totals (if required) should be provided on the appropriate line items tab on Ion Wave. Submissions without line item totals (if required) may be rejected and deemed non-responsive. **Please submit all questions via the Q&A Module on ION WAVE.**

- Pre-bid meeting Questions:
  - Questions may be asked verbally. Questions will be recorded and issued as part of an addendum.
  - Verbally asked questions may be verbally responded to by the Owner/Engineer at the meeting, and responses recorded in the addendum.
  - Responses from Owner/Engineer at pre-bid meeting may change after we have had a chance to get back to the office and research/clarify information.
- Final written responses in addendums will override any verbal question responses.
- Final issued addendums will be the legal response of record.

3. Affirmative Action

- The successful Bidder must submit with their bid (see section 00410 – Bid Form) the following items:
  - Affirmative Action Plan of the firm
  - Current Work Force Analysis Form

  - LFUCG MWDBE Participation Form
  - Attachment A – Small and Disadvantaged, Minority, Women and Veteran Owned Business Outreach plan
- It is requested that each Bidder include in its bid a goal of (17%) 5% Minority Business Enterprises (MBEs) and 12% Women Business Enterprise (WBEs) and a goal of (3%) for Veteran Owned Small Business (VOSB) participation.
- Contact Sherita Miller, MBE Liaison, smiller@lexingtonky.gov Division of Procurement for additional information.
- Any subcontractor used must be on the certified list provided by LFUCG.
- Monthly Contract audits will be required for this project.
- All details are outlined in the Contract Document Specifications.

4. Erosion and Sediment Control Measures

Contractor shall follow the permitting, inspection, and enforcement procedures for erosion, sediment, and stormwater control established by Tetra Tech. Copies of the permitting, inspection, and enforcement (PIE) procedures will be distributed following the meeting with the meeting minutes as part of the Addendum.

- Land Disturbance Permit will be required. That will require a SWPPP and must be submitted via Accela for approval by LFUCG.
- The PIE procedures are included in the Specifications.
- All details are included in Contract Document Specifications.

5. Project Description

The project includes providing all construction supervision, labor, materials, tools, and test equipment necessary for the EHPS-P2 project. The project consists of the removal and replacement of the four (4) duty submersible sanitary pumps, removal of two (2) mechanical bar screens and replacement with two (2) channel grinders, installation of an overhead crane hoist, wet well connector pipe, and update controls and operations sequences as shown on the Contract Documents.

At least one grinder or mechanical screen must always remain in operation during construction.

The foregoing descriptions shall not be construed as a complete description of all work required.

6. Bid/Construction Schedule

- May 28, 2025: Mandatory Pre-bid Meeting (10:30am)
- May 28, 2025: Non-Mandatory Site Visit (at the conclusion of meeting)
- June 2, 2025: Cut-Off Date for Questions (at 5:00pm)
- June 5, 2025: Final Addendum Issued
- June 12, 2025: Bid Opening (2:00pm), IonWave
- July 7, 2025: Notice of Award (tentative)
- July 10, 2025: Preconstruction Conference (tentative)

- August 2026: Construction Complete (tentative)
- December 31, 2026: Funding and Consent Judgement Construction Deadline

The East Hickman Pump Station address is 3318 Buckhorn Drive, Lexington, KY.

7. Wage Rates

- State and Federal Wage rates **are not** included as part of this project.

8. Tax Exemption

- KRS 139.480(34)(a) Creates a new sales tax exemption for materials purchased by a contractor to be installed as part of a water or sewer project for certain water or sewer utilities (See section 13 of House Bill 360, Page 58).
- A tax exemption form will be supplied to the awarded contractor during the pre-construction meeting.

9. Bid Form

- The bid form contains lump sum work bid items.
  - The lump sum work includes everything in the plans and specifications

10. Permits to be completed

- Storm Water Pollution Prevention Plan (SWPPP)
  - Included in specification section 02371. Partially completed. Contractor to complete.
  - Approved LFUCG Land Disturbance Permit Application & Erosion and Sediment Control (ESC) checklist is included in SWPPP specification
- View General Notes, sheet G-0-001 through G-0-004 of the drawings
- KDOW Construction permit was issued as Addendum No. 1.

11. Site Access

- Contractor access to the site shall be through the gate at the intersection of Alumni and Buckhorn.

12. General Construction

- Blasting will NOT be allowed.
- The site is fenced, but the Contractor will need to work with LFUCG for locks and access at the two gates.
- Staging/laydown areas are available inside the fenced site and shall be worked out with LFUCG. Any additional area needed will be the responsibility of the Contractor.
- The entire site shall be maintained by the contractor (mowing, cleanup, site access, etc.)
- Concrete washout structures shall be located and installed by the Contractor.
- Bypass pumping and maintaining service at all times is the Contractor's responsibility.
- Materials to be salvaged from the existing pump station are listed on DWG. G-0-004.
- Funding Deadline December 31, 2026.

- Liquidated Damages
  - $3,000/day
  - If the Contractor's delay or failure to complete the project within the allowable Contract time, the Contractor is responsible for damages caused by loss of project grant funding. See Specification Section 01170 – Special Conditions for additional information.
  - LFUCG-DWQG requested that submittals be started early and approved as quickly as possible.
  - LFUCG is willing to help with storage indoors of equipment received early if needed.
- Wet Well Connector Pipe required DIP class based on selected backfill. This will be a submittal.

13. Submittals

Required submittals include but are not limited to:

- Schedule of Values
- Construction Sequencing Plan
- Construction Access Plan
- Staging Area Plan
- Bypass Pumping Plan
- Concrete Washout Structures
- Maintenance of Operations Plan
- Spoils Management Plan
- Dewatering Plan

The named submittals are incidental to the contract and are not pay items
Submittals will be processed electronically through Procore.

14. Questions and Comments

- Can remaining wet weather pumps handle the flow into the station?
  - No, only the duty (dry weather) pumps being replaced can convey flow out of the pump station to the West Hickman WWTP. The wet weather pumps only pump to the wet weather storage tank (WWST) and the WWST drains back into the dry weather wet well.
- Do we have any photos or As-Builts of how much was excavated and what the backfill was around the pump station?
  - We can find some photos and will share in a future addendum.
  - We have presumed the connector pipe will be in rock.
- Hazen worked with Concrete Coring of KY to determine the best location for the coring.
- What is the flow rate of the pumps station?
  - Max flow of the station is 12,500 gpm. This is the design capacity of existing 3 pumps operating in parallel.
- There are skylights above the mechanical screens that can be used for removal.

- Regular working hours are 7am to 10pm Monday through Friday. Any work overnight or weekend work must be approved prior by LFUCG.

SIGN-IN SHEET
Pre-Bid Meeting #154- Floyd Drive Trunk Sewer Wastewater System Improvements
December 3, 2024 @ 2:00 PM

Representative	Company Name	DBE/MBE/WBE/ Veteran	Phone#	Email Address
Brian Marcum	LFUCG		859-258-3320	brianm@lexingtonky.gov
Sherita Miller	LFUCG		859-258-3323	smiller@lexingtonky.gov
Bubba Weber	Allied Pump Rentals		513 407 2403	Bubba.Weber@alliedpumprentals.com
Miller Griffith	Thieneman Construction		812-620-0269	estimating@t-c-i.net
ED CALVERT	MAC CONST		812-786-5616	EDC@MACCONSTRUCTION.COM
RYAN GABBARD	HERRICK COMPANY		502-682-6903	RYAN@HCI96.COM
CAMERON BESS	JUDY CONST. CO		606-584-8210	CBESS@JUDYCC.COM
BRIAN NASH	NAC HEAVY HWY INC		859-333-1154	BRIAN@NACHEAVYHWY.COM
Lester Jurgens	AEES		5026821238	ljurgens@aees.com
Jesus Patino	AEES		502 395 2670	jpatino@aees.com
Chris Dove	LFUCG		859-608-9615	cdove@Lexingtonky.gov
Abby Terry	Tetra Tech		859-514-8819	abby.terry@tetratech.com
Austin Martin	Blue Tank + Pump		859-361-6331	amartin@Bluetankandpump.com
Kurt Zehnder	Hazen and Sawyer		859 286.1266	kzehnder@hazenandsawyer.com
Tyler Bridges	Hazen and Sawyer		502-290-0640	tbridges@hazenandsawyer.com
Odus Baker	Hazen & Sawyer		859 539 4366	obaker@hazenandsawyer.com
Bob Peterson	LFUCG		859 425 2438	RPETERSON@LEXINGTONKY.GOV

LEXINGTON

MINORITY BUSINESS ENTERPRISE PROGRAM

Sherita Miller, MPA, CPSD
Minority Business Enterprise Liaison
Division of Procurement
Lexington-Fayette Urban County Government
200 East Main Street
Lexington, KY 40507
smiller@lexingtonky.gov
859-258-3323

OUR MISSION: The mission of the Minority Business Enterprise Program (MBEP) is to facilitate the full participation of minority and women owned businesses in the procurement process and to promote economic inclusion as a business imperative essential to the long- term economic viability of Lexington-Fayette Urban County Government.

To that end the urban county council adopted and implemented Resolution 272-2024 – a Certified Minority and Women Business Enterprise seventeen percent (17%) minimum goal including minimum subgoals of five percent (5%) for Minority Business Enterprises (MBE) and a subgoal of twelve percent (12%) for Women Business Enterprises (WBE); a three (3%) minimum goal for Certified Veteran-Owned Small Businesses and/or Certified Service- Disabled Veteran Owned Businesses; and a goal of utilizing Disadvantaged Business Enterprises (DBE), where applicable, for government contracts.

The resolution states the following definitions shall be used for the purposes of reaching these goals:

Certified Disadvantaged Business Enterprise (DBE) *– a business in which at least fifty-one percent (51%) is owned, managed and controlled by a person(s) who is socially and economically disadvantaged as define by 49 CFR subpart 26.*

Certified Minority Business Enterprise (MBE) *– a business in which at least fifty-one percent (51%) is owned, managed and controlled by an ethnic minority (i.e. Black American, Asian American, Hispanic American, Native American)*

Certified Women Business Enterprise (WBE) *– a business in which at least fifty-one percent (51%) is owned, managed and controlled by a woman.*

Certified Veteran-Owned Small Business (VOSB) *– a business in which at least fifty-one percent (51%) is owned, managed and controlled by a veteran who served on active duty with the U.S. Army, Air Force, Navy, Marines or Coast Guard.*

Certified Service -Disabled Veteran Owned Small Business (SDVOSB) *– a business in which at least fifty-one percent (51%) is owned, managed and controlled by a disabled veteran who served on active duty with the U.S. Army, Air Force, Navy, Marines or Coast Guard.*

The term "Certified" shall mean the business is appropriately certified, licensed, verified, or validated by an organization or entity recognized by the Division of Procurement as having the appropriate credentials to make a determination as to the status of the business.

The following certifications are recognized and accepted by the MBEP:

Kentucky Transportation Cabinet (KYTC), Disadvantaged Business Enterprise (DBE)
Kentucky Minority and Women Business Enterprise (MWBE)
Women's Business Enterprise National Council (WBENC)
National Women Business Owners Corporation (NWBOC)
National Minority Supplier Development Council (NMSDC)
Tri-State Minority Supplier Development Council (TSMSDC)
U.S. Small Business Administration Veteran Small Business Certification (VetCert)
Kentucky Service- Disabled Veteran Owned Small Business (SDVOSB)

To comply with Resolution 272-2024, prime contractors, minority and women business enterprises, veteran owned small businesses, and service-disabled veteran owned small businesses must complete monthly contract compliance audits in the Diverse Business Management Compliance system, https://lexingtonky.diversitycompliance.com/

A list of organizations that certify and/or maintain lists of certified businesses (i.e. DBE, MBE, WBE, VOSB and/or SDVOSB) is available upon request by emailing, Sherita Miller, smiller@lexingtonky.gov.

LEXINGTON

LFUCG MWDBE PARTICIPATION FORM
Bid/RFP/Quote Reference #_____

The MWDBE and/or veteran subcontractors listed have agreed to participate on this Bid/RFP/Quote. If any substitution is made or the total value of the work is changed prior to or after the job is in progress, it is understood that those substitutions must be submitted to the Division of Procurement for approval immediately. **Failure to submit a completed form may cause rejection of the bid.**

MWBE Company, Name, Address, Phone, Email	DBE/MBE WBE/VOSB/SDVOSB	Work to be Performed	Total Dollar Value of the Work	% Value of Total Contract
1.				
2.				
3.				
4.				

The undersigned company representative submits the above list of MWDBE and veteran firms to be used in accomplishing the work contained in this Bid/RFP/Quote. Any misrepresentation may result in the termination of the contract and/or be subject to applicable Federal and State laws concerning false statements and false claims.

_____ _____

Company **Company Representative**

_____ _____

Date **Title**

LEXINGTON

LFUCG MWDBE SUBSTITUTION FORM
Bid/RFP/Quote Reference #_____

The substituted MWDBE and/or veteran subcontractors listed below have agreed to participate on this Bid/RFP/Quote. These substitutions were made prior to or after the job was in progress. These substitutions were made for reasons stated below and are now being submitted to the Division of Procurement for approval. By the authorized signature of a representative of our company, we understand that this information will be entered into our file for this project. **Note: Form required if a subcontractor is being substituted on a contract.**

SUBSTITUTED DBE/MBE/WBE/VOSB Company Name, Address, Phone, Email	DBE/MBE/WBE/VOSB/SDVOSB Formally Contracted/ Name, Address, Phone, Email	Work to Be Performed	Reason for the Substitution	Total Dollar Value of the Work	% Value of Total Contract
1.					
2.					
3.					
4.					

The undersigned acknowledges that any misrepresentation may result in termination of the contract and/or be subject to applicable Federal and State laws concerning false statements and false claims.

_____ _____

Company **Company Representative**

_____ _____

Date **Title**

LEXINGTON

DOCUMENTATION REQUIRED FOR GOOD FAITH EFFORTS AND OUTREACH PLANS

As affirmed in Resolution Number 272-2024, the Urban County Council has adopted an annual aspirational goal of utilizing at least seventeen percent (17%) of public funds spend from certain discretionary agreements with certified Minority Business Enterprises (MBEs) and certified Woman Business Enterprises (WBEs); utilizing at least three percent (3%) of public funds from certain discretionary agreements with Certified Veteran-Owned Small Business and Certified Service-Disabled Veteran-Owned Small Businesses (VOSBs); and utilizing Disadvantaged Business Enterprises (DBEs) where applicable. Bidders should make every effort to achieve these goals.

Therefore, as an element of the responsiveness of the bid, all Bidders are required to submit documentation of their good faith and outreach efforts to ensure all businesses, including small and disadvantaged businesses such as minority-, woman-, and veteran-owned businesses, have an equal opportunity to compete for and participate in the performance of any subcontracts resulting from this procurement. Examples of good faith and outreach efforts that satisfy this requirement to encourage the participation of, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs include:

1. Advertised opportunities to participate in the contract in at least two (2) publications of general circulation media; trade and professional association publications; small and minority business or trade publications; and publications or trades targeting minority, women, and disadvantaged businesses not less than fifteen (15) days prior to the deadline for submission of bids to allow, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs to participate.

2. Attended LFUCG Procurement Economic Inclusion Outreach event(s) within the past year to meet new small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs to partner with on LFUCG contracts and procurements.

3. Attended pre-bid/pre-proposal meetings that were scheduled by LFUCG to inform small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs of subcontracting opportunities.

4. Sponsored Economic Inclusion event to provide networking opportunities for prime contractors and small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs.

5. Requested a list of certified small, DBE, MBE, WBE, VOSB and/or SDVOSB subcontractors or suppliers from LFUCG and showed evidence of contacting the companies on the list(s).

6. Contacted organizations that work with small, DBE, MBE, WBE, and VOSB companies for assistance in finding certified DBEs, MBEs, WBEs, VOSB and/or SDVOSBs to work on this project. Those contacted and their responses must be a part of the bidder's outreach efforts documentation.

7. Sent written notices, by certified mail, email, or facsimile, to qualified, certified small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs soliciting their participation in the contract not less than seven (7) days prior to the deadline for submission of bids to allow them to participate effectively.

8. Followed up initial solicitations by contacting small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs via tailored communications to determine their level of interest.

9. Provided the interested small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs with adequate and timely information about the plans, specifications, and requirements of the contract.

10. Selected portions of the work to be performed by small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs in order to increase the likelihood of subcontracting participation. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate small, DBE, MBE, WBE, VOSB and/or SDVOSB participation, even when the prime contractor may otherwise perform these work items with its own workforce.

11. Negotiated in good faith with interested small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs, not rejecting them as unqualified without sound reasons based on a thorough investigation of their capabilities. Any rejection must be so noted in writing with a description as to why an agreement could not be reached.

12. Included documentation of quotations received from interested small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs that were not used due to uncompetitive pricing or were rejected as unacceptable and/or copies of responses from firms indicating that they would not be submitting a bid.

    a. Bidder has to submit sound reasons why the quotations were considered unacceptable. The fact that the bidder has the ability and/or desire to perform the contract work with its own forces will not be considered a sound reason for rejecting a small business', DBE's MBE's, WBE's, VOSB's and/or SDVOSB's quote. Nothing in this provision shall be construed to require the bidder to accept unreasonable quotes in order to satisfy the participation goals.

13. Made an effort to offer assistance to or refer interested small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs to obtain the necessary equipment, supplies, materials, insurance and/or bonding to satisfy the work requirements of the bid proposal.

14. Made efforts to expand the search for small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs beyond the usual geographic boundaries.

15. Other – any other evidence that the bidder submits that may demonstrate that the bidder has made reasonable efforts to include small, DBE, MBE, WBE, VOSB and/or SDVOSB participation.

Bidder must document, with specificity, each of the efforts it made to include small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs as subcontractors in the procurement, including the date on which each effort was made, the medium through which each effort was made, and the outcome of each effort.

Note: Failure to submit the documentation requested in this section may be cause for rejection of bid. Bidders may include any other documentation deemed relevant to this requirement which is subject to review by the MBE Liaison. Documentation of Good Faith and Outreach Efforts must be submitted with the Bid, regardless of the proposed level of small, DBE, MBE, WBE, VOSB and/or SDVOSB participation in the procurement. If the Good Faith and Outreach Effort documentation is not submitted with the bid response, the bid may be rejected.

OUTREACH EFFORTS EVALUATION

Outreach efforts demonstrated by the bidder or respondent will be evaluated on a pass/fail basis.

ATTACHMENT A – SMALL AND DISADVANTAGED, MINORITY-, WOMEN-, AND VETERAN-OWNED BUSINESS OUTREACH PLAN

Proposer Name: _____ **Date:** _____

Project Name: _____ **Project Number:** _____

Contact Name: _____ **Telephone:** _____

Email: _____

The mission of the Minority Business Enterprise Program is to facilitate the full participation of disadvantaged businesses, minority-, women-, veteran-, and service-disabled veteran-owned businesses in the procurement process and to promote economic inclusion as a business imperative essential to the long -term economic viability of Lexington-Fayette Urban County Government.

To that end, small and disadvantaged businesses, including minority-, woman-, veteran-, and service-disabled veteran-owned businesses, must have an equal opportunity to be utilized in the performance of contracts with public funds spent from certain discretionary agreements. By submitting its offer, Bidder/Proposer certifies that it has taken, and if there are further opportunities will take, reasonable steps to ensure that small and disadvantaged businesses, including minority-, woman-, veteran-, and service-disabled veteran-owned businesses, are provided an equal opportunity to compete for and participate in the performance of any subcontracts resulting from this procurement.

The information submitted in response to this clause will not be considered in any scored evaluation. Failure to submit this form may cause the bid or proposal to be rejected.

Is the Bidder/ Proposer a certified firm? Yes ☐ No ☐

If yes, indicate all certification type(s):

DBE ☐ MBE ☐ WBE ☐ SBE ☐ VOSB/SDVOSB ☐

and supply a copy of the certificate and/or certification letter if not currently listed on the city's Minority Business Enterprise Program's (MBEP) certified list.

1. Include a list of firms that Bidder/ Proposer has had a contractual relationship with within the last two years that are minority-owned, woman-owned, veteran-owned or small businesses, regardless of their certification status.

Click or tap here to enter text.

2. Does Bidder/Proposer foresee any subcontracting opportunities for this procurement?

Yes ☐ No ☐

If no, please explain why in the field below. Do not complete the rest of this form and submit this first page with your bid and/or proposal. Click or tap here to enter text.

ATTACHMENT A – SMALL and DISADVANTAGED, MINORITY-, WOMEN-, and VETERAN-OWNED BUSINESS OUTREACH PLAN

If yes, please complete the following pages and submit all pages with your bid and/or proposal.

Describe the steps Bidder/Proposer took to solicit small and disadvantaged businesses, including MBEs, WBEs, VOSBs, and SDVOSBs, for subcontracting opportunities for this procurement.

3. Check the good faith and outreach efforts the Bidder/Proposer used to encourage the participation of small and disadvantaged businesses including, MBEs, WBEs, VOSBs and SDVOSBs:

- ☐ Bidder placed advertisements in search of prospective small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs for the solicitation.
- ☐ Bidder attended LFUCG Procurement Economic Inclusion Outreach event(s) within the past year.
- ☐ Bidder attended pre-bid and/or pre-proposal meetings for this solicitation.
- ☐ Bidder sponsored an Economic Inclusion Outreach event.
- ☐ Bidder requested a list of certified small, DBE, MBE, WBE, VOSB and/or SDVOSB subcontractors or suppliers from LFUCG.
- ☐ Bidder contacted organizations that work with small, DBE, MBE, WBE, VOSB and/or SDVOSB companies.
- ☐ Bidder sent written notices to certified small, DBE, MBE, WBE, VOSB and SDVOSB businesses.
- ☐ Bidder followed up to initial solicitations with interested small, DBE, MBE, WBE, VOSB and/or SDVOSB.
- ☐ Bidder provided small, DBE, MBE, WBE, VOSB and/or SDVOSB businesses interested in performing the solicited work with prompt access to the plans, specifications, scope of work, and requirements of the solicitation.
- ☐ Bidder made efforts to segment portions of the work to be performed by small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs, including dividing sub-bid/partnership opportunities into economically feasible units/parcels, to facilitate participation.
- ☐ Bidder negotiated in good faith with interested small, DBE, MBE, WBE, VOSB and/or SDVOSB businesses.

☐ Bidder provided adequate rationale for rejecting any small business', DBEs, MBEs, WBEs, VOSBs or SDVOSBs for lack of qualifications.

☐ Bidder offered assistance in obtaining bonding, insurance, financial, equipment, or other resources to small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs, in an effort to assist them in meeting project requirements.

☐ Bidder made efforts to expand the search for small businesses, DBEs MBEs, WBEs, VOSBs and/or SDVOSBs beyond the usual geographic boundaries.

☐ Bidder made other reasonable efforts to include small businesses, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs participation.

4. Bidder/Proposer must include documentation, including the date each effort was made, the medium through which each effort was made, and the outcome of each effort with this form, regardless of the level of small, DBE, MBE, WBE, VOSB and/or SDVOSB participation. Examples of required documentation include copies of email communications, copies of newspaper advertisements, or copies of quotations received from interested small businesses, DBEs, MBEs, WBEs, VOSBs or SDVOSBs.

Click or tap here to enter text.

For detailed information regarding outreach efforts that satisfy the MBE Program's requirements, please see "Documentation Required for Good Faith Efforts and Outreach Plans" page.

Note: The Bidder/Proposer must be willing to report the identity of each subcontractor and the value of each subcontract to MBEP if awarded a contract from this procurement.

Failure to submit the documentation requested may be cause for rejection of the bid. Bidders may include any other documentation deemed relevant to this requirement, which is subject to review by the MBE Liaison. Documentation of Good Faith and Outreach Efforts must be submitted with the bid, regardless of the proposed level of SBEs, DBEs, MBEs, WBEs, VOSBs and/or SDVOSBs participation in the procurement. If the Good Faith and Outreach Effort Form and associated documentation is not submitted with the bid response, the bid may be rejected.

The undersigned acknowledges that all information is accurate. Any misrepresentations may result in termination of the contract and/or be subject to applicable Federal and State laws concerning false statements and claims.

Company	**Company Representative**
Date	**Title**

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GRW Engineers, Inc. ✧ ✧ 502-352-0016

Project	4509	**Project Resident Inspector**	Chris Riddle
Name	East Hickman Wet Weather Storage Facil.	**Project Engineer**	Alan Bryan
Location	Lexington, Kentucky	**Superintendent**	Ricky Raizor
		General Superintendent	Darryl Well

Daily Log

Tuesday, November 27, 2018

Weather:

Conditions: Overcast Precipitation: Snow 0.25in. Temperature: Low 20°F High 27°F
6:30am: 25*, Relative Humidity 77%, Wind WNW 18 mph

Visitors To Site:

Jacob Walker, Geotechnology Inc.
Bob Peterson, LFCUG, Division of Water
Nic Adam, Crom LLC.
Kevin Levesque, LFCUC, Division of Water
Kurt Zehnder, Hazen & Sawyer
Jon Schubarth, Hazen & Sawyer
Paul Lawrence, Judy Construction
Rick Raisor, Judy Construction
Alan Bryan, GRW

Deliveries:

2 truckloads structural steel

Activities (2 photos attached):

Wet Weather Storage Tank:
Subcontractor, Crom LLC unloaded (2) truckloads of structural steel for use in wet weather storage tank construction.
The pre-pour tank slab meeting occurred on-site with the following stake holders represented: LFCUG, GRW, Judy Construction, Hazen & Sawyer, Crom LLC. And Geotechnology Inc. The purpose of this meeting was to discuss the upcoming construction of the tank slab.

Pump Station Construction:
Contractor has completed excavation of the wet well and is making ready the wet well site for sump and bottom slab construction.

Problems And Comments:

A discussion occurred between GRW Project Manager, Alan Bryan and Judy Construction Project Manager Paul Lawrence in regard to the 6" crushed stone base shown in the drawing beneath the

bottom slab in the wet well of the proposed pump station. Lawrence requested that the cut stone base requirement be changed to allow the Contractor to place a concrete mud mat directly on top of solid rock and do away with the stone requirement. Bryan agreed with Lawrence's recommendation.

Manpower And Operations:

Supplier/Resource	Qty	Trade	Operations
Crom Corporation	3	Laborer	General Construction 5 hrs
	1	Operator	Moving Materials 5 hrs
Judy Construction Company	1	Carpenter	General Construction 10 hrs
	2	Laborer	General Construction 10 hrs
	1	Operator	Moving Material 10 hrs
	1	Project Manager	Coordinating Project
	1	Superintendent	Project Supervision 10 hrs

Equipment:

Supplier/Resource	Qty	Equipment	Operations
Crom Corporation	2	Highlift	Kawasaki 60Z
Judy Construction Company	1	Backhoe	Case 580
	1	Trackhoe	Komatsu 290

Materials:

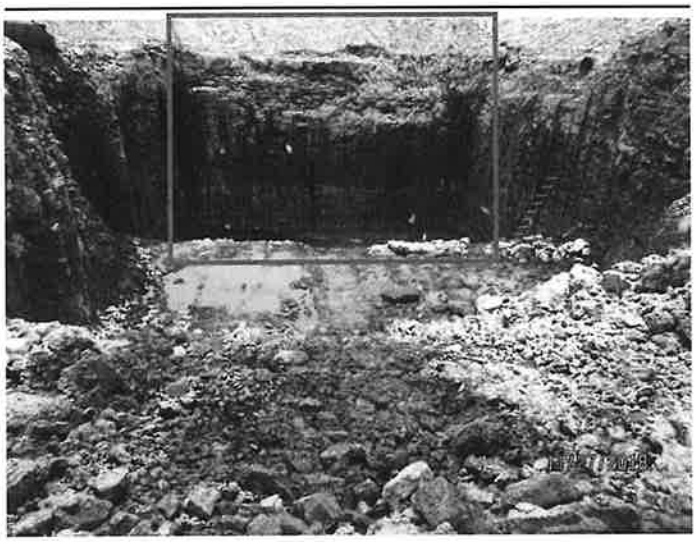
Supplier/Resource	Qty	Material	Remarks
CMC	2	Structural Steel	Structural Steel

Activities: Photo #1



Pump Station wet well subgrade. Contractor cleaning up area and removing excess material.

Activities: Photo #2



Pump station excavated site view from screen room toward wet well

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GRW Engineers, Inc. ✧ ✧ 502-352-0016

Project	4509	**Project Resident Inspector**	Chris Riddle
Name	East Hickman Wet Weather Storage Facil.	**Project Engineer**	Alan Bryan
Location	Lexington, Kentucky	**Superintendent**	Ricky Raizor
		General Superintendent	Darryl Well

Daily Log

Thursday, January 17, 2019

Weather:

Conditions: Light Rain Precipitation: Rain 0.25in. Temperature: Low 36°F High 44°F
6:30am: Cloudy, 35*, Relative Humidity 93%, Wind SE 3 mph

Visitors To Site:

Deliveries:

Activities (3 photos attached):

Pump Station Construction:
Structural steel addition to lower foundation outer walls is complete.
Contractor is focusing on Southwest corner lower foundation wall forming. Corner transitional gang forms are being installed and braced together with she-bolts.

Problems And Comments:

Manpower And Operations:

Supplier/Resource	Qty	Trade	Operations
Judy Construction Company	1	Carpenter	General Construction 9 hrs
	4	Laborer	General Construction 9 hrs
	1	Operator	Moving Materials 9 hrs
	1	Superintendent	Project Supervision 9 hrs

Equipment:

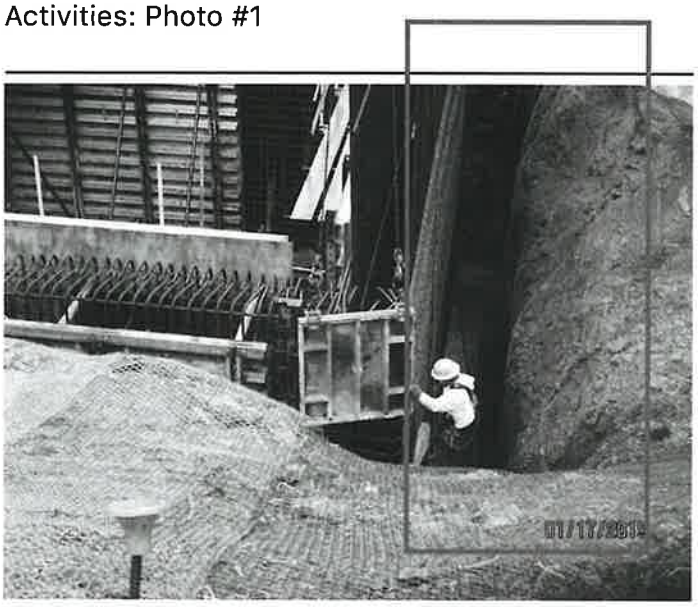
Supplier/Resource	Qty	Equipment	Operations
Judy Construction Company	1	Backhoe	Case 580
	1	Lattice crawler crane	Link Belt 138N

Materials:

Supplier/Resource	Qty	Material	Remarks

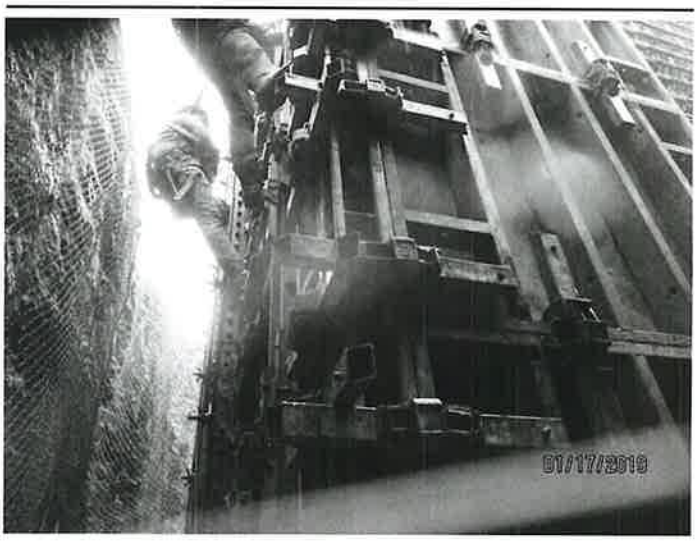
By: Chris Riddle, RPR 1/18/19

Activities: Photo #1



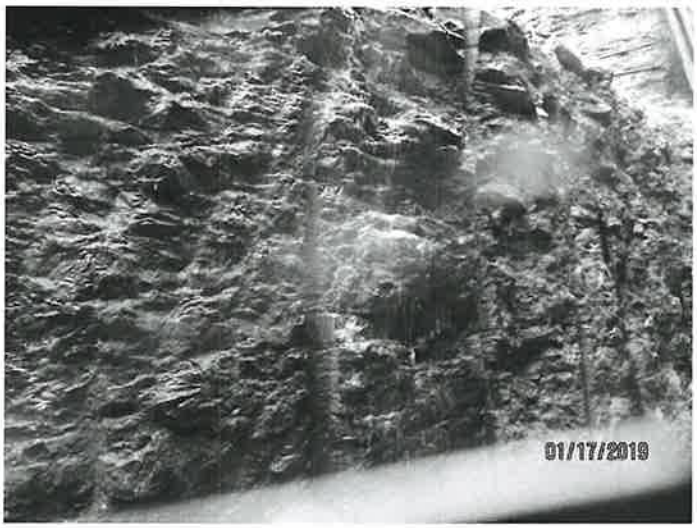
Pump station wet well, Contractor installing gang forms on corner of lower foundation outer wall on the Southwest corner of station.

Activities: Photo #2



Pump station wet well lower foundation Southwest corner outer wall.

Activities: Photo #3



South excavated wet well wall, ground water infiltrating into wet well site.

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GRW Engineers, Inc. ✧ ✧ 859-948-6361

Project	4509	**Project Resident Inspector**	Mike LaSage
Name	East Hickman Wet Weather Storage Facil.	**Project Engineer**	Alan Bryan
Location	Lexington, Kentucky	**Superintendent**	Ricky Raizor
		General Superintendent	Darryl Well

Daily Log

Tuesday, March 12, 2019

Weather:

Conditions: Partly Cloudy Precipitation: None Temperature: Low 30°F High 51°F
- 0945 - wind NE 6, RH 70%, temp 36*F

Visitors To Site:

Deliveries:

Activities (6 photos attached):

Crom
Building a form around base of tank. Prepare to spray concrete.

Judy Construction
Continuing installation of form on SE corner of wet well.

Problems And Comments:

Manpower And Operations:

Supplier/Resource	Qty	Trade	Operations
Crom Corporation	18	Laborer	General Construction activities
	1	Superintendent	Supervision of construction activities
Judy Construction Company	1	Carpenter	General Construction activities
	4	Laborer	General Construction activities
	1	Superintendent	Supervision of construction activities

Equipment:

Supplier/Resource	Qty	Equipment	Operations
Crom Corporation	1	Highlift	Kawasaki 60Z
Judy Construction Company	1	Backhoe	Case 580
	1	Lattice crawler crane	Link Belt 138N

Materials:

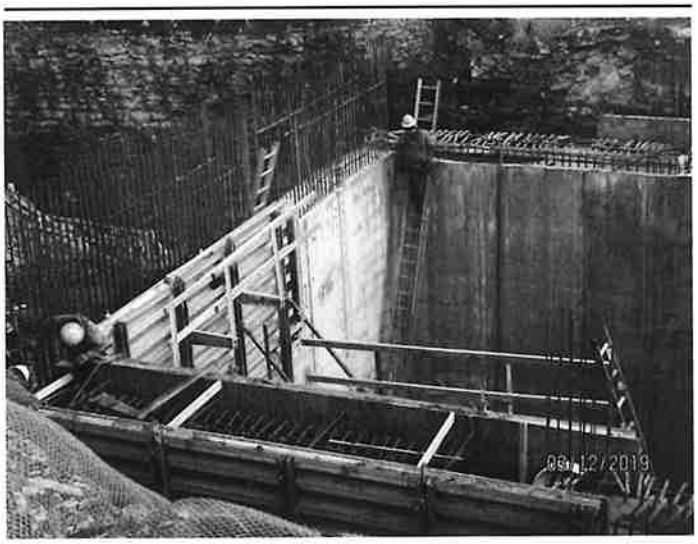
Supplier/Resource	Qty	Material	Remarks

Activities: Photo #1



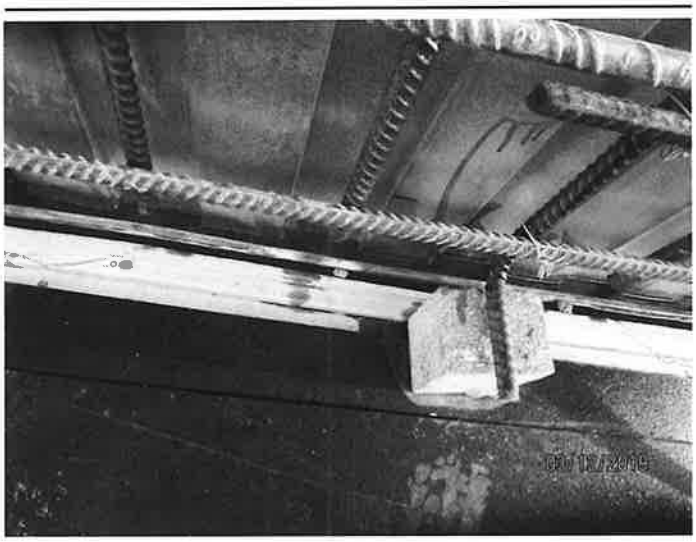
Judy Construction Forming SE corner of the wet well

Activities: Photo #2



Judy Construction Forming SE corner of the wet well

Activities: Photo #3



Crom Construction Storage Tank - Epoxy seal at base of steel panels

Activities: Photo #4



Crom Construction Storage Tank - 10" tall form to pour concrete to insure entrapment of cables

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GRW Engineers, Inc. ✧ ✧ 5023302710

Project	4509	**Project Resident Inspectors**	Dwayne Hall
Name	East Hickman Wet Weather Storage Facil.	**Project Engineer**	Alan Bryan
Location	Lexington, Kentucky	**Superintendent**	Ricky Raizor
		General Superintendent	Darryl Well

Daily Log

Wednesday, March 27, 2019

Weather:

Conditions: Clear Precipitation: None Temperature: Low 32°F High 65°F
Humidity-64%,BP-30.41,winds-ESE4mph. Clear

Visitors To Site:

Deliveries:

Activities (5 photos attached):

Judy is setting forms on an internal wall. Poured flowable fill on NE side of pump station. Crom sprayed inside of tank.

Problems And Comments:

Manpower And Operations:

Supplier/Resource	Qty	Trade	Operations
Crom Corporation	1	General Superintendent	General supervision
	16	Laborer	Concrete
Judy Construction Company	1	Carpenter	Form work
	1	General Superintendent	Supervision
	4	Laborer	General Construction
	2	Operator	Crane , hoe ram and excavate footing

Equipment:

Supplier/Resource	Qty	Equipment	Operations
Crom Corporation	1	Air Compressor	Concrete application
	1	Concrete Pump	Concrete application
	1	Highlift	Forklift
Judy Construction Company	1	Lattice crawler crane	Set forms , pour flowable fill
	1	Trackhoe	Backfill, slab and footing grade

Equipment:

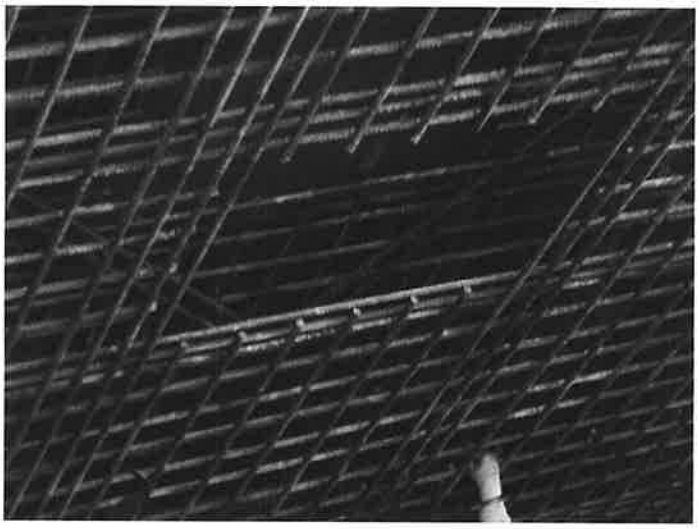
Supplier/Resource	Qty	Equipment	Operations
Judy Construction Company	1	Trackhoe w/ Breaker	Footing and slab grade

Materials:

Supplier/Resource	Qty	Material	Remarks
Crom Corporation	48	Design Mix 4509SC	Crom tank

By: Dwayne Hall, Project Resident Representative 3/28/19

Activities: Photo #1



Rebar inside wall pump station

Activities: Photo #2



Roe ram and back fill SE side of pump station

Activities: Photo #3



Setting forms internal wall

Activities: Photo #4



Setting forms internal wall

MAYOR LINDA GORTON

LEXINGTON

TODD SLATIN
DIRECTOR
CENTRAL PURCHASING

ADDENDUM #3

Bid Number: **#65-2025**

Date: June 5, 2025

Subject: East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2 Wastewater System Improvements

Address inquiries to:
Brian Marcum
brianm@lexingtonky.gov
(859) 258-3325

TO ALL PROSPECTIVE SUBMITTERS:

Please be advised of the following clarifications to the above referenced Bid:

1. BID QUESTIONS

	Questions	Answers
1.	There is a PLC control panel on this project. The specifications do not identify if the owner is responsible for the programming of the panel or if the programming is to be part of the bid. Please clarify.	There are modifications to an existing PLC panel, PLC-EHPS, on this project as indicated on the contract documents. PLC, OIT and HMI programming modification shall be included within the scope of this contract. Refer to network changes, I/O changes, sheet keynotes on the drawings as well as control descriptions listed as **"Revised"** under specification section 17480 for additional details.
2.	Over the past year, LFUCG has only accepted programming bids from (3) pre-approved systems integrators: Rawdon Myers, Inc., LOVO and AES. Will that be in place on this project bid?	The following three (3) System Integrators are LFUCG approved for this project work: 1. Rawdon Myers Inc. 2. LOVO Systems 3. AEES
3.	Per Section 11310, Article 1.03.A., Xylem/Flygt, KSB, and Grundfos are approved manufacturers of the Solids Handling Submersible Sewage Pumps. Per Section 00410 (Bid Form), Page 6, Xylem/Flygt is not listed as an approved manufacturer. Please verify the status of Xylem/Flygt.	Xylem/Flygt are listed in specification 11310-1.03 and will be included on the Equipment Manufacturer list as well. See the updated Bid Form 00410 included within this addendum.

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LEXINGTON

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DIRECTOR
CENTRAL PURCHASING

4.	Will attendance at the mandatory pre-bid be required to bid the project? If so, will there be an opportunity to meet the engineer and LFUCG personnel on a separate occasion considering the late change to the time of the meeting?	Yes, attendance at the mandatory prebid was required to bid the project and no additional opportunities will be given.
5.	Can remaining wet weather pumps handle the flow into the station?	No, only the duty (dry weather) pumps being replaced can convey flow out of the pump station to the West Hickman WWTP. The wet weather pumps only pump to the wet weather storage tank (WWST) and the WWST drains back into the dry weather wet well.
6.	Do we have any photos or As-Builts of how much was excavated and what the backfill was around the pump station?	Please see the four (4) photos included in this addendum. We have presumed the connector pipe will be in rock.
7.	What is the flow rate of the pumps station?	Max flow of the station is 12,500 gpm. This is the design capacity of existing 3 pumps operating in parallel.
8.	Refer schematic I-07 sheet keynote 14: The new Modbus TCP card is shown as the last card in the chassis. These slots are currently used for the DeviceNet cards. Can Slot 1, which is currently empty, be used for the new Modbus TCP card?	The representation on Sheet I-07 was not intended to assign a slot for the module, but only to show the general interconnection. No exceptions taken to using the available slot as suggested.

9.	Detail A on plans sheet M-008 requires "Annulus space between pipe and cored wall shall be pressure injected around entire pipe with epoxy grout". Please provide specifications for the epoxy grout system required?	The epoxy system shall meet ASTM C881 Type I, Class 2, or better. Below are some suppliers of pressure injection epoxy grouting systems approved for this application. 1) Euclid Chemical - Concrete Epoxy Injection | Dural Injection Gel 2) W.R. Meadows - REZI-WELD LV - Low Viscosity Injection Epoxy - W. R. Meadows 3) Sika USA - SikaFlow®-647 | Epoxy Grouts 4) SealBond - SEALBOND 218-P - Sealbond Chemicals Industries Inc.
10.	If available, can you please share the original geotechnical report for the pump station when it was originally built? Specifically the area of the new 30" wet well connector piping?	Two previous geotechnical reports from the preliminary design and phase 1 project are included in this addendum. These geotechnical reports are provided for informational purposes only. Since the completion of these reports, construction activities have taken place on the site, which may have altered the original subsurface conditions. As such, the findings and recommendations contained herein may no longer accurately reflect current site conditions and should not be solely relied upon for design or construction decisions without further evaluation. Contractors shall use these for informational purposes only.
11.	If available, can you please provide pictures of the excavation and construction of the pump station when it was originally built? Specifically the area of the new 30" wet well connector piping?	Four (4) Daily Reports from the East Hickman Phase 1 project including photos of the excavation during construction were included as part of Addendum 02.

MAYOR LINDA GORTON

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DIRECTOR
CENTRAL PURCHASING

12.	Can you please provide the original submittals and/or O&M manuals for the existing mechanically cleaned fine bar screens?	This submittal is included in Addendum 03.
13.	Refer Schematic sheet I-06 sheet keynote 14: Will the electrical contractor be responsible for the removal of the existing Bar Screen and Compactor electrical panels and conduit?	The Contractor shall confirm division of scope of work for their subcontractors. Refer to electrical sheets E-003 and E-004 for direction of physical removal of panels and associated wiring associated with this equipment. Removal of Screen and Compactor programming associated with this equipment including, but not limited to, PLC programming, PLC to PLC messaging, monitoring, soft interlocks, and HMI screens is performed under Division 17 work.
14.	Refer schematic sheet I-10: will the existing Radar level sensor LIT300 be re-used?	The design does not re-use the differential level monitoring that was provided with the bar screen and wired to the bar screen control panel. Provide new radar level sensor.
15.	Refer schematic sheet I-13: Who will be responsible for the integration of the new Pump Monitoring System to the existing Schneider VFDs?	Refer to sheet E-014 for hardwired interlocks from the new Pump Monitoring system to the existing Dry Weather Pump Control Wiring.
16.	1.03.E calls for all manufacturer information to be submitted to the contractor within 30 days of the Notice to Proceed. While general submittal information can be provided it this time frame, structural calculations and FEA reports can require much more time. Will this be acceptable?	Yes, additional time is acceptable for structural calculations and FEA reports. However, both should be submitted in a timely manner to not impede the proposed project schedule.
17.	1.08.A.1 – Per HI 9.6.8, a Level 1 Analysis, due to the simplified equations and systems, generally only calculates the 1st critical speeds. Does the 2nd critical speed have to be calculated as this is generally not included in a Level 1 analysis?	Instead of preparing level 1 analysis for wet pit submersible pumps, perform factory and field vibration testing at 50 rpm speed intervals across the full range of operations to validate that there is no vibration in excess of HI 9.6.4 and no apparent resonance condition. Revise specification section 11310-1.08.

18.	1.08.A.3 – Per HI 9.6.8, a Level 1 Analysis, due to the simplified equations and systems, assumes that the foundation is fixed. Please confirm that this is acceptable.	Instead of preparing level 1 analysis for wet pit submersible pumps, perform factory and field vibration testing at 50 rpm speed intervals across the full range of operations to validate that there is no vibration in excess of HI 9.6.4 and no apparent resonance condition. Revise specification section 11310-1.08.
19.	1.08.C - Lateral Analysis Calculations – The structure will not be included in a level 1 lateral analysis.	Instead of preparing level 1 analysis for wet pit submersible pumps, perform factory and field vibration testing at 50 rpm speed intervals across the full range of operations to validate that there is no vibration in excess of HI 9.6.4 and no apparent resonance condition. Revise specification section 11310-1.08.
20.	1.08.C – Structural analysis – For an HI 9.6.8 level 1 analysis, the structure is not included and is assumed to be rigid. Note, due these being wet pit submersibles, the assumptions used in an HI level 1 analysis may not be accurate as the pump is not fixed at the bottom (HI assumes the pump acts like a beam fixed at one end for a level 1 structural analysis). Please confirm that not including the structure in the analysis is acceptable.	Instead of preparing level 1 analysis for wet pit submersible pumps, perform factory and field vibration testing at 50 rpm speed intervals across the full range of operations to validate that there is no vibration in excess of HI 9.6.4 and no apparent resonance condition. Revise specification section 11310-1.08.
21.	1.08.C Motor Reed Frequency – As these are submersible pumps and the motors are internal to the pump, the motor RCF and post manufactured pre shipment verification are not included or required.	Instead of preparing level 1 analysis for wet pit submersible pumps, perform factory and field vibration testing at 50 rpm speed intervals across the full range of operations to validate that there is no vibration in excess of HI 9.6.4 and no apparent resonance condition. Revise specification section 11310-1.08.

MAYOR LINDA GORTON

LEXINGTON

TODD SLATIN
DIRECTOR
CENTRAL PURCHASING

22.	1.08.D.1 – As the analysis will be done by an engineer from our factory, the report will be signed by an engineer in the country of manufacturer. Note that local regulations (in the country of manufacture) dictate legal requirements for "engineering" signatures similar to what a Professional Engineer in the US has. Please confirm that this is acceptable.	Instead of preparing level 1 analysis for wet pit submersible pumps, perform factory and field vibration testing at 50 rpm speed intervals across the full range of operations to validate that there is no vibration in excess of HI 9.6.4 and no apparent resonance condition. Revise specification section 11310-1.08.
23.	2.01.G.2 – L-10 life based on ½ BEP to 1.5tims BEP conflicts with the bearing life requirement across the entire curve specified in section 2.02.A	Specification section 11310-2.02A is correct. L-10 Bearing life shall be a minimum of 100,000 hours at all points along the usable portions of the pump curve at maximum pump speed.
24.	2.01.L Three options are listed but option 2 says for all pumps over 100hp vibration sensors should be included. Is a vibration sensor required for all three monitoring options?	Only if electing to comply with option 2 for protection of the pumps. Only 1 of the 3 options provided in section 2.01.L is required for compliance with the specifications.
25.	2.02 Schedule calls for three pumps and the drawing shows 4 pumps. Please confirm if the job is for 3 or 4 pumps.	The project includes the replacement of four (4) dry weather pumps.
26.	Specification Section/Page 01520-2 requires contractor to put station back into operation and to stop by pass pumping at the end of each work day--- Can temp. by pass pumping continue through the night until all work is completed. Could be several weeks at a time.	See clarification 'A' below. The station has the ability to isolate wet wells such that one wet well could be closed for construction activities while the other stays active. Each wet well contains two pumps. It is anticipated that with ability long term bypass will not be necessary, but it is the Contractor's responsibility to determine their best and most efficient method of installation.

27.	What is the backfill material of the existing pump station? What was called for and installed for backfill between new concrete pump station wet well structure and earth/rock existing ground?	The actual backfill material used around the existing pump station and the manner in which it was installed exactly are unknown, as there are no as-built records or field inspection reports confirming the materials or methods used during original construction. However, notes from the original construction plans indicate that compacted structural fill was intended, with the following specification: "Compaction of backfill within 2 feet of foundation walls shall be accomplished with hand equipment. Where fill is required on both sides of foundation wall, bring the fill up each side simultaneously and uniformly." This suggests that granular backfill placed in controlled lifts was expected, but in the absence of documentation, the actual field conditions and compliance with these requirements cannot be confirmed.
28.	It the prebid meeting sign in sheet in Addendum 2 correct? The title page says Floyds Fork with the bid date of December, 2024. Thank you.	This is the correct sign in sheet from the mandatory EHPS – Phase 2 prebid meeting although the title references the incorrect project.
29.	It appears the 30" Wall Pipes with face plate flanges at the wall are to be a custom welded fabrication with no link seal at the cored openings as may be found in a typical thru-wall installation (reference Detail A on M-008). It is difficult to properly weld ductile iron pipe in this manner; therefore, please advise/confirm if the wall piping and the welded plate is to be ductile iron, or if stainless steel or painted carbon piping will be acceptable in this application. The installation will require at least one of the flanges to be field welded in order to limit the size of the opening as shown.	The 30-inch 'wall pipe' section shall be carbon steel with a minimum thickness of 0.34 inches and face plates shall have a minimum thickness of 0.50 inches. The interior of the wall piece shall be coated with Protecto 401 or approved equal and touched up after welded in place. The plain end of the steel pipe shall be sized to join either the MJ plug valve or push on DIP as shown on Drawing M-007. See revised Detail A from Drawing M-008 included in this addendum.

MAYOR LINDA GORTON

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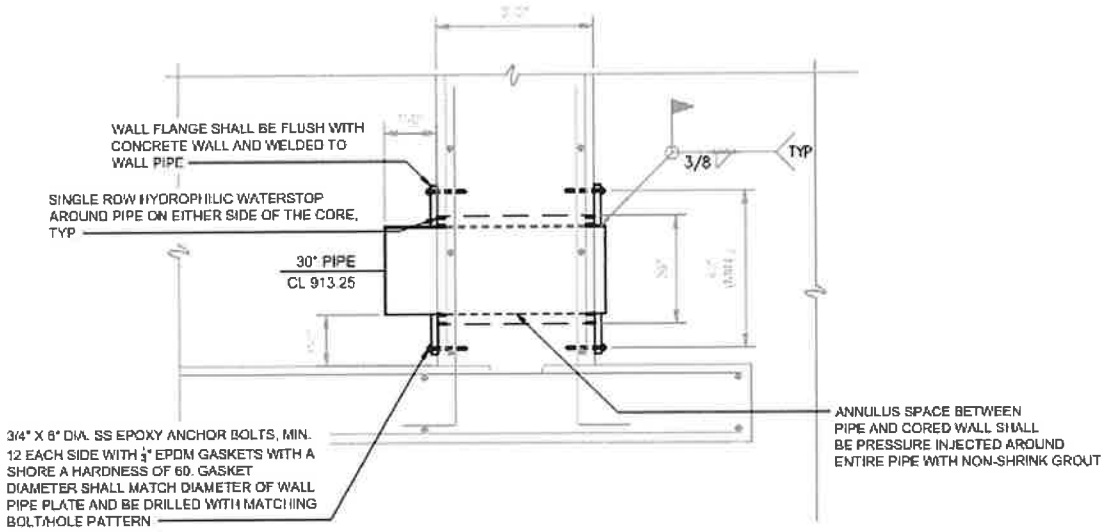
TODD SLATIN
DIRECTOR
CENTRAL PURCHASING

30.	Will all the pressure, level and flow transmitters be re-used, or is there a requirement for supply of new transmitters?	The design provides for re-use of pressure, level and flow transmitters shown on existing and revised drawings I-11 through I-15. Level range re-calibration is anticipated. Refer to level range notes on sheet I-23.
31.	Please provide the last soil borings or any other geotechnical information that may be available.	Two previous geotechnical reports from the preliminary design and phase 1 project are included in this addendum. These geotechnical reports are provided for informational purposes only. Since the completion of these reports, construction activities have taken place on the site, which may have altered the original subsurface conditions. As such, the findings and recommendations contained herein may no longer accurately reflect current site conditions and should not be solely relied upon for design or construction decisions without further evaluation. Contractors shall use these for informational purposes only.
32.	What material is the existing 20" pipe (sheet note 7 on sheets C-001 & C-002)?	Ductile Iron Pipe

125 Lisle Industrial Ave., Suite 180, Lexington, KY 40511 / 859.425.2400 Phone / 859.254.7787 Fax / lexingtonky.gov

2. DRAWINGS

A. Drawing M-008 – Mechanical Pump Station – Detail A
   a. Replace Detail A on Drawings M-008 with the following detail.



A DETAIL
NOT TO SCALE

3. SPECIFICATIONS

A. Specification Section 11310 – Solids Handling Submersible Sewage Pumps
   a. Section 1.08 – Delete this section in its entirety and replace with the following: Instead of preparing level 1 analysis for wet pit submersible pumps, perform factory and field vibration testing at 50 rpm speed intervals across the full range of operations to validate that there is no vibration in excess of HI 9.6.4 and no apparent resonance condition.
   b. Section 2.01.G.2 - L-10 bearing life requirements shall be changed to state the following: L-10 bearing life shall be a minimum of 100,000 hours at all points along the usable portion of the pump curve at maximum pump speed.

c. Section 2.02.A – Change Number of Units from 3 to 4. Add pump identification number 403 to account for the 4th pump.
d. Section 3.03.E.1 – Revise paragraph to be the following: After installation and as soon as conditions permit full speed operation, and in the presence of the Engineer, have the vibration tests performed at 50 rpm speed intervals across the full range of operations in accordance with ANSI/HI 9.6.4 on each unit to (a) prove compliance with specified limitations, and (b) prove that there are no field installed resonant conditions due to misalignment, the foundation, or the connecting piping and its supports, when operating at any speed within the specified operating range.

B. Specification Section 17410 – Basic Control Instrumentaiton
   a. See attached specification which includes revisions as described in the addenda.

4. CLARIFICATIONS

A. During the construction period, the contractor is required to maintain a minimum of 2 dry weather pumps in operation at all times. The contractor shall also maintain wet weather pump station operation as much as practicable. The maximum acceptable down time for the wet weather pump station for the installation of the connector pipe shall be 5 days (one working week Monday to Friday). In addition this work should occur during a time of extended dry weather so that the wet weather pumps are unlikely to be needed during this period.

B. Existing duty/dry weather pumps.
   a. There are currently two operational dry weather pumps at the EH Pump Station. Two additional pumps have been ordered and are expected to be delivered around the time the project Notice to Proceed is issued. The Contractor may relocate the two existing pumps to any of the four available pump guiderails and bases, as needed, to facilitate the isolation of each dry weather wet well during construction of the project.

Todd Slatin

Todd Slatin, Director
Division of Central Purchasing

MAYOR LINDA GORTON

LEXINGTON

TODD SLATIN
DIRECTOR
CENTRAL PURCHASING

All other terms and conditions of the Bid and specifications are unchanged.
This letter should be signed, attached to and become a part of your Bid.

COMPANY NAME: _____

ADDRESS: _____

SIGNATURE OF BIDDER: _____

125 Lisle Industrial Ave., Suite 180, Lexington, KY 40511 / 859.425.2400 Phone / 859.254.7787 Fax / lexingtonky.gov

SECTION 17410

BASIC MEASUREMENT AND CONTROL INSTRUMENTATION MATERIALS AND METHODS

PART 1 – GENERAL

1.01 WORK INCLUDED

A. The Contractor, through the use of a Pre-Approved System Supplier, shall furnish all materials, labor, tools, equipment, supplies and services necessary to install all process control and instrumentation equipment complete as specified herein and shown on the Drawings. System Supplier services include installation, PLC/OIT/HMI programming, instrument calibration, testing, commissioning, training, documentation, and requirements as further defined in the Contract Documents. The Contractor shall be responsible for the expense of changing Drawings or structures, or any other expense necessitated by reason of installing alternative equipment. The Contractor will assume the responsibility for the satisfactory operation of any and all equipment offered.

B. The following equipment specification is included to establish the quality of equipment to be obtained. It is the intent of these Specifications to obtain industrial quality instrumentation and control equipment. Equipment furnished shall be accepted by the Engineer, prior to purchase by the Contractor.

C. Auxiliary and accessory devices necessary for system operation or performance, such as transducers or relays to interface with equipment provided under other Sections of this Specification, shall be included whether specified or not, at no extra cost.

D. In order to ensure proper integration and compatibility of the plant instrumentation and control systems, the systems must be supplied by a single provider of instrumentation and control equipment. This is not to say that all equipment being supplied shall be manufactured by a single manufacturer, but rather that a single provider of instrumentation and control equipment shall be responsible for supplying the complete system. To facilitate the Owner's future operation and maintenance, products performing the same function shall all be of the same manufacturer, type, and model number.

E. Substitutions on functions or equipment specified will not be acceptable. In order to ensure the interchangeability of parts, the maintenance of quality, the ease of interfacing between the various subsystems, and the establishment of minimums with regard to ranges and accuracy, strict compliance with the above requirements shall be maintained. In order to ensure compatibility between all equipment, it shall be the responsibility of the system supplier hereunder to coordinate all interface requirements with mechanical and electrical system suppliers and furnish any signal isolation devices that might be required.

F. Equipment shall be fabricated, assembled, installed, and placed in proper operating condition in full conformity with detail drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer as accepted by the Engineer.

G. The instrument supplier for this Contract shall be responsible for making the modifications shown on the Drawings and for recalibrating all instruments and placing them in proper working order.

1.02 RELATED WORK

A. The following Sections of this Specification Division contain requirements on instrumentation and control equipment and software which are considered to be covered by applicable requirements of this section (and shall be included in the bid by a single Instrumentation Supplier for this Project):

1. Section 17311 – PLC Hardware and Software
2. Section 17420 - Instruments
3. Section 17430 - Boxes, Panels and Control Centers
4. Section 17480 - Instrument Lists and Reports
5. Section 17490 - Measurement and Control Commissioning

B. The following Divisions of these Specifications contain requirements on equipment furnished by other suppliers that must interface with the instrument system, or on methods and materials to be performed/used in the installation and/or wiring of the instrumentation system.

1. Division 1 - General Requirements
2. Division 11 - Equipment
3. Division 16 - Electrical

1.03 QUALITY ASSURANCE

A. The system supplier shall be required to demonstrate a minimum of 4 years recent, past experience in the design, manufacture, PLC/OIT/HMI programming, and commissioning of instrumentation and control systems of comparable size, type, and complexity to the proposed project. Further, the manufacturer must have at least 10 similar systems in operation currently. The system supplier shall be required to have his own in-house capability to handle complete system engineering, fabrication, and testing.

B. The system supplier shall have in his employ the capable personnel for detail engineering, coordination, drafting, procurement and expediting, scheduling

construction, testing inspection, installation, PLC/OIT/HMI programming, start-up service for calibration and commissioning, and warranty compliance for the period specified.

C. Pre-Approved System Suppliers are as listed below:

1. Rawdon Myers, Inc.

2. LOVO Systems

3. AEES

~~B.~~

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1.04 REFERENCES

A. The Contractor is referred to Standards and Practices for Instrumentation published by the International Society of Automation (latest edition), for terminology, symbols, methods and practices used or described herein or on the Drawings.

1.05 SUBMITTALS

A. General

1. Complete detail Drawings of the instrumentation and control systems and all components shall be submitted in 3 copies in a 3-ring loose-leaf cardboard reinforced vinyl binder to the Engineer for preliminary review. They shall include installation instructions, operation and maintenance instructions, descriptive literature, connection drawings, and parts list for each item as well as individual control schematic drawings for each item.

2. The Contractor shall make any corrections or changes required by the Engineer, within the scope of the Drawings and Specifications, and return copies in 3-ring loose-leaf cardboard reinforced vinyl binders for final review and distribution. Number of copies shall be as specified in Special conditions and as agreed at the pre-construction conference.

3. Should any system submitted in the shop drawings not meet with the Engineer's acceptance as to conformity with requirements of the Drawings and Specifications, it shall be the responsibility of the successful Contractor to make whatever changes are necessary for acceptance at no extra cost to the Owner.

B. Detailed Requirements - Instruments/Hardware

1. Detailed information for each instrument or control device shall be submitted, including manufacturer's descriptive literature and a specific data sheet for each device which shall include as a minimum:

a. Tag number assigned by the Contract Documents.

b. Product (item) name used herein and on the Contract Drawings.

c. Manufacturer's complete model number.

d. Location of the device.

e. Input - output characteristics.

f. Electrical characteristics.

g. Range, size, and graduations.

h. Physical size with dimensions, enclosure NEMA classification, and mounting details.

i. Materials of construction of all components.

j. Instrument or control device sizing calculations where applicable.

k. Certified calibration data on all flow metering devices.

2. Submit a detailed loop diagram, for each monitoring or control loop, each on a single 8 ½ in. x 11 in. sheet. The format shall be the Instrument Society of America, Standard for Instrument Loop Diagrams, ISA-S5.4.

3. The data sheets shall be provided with an index and proper identification and cross-referencing. Partial submittals will be rejected.

4. Submit detailed drawings concerning control panels and/or enclosures including:

   a. Cabinet assembly and layout drawings to scale.

   b. Fabrication and painting specifications.

   c. I/O layout.

   d. Elementary panel wiring diagrams

   e. Point to point wiring diagrams depicting wiring within the panel as well as connections to external devices.

   f. Color samples for paint selection by the Engineer and/or Owner.

   g. Panel submittal drawings shall be on 11 in x 17 in. sheets.

5. Exceptions to the Specifications or Drawings shall be clearly indicated in the submittal by the system supplier. Data shall contain sufficient details so a proper evaluation may be made by the Engineer.

6. Prior to final acceptance, the final shop drawing submittal, which is to include Installation, Operation, and Maintenance instructions, shall be updated to reflect "As Constructed" status, and shall provide at least the following as a minimum:

   a. A comprehensive index.

   b. A complete "As Constructed" set of accepted shop drawings.

   c. A complete list of the equipment supplied, including serial numbers, ranges, and pertinent data.

   d. Full specifications on each item.

   e. System schematic drawings "As Constructed", illustrating all components, piping and electrical connections of the systems supplied under this Section.

   f. Detailed service, maintenance, and operation instructions for each item supplied.

   g. Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.

   h. The operating instructions shall also incorporate a functional description of the entire system, with reference to the systems schematic drawings and instructions.

   i. Complete parts lists with stock numbers and name, address, and telephone number of the local supplier.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Shipping Precautions:

   1. After completion of shop assembly, factory test, and acceptance, all equipment, cabinets, panels, and consoles shall be packed in protective crates and enclosed in heavy duty polyethylene envelopes or secured sheeting to provide complete protection from damage, dust, and moisture. Dehumidifiers shall be placed inside the polyethylene coverings. The equipment shall then be skid-mounted for final transport. Lifting rings shall be provided for moving without removing protective covering. Boxed weights shall be shown on shipping tags together with instructions for unloading, transporting, storing, and handling at the job site.

   2. Special instructions for proper field handling, storage and installation required by manufacturer for proper protection, shall be securely attached to each piece of equipment proper to packaging and shipment.

B. Identification:

1. Each component shall be tagged to identify its location, tag number and function in the system. Identification shall be prominently displayed on the outside of the package.

2. A permanent stainless steel or other non-corrosive material tag firmly attached and permanently and indelibly marked with the instrument tag number, as given in the tabulation, shall be provided on each piece of equipment supplied under this Section.

C. Storage:

1. Equipment shall not be stored out-of-doors. Equipment shall be stored in dry permanent shelters including in-line equipment, and shall be adequately protected against mechanical injury. If any apparatus has been damaged, such damage shall be repaired by the Contractor at his own cost and expense. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such tests as directed by the Engineer. This shall be at the cost and expense of the Contractor, or the apparatus shall be replaced by the Contractor at his own expense.

1.07 WARRANTY (MAINTENANCE CONTRACT)

A. A written total instrument maintenance contract shall be provided to the Owner, executed by the system supplier as a part of the work under this Section. The maintenance contract shall include all labor, parts, and emergency calls providing on-site response within 48 hours, to provide complete instrument system maintenance for a period of one year after the date of final acceptance of the system. The maintenance contract shall also include a minimum of 2 semi-annual preventive maintenance visits by a qualified serviceman of the supplier who is familiar with the type of equipment provided for this project. Each preventive maintenance visit shall include routine adjustment, calibration, cleaning, and lubrication of all system equipment and verification of correct operations. Emergency maintenance procedures or plant visits may coincide with a scheduled preventive maintenance visit, however, they shall not replace the work intended to be performed during a preventive maintenance visit. The system supplier shall have full responsibility for the preventive and corrective maintenance including replacing of defective components, maintaining sufficient spare parts on-site, and complete calibration of all components under this section, all at no cost to the Owner. The maintenance contract shall not begin until both the instrumentation training course and the system acceptance test have been successfully completed, at which time the Owner shall be capable of performing necessary preventive maintenance, and all instruments shall be functional.

B. During the one-year maintenance period, observation of maintenance operations by designated Owner personnel, and the instruction of said personnel in the details of the maintenance work being performed shall be provided.

C. A complete written report shall be furnished the Engineer and Owner after each scheduled and unscheduled visit, giving problems corrected, systems needing recalibration, and recommendations to prevent recurrence, if applicable.

D. The costs for the one-year maintenance service contract shall be included in the Contract price.

1.08 TRAINING

A. A training program shall be set up and conducted by the major equipment manufacturer furnishing the instrumentation package. The training session shall be for a minimum period of 1 day uninterrupted and shall be conducted at the pump station.

B. A course outline showing the material to be covered shall be submitted to the Engineer for review. The training program shall include both classroom and "hands-on" instruction for each instrument supplied under this group of the Specifications and shall furthermore include operational training, maintenance training, and training on use of calibration equipment.

C. As the equipment installed at the plant shall be used for the "hands-on" training, the training program shall not be conducted until all of the systems are operational, and operational related "punch list" items are corrected.

D. Training on equipment supplied by a manufacturer other than the major equipment manufacturer shall be by the original equipment manufacturer, and shall be scheduled in the training programs by the major equipment manufacturer. Exceptions may be granted if the instructor demonstrates adequate knowledge on the care and operation of the other manufacturers' equipment.

E. The training programs shall be conducted at a time mutually agreeable to the Engineer, Owner, Contractor, and Supplier. The Owner shall decide how many of his personnel shall attend the training. A representative of the Engineer may observe the training in progress. The Owner shall have the right to videotape all training as it is conducted.

F. The supplier shall make use of audio-visual aids in the training courses and shall provide the OWNERS staff his undivided attention (i.e., shall not conduct his company business during training hours) for the full 1 day. The supplier shall furnish training participants with written handouts, preferably copies of the shop drawing submittal books, up to a maximum of 6 copies, for purposes of familiarization with the shop drawings, and to assist in explanations.

PART 2 – PRODUCTS

2.01 GENERAL

A. All instrumentation supplied shall be of the manufacturer's latest design and shall produce or be activated by signals which are established standards for the water industry.

B. All electronic instrumentation shall be of the solid-state type and shall utilize linear transmission signals of 4 to 20 mAdc (milliampere direct current), however, signals between instruments within the same panel or cabinet may be 0-10 V.d-c (volts direct current), or other manufacturer standard.

C. Outputs of equipment that are not of the standard signals as outlined, shall have the output immediately raised and/or converted to compatible standard signals for remote transmission. No zero based signals will be allowed for remote transmission.

D. All instruments shall be provided with mounting hardware and floor stands, wall brackets, or instrument racks as shown on the Drawings or as required.

E. All indicators and LED readouts shall be linear, direct reading in process units, unless otherwise noted. Percentage scales and indicators are prohibited.

F. All transmitters shall be provided with either integral indicators or conduit mounted indicators in process units, accurate to two percent, unless otherwise noted.

G. Electronic equipment shall be of the manufacturer's latest design, utilizing printed circuitry and suitably coated to prevent contamination by dust, moisture and fungus. Solid state components shall be conservatively rated for their purpose, to assure optimum long term performance and dependability over ambient atmosphere fluctuations and 0 to 95 percent relative humidity. The field mounted equipment and system components shall be designed for installation in dusty, humid, and slightly corrosive service conditions.

H. All equipment, cabinets and devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single manufacturer, in-so-far as possible, and shall consist of equipment models which are currently in production. All equipment provided shall be of modular construction and shall be capable of field expansion.

I. All equipment shall be designed to operate on a 60 Hertz alternating current power source at a nominal 115 volts, plus or minus 10 percent, except where specifically noted. All regulators and power supplies required for compliance with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.

J. All analog transmitter and controller outputs shall be 4-20 milliamperes into a load of 0-750 ohms, unless higher load capacity is required.

K. All switches shall have double-pole double-throw contacts rated at a minimum of 600 VA, unless specifically noted otherwise.

L. Materials and equipment used shall be UL listed (or other independent lab listed) wherever such listed equipment and materials are available.

M. All equipment shall be designed and constructed so that in the event of a power interruption, the equipment specified hereunder shall resume normal operation without manual resetting when power is restored.

N. All circuit boards in instruments mounted in damp locations or mounted outdoors shall be fungus proofed. All field transmitters mounted outside shall be equipped with sunshields and shall be capable of operation to -20° Fahrenheit.

O. Equipment installed in a hazardous area shall meet Class, Group and Division as shown on the contract drawings, to comply with the National Electrical Code. All power supply and signals coming from and going to hazardous areas shall have intrinsic safety barriers provided.

2.02 INSTRUMENTS AND ACCESSORY EQUIPMENT

A. Refer to other Division 17 Instrumentation Specification Sections for equipment requirements for field mounted primary devices, transmitters and secondary instruments, receivers and central control equipment.

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 00320 – PRELIMINARY GEOTECHNICAL EXPLORATION REPORT

1.01 PRELIMINARY GEOTECHNICAL EXPLORATION REPORT

The preliminary geotechnical report titled "Preliminary Geotechnical Exploration Report, Lexington-Fayette Urban County Government, East Hickman Pump Station, Lexington, KY" as investigated and written by Thelen Associates, Inc. and dated October 9, 2013, has been included in this specification section. The geotechnical report shall be used as a reference for the execution of this work and all recommendations included therein shall be followed in full.

END OF SECTION

PRELIMINARY GEOTECHNICAL EXPLORATION REPORT LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT EAST HICKMAN PUMP STATION LEXINGTON, KENTUCKY

Prepared for: **Hazen and Sawyer, P.C.**
Thelen Project No.: **130007LE**

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October 9, 2013

Hazen and Sawyer, P.C.
444 Lewis Hargett Circle, Suite 260
Lexington, Kentucky 40503

Attention: Mr. John Steinmetz, P.E.

Re: Preliminary Geotechnical
Exploration Report
Lexington-Fayette Urban Co. Govt.
East Hickman Pump Station
Lexington, Kentucky

Ladies and Gentlemen:

Contained herein are the results of preliminary geotechnical services performed for a study related to the design and construction at the proposed equalization tank site in Lexington, Kentucky. Hazen and Sawyer, P.C. is performing civil engineering design services for the proposed site as part of the Lexington-Fayette Urban County Government sanitary sewer improvement program. These services were performed in accordance with our Proposal-Agreement K213002 dated January 2, 2013. Authorization to proceed was provided by a signed Proposal-Agreement between Hazen and Sawyer and Thelen Associates, Inc.

We are enclosing with this report a reprint of "Important Information About Your Geotechnical Engineering Report" published by ASFE, Professional Firms Practicing in the Geosciences, which our firm would like to introduce to you at this time.

We appreciate the opportunity to provide the geotechnical services related to the proposed equalization basin(s) site selection. Should you have any questions concerning the information, conclusions or recommendations contained in this report, please do not hesitate to contact us.

Respectfully submitted,
THELEN ASSOCIATES, INC.

Lee J. Czor, P.E.
Senior Geotechnical Engineer

STATE OF KENTUCKY
LEE J. CZOR 24747
LICENSED PROFESSIONAL ENGINEER

LJC:dld
130007LE

Copies submitted: Hazen and Sawyer, P.C. (2 mailed / 1 email)

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October 9, 2013

PRELIMINARY GEOTECHNICAL EXPLORATION REPORT
LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT
EAST HICKMAN PUMP STATION
LEXINGTON, KENTUCKY

1.0 INTRODUCTION

Presented herein are the results of our Preliminary Geotechnical Exploration completed for the proposed Equalization (EQ) tank site to be constructed as part of the Lexington-Fayette Urban County Government (LFUCG) sanitary sewer improvement program. We understand that EQ tank structure may be constructed at the potential site described in the Project Characteristics section below. Our services for this project included a site reconnaissance at the site by our Senior Geotechnical Engineer, the drilling of four (4) preliminary test borings to evaluate the subsurface profiles at the location, laboratory soil sample review, preliminary engineering analyses, and preparation of this preliminary report. The preliminary findings, conclusions, and recommendations of this report are intended to assist in evaluating the site in light of the subsurface information obtained within the test borings.

2.0 PROJECT AND SITE CHARACTERISTICS

The potential EQ tank site is located at the site of the existing East Hickman pump station southeast of the intersection of Alumni Drive and Buckhorn Drive in Lexington, Kentucky. The site is bounded on the east by the Lexington Reservoir No. 4, a wooded area to the south, and by residential areas to the west and north. The property is currently accessed using a service road from Buckhorn Drive. The existing ground surface elevations vary across the site from about elevation 962 feet nearest Buckhorn Drive to a low of about 946 feet to the east of the existing pump station. As noted, the existing East Hickman Pump

Station is located on this site and contains several structures that bear at- and below-grade as well as piping and additional utility infrastructure required for the operations of the pump station.

Additionally, an alternate site to the south of the existing pump station (Alternate 1) is being considered for use. This site is primarily grass covered and partially wooded. The ground surface elevations vary from about 956 feet at the west end of the Alternate 1 site to about 942 feet at the east end of the site.

3.0 GEOLOGIC RESEARCH

Available United States Geological Survey (USGS) and Kentucky Geologic Service (KGS) maps were consulted to provide the following geologic descriptions of the proposed tank site. According to the USGS 7.5 minute geologic map of the Coletown Quadrangle (1967, GQ-647), the proposed project site is underlain by Ordovician Age bedrock of the Tanglewood Member of the Lexington Limestone. The Tanglewood Member is described on the map as Limestone (calcarenite), medium-light-gray to medium-brownish-gray in color, fine- to coarse-grained, sparry calcite cemented, very thin to thin even beds, partly cross-bedded, irregularly bedded in part. Structure contours drawn on the base of the Brannon Limestone Member of the Lexington Limestone show the bedrock to be relatively horizontal, with a regional dip in the project vicinity of less than one percent to the west-northwest. The Bryan Station Fault Zone, which trends from northeast to southwest, is shown on the mapping approximately 11,000 feet to the northwest of the proposed project site. Additionally, several smaller, unnamed faults are shown on the mapping to the south between 1 and 2 miles from the project site. According to the KGS mapping, the underlying Tanglewood Member bedrock within the project vicinity has a high to very high karst potential. No sinkholes have been mapped in the immediate vicinity of the proposed project site.

4.0 FIELD EXPLORATION

Our fieldwork for this project included a site reconnaissance by a Senior Geotechnical Engineer as well as the drilling of four (4) preliminary test borings. The test boring locations were selected by Thelen, and were staked in the field and surveyed for location

and elevation by Thelen personnel. The test boring locations and elevations were then plotted on the site and topographic maps provided by Hazen & Sawyer. These drawings were used to create the Proposed Site Boring Plan (Drawing 130007LE-1) included in the report Appendix.

The test borings were made with an ATV-mounted drill rig advancing hollow-stem augers. Sampling was accomplished ahead of the augers with a standard 2-inch outside diameter (O.D.) split spoon sampler driven with a 140-pound weight falling 30-inches. This procedure is described as the standard drive sample method (ASTM D1586) and results in the standard penetration test. Upon encountering the top of rock, rock coring operations were then performed in two (2) of the test boring locations (using an NXM core barrel per ASTM D2113) to approximate depths between 5 and 10 feet below the top of bedrock. Additionally, a groundwater observation well was installed at one (1) of the test borings. Observations for groundwater were made in the borings during, at the completion of, and at selected time intervals after completion of drilling.

Representative portions of the split spoon samples were selected by the Drilling Technician and sealed in properly labeled glass jars for return to our laboratory. The rock core samples were stored in labeled rock core boxes for transport to our materials testing facility. As the test borings proceeded, the Drilling Technician prepared field logs documenting the subsurface profile and noting soil and bedrock descriptions, stratifications, groundwater levels, standard penetration test resistance, and other pertinent data.

5.0 LABORATORY TESTING AND REVIEW

Following the completion of the test borings, the samples were returned to our Soil Mechanics Laboratory where they were reviewed and visually classified by the Project Geotechnical Engineer. Representative samples were selected for moisture content determinations and Atterberg limits testing. Soil classifications were developed in accordance with the Unified Soil Classification System (USCS). Thelen personnel performed laboratory testing in accordance with applicable ASTM methods for soil

testing. The results of these tests are included in the Tabulation of Laboratory Tests in the Appendix.

Final test boring logs were prepared based on the Drilling Technician's field logs, the Engineer's visual classification of the samples and the laboratory testing. Copies of the test boring logs can be found in the Appendix along with a "Soil Classification Sheet" and a "Rock Weathering and Strength Classification Sheet" which describes the terms and symbols used on the boring logs.

The dashed lines on the test boring logs identify the changes between the soil and/or bedrock types, which were determined by interpolation between samples and should be considered approximate. Only changes that occur within samples can be precisely determined and are indicated by solid lines on the logs. The transition between soil and bedrock types may be abrupt or gradual.

A Rock Quality Designation (RQD) was recorded for each bedrock coring run. The RQD is defined as the sum of the lengths of all pieces of intact core longer than 4 inches in a coring run, divided by the total length of the run. This value is then multiplied by one hundred to express the result as a percentage. The RQD provides a qualitative indication of rock quality. RQD values are presented on the Logs of Test Boring sheets in the Appendix to this report. Table 1 included below shows the correlation of RQD values with Rock Mass Quality.

TABLE 1. RELATION OF RQD TO IN SITU ROCK QUALITY*

RQD Percent	Rock Mass Quality
90-100	Excellent
75-90	Good
50-75	Fair
25-50	Poor
0-25	Very Poor

***From Naval Facilities Engineering Command, NAVFAC D.M. 7-1 (1982)**

It should be noted that the "Top of Rock" and "Auger Refusal" as determined in the rock-line soundings are defined as rock-like resistance to the advancement of the augers (Track-mounted drill rig advancing 3-1/4" continuous flight augers using carbide steel cutting teeth). This may indicate the presence of weathered bedrock, boulders, or rock remnants. A more accurate determination regarding the location of the top of rock cannot be made without performing rock coring.

6.0 SUBSURFACE CONDITIONS

Four (4) test borings (TB-101 through TB-104) were advanced at this proposed site on January 10, 2013. TB-101 and TB-102 were advanced at the primary portion of the site. TB-103 and TB-104 were competed at the Alternate 1 portion of the site. The locations of the test borings are shown on the Boring Plan, Drawing 130007LE-1, and are included in the Appendix to this report. The subsurface profile at this site generally consists of an intermittent layer of topsoil (encountered in TB-101) overlying fill materials, native silty/clayey soils, sediments (encountered in TB-104), and bedrock.

The fill materials primarily consisted of CLAYEY SILT/SILTY CLAY, with varying amounts of brick, roots, rock fragments, organic material, and crushed limestone aggregate. The fill materials were encountered at the ground surface or below the topsoil layer in each of the test borings in thicknesses ranging from approximately 2.0 to 4.5 feet, with an average thickness of approximately 2.6 feet. The consistency of the fill materials ranged from medium stiff to stiff. SPT "N" values ranged from 9 blows per foot (bpf) to 35 bpf, with an average value of about 15 bpf. Laboratory testing of three (3) jar samples of these fill soils indicated moisture content values of 21.6, 28.2 and 15.3 percent. Atterberg limits testing of one (1) representative sample of the fill materials from TB-101 yielded a liquid limit of 43 percent, a plastic limit of 27 percent, and a corresponding plasticity index of 16 percent. This material was classified as ML according to the Unified Soil Classification System (USCS).

A layer of sediment material was encountered below the fill at the TB-104 location between approximate depths of 2.0 and 7.0 feet. These sediments are described as brown to gray, moist to very moist, soft, CLAYEY SILT with medium sand particles. The

consistency of the materials was soft with SPT "N" values of 2 and 10 bpf. Laboratory moisture content testing of two (2) samples of this material yielded moisture content values of 28.0 and 29.8 percent.

A layer of native (residual) silty clay/clayey silt soils was encountered in each of the test borings below either the fill materials or sediments, and above the bedrock. This material was encountered in TB-101, TB-102, and TB-103 below the fill materials and in TB-104 below the sediments mentioned above. The material generally consists of brown to orange-brown and gray, moist, medium stiff to stiff SILTY CLAY and CLAYEY SILT with varying amounts of chert, weathered shale and limestone fragments and exhibits iron oxide staining. The material was encountered in thicknesses ranging from approximately 1.5 to 8.5 feet, with an average thickness of approximately 4.3 feet. SPT "N" values ranged from 8 to 11 bpf, with an average value of about 10 bpf. Laboratory testing of five (5) jar samples of these soils yielded moisture content values ranging from 22.1 to 27.7 percent, with an average value of 24.2 percent. Atterberg limits testing of one (1) representative sample of the native materials from TB-103 yielded a liquid limit of 48 percent, a plastic limit of 30 percent, and a corresponding plasticity index of 18 percent. This material was classified as ML according to the USCS.

The top of bedrock was encountered in TB-101 and TB-104 at depths of approximately 5.0 feet and 11.0 feet, respectively. Rock cores were advanced in these test borings to overall depths of 10.0 feet and 17.7 feet, respectively. Auger refusal was encountered in TB-102 and TB-103 at depths of 6.5 feet and 10.5 feet, respectively.

The bedrock core samples recovered generally consist of LIMESTONE. The limestone is described as light brown to gray, fine to coarse grained, thin to thick bedded, zones slightly weathered, with shale stringers, streaks, and partings. The recovery of the core runs was between 95 and 98 percent. The RQD values of the samples from TB-101 and TB-104 were 33 and 53 percent, respectively; corresponding to Rock Mass Quality values of "Poor" and "Fair".

Please note that auger refusal as used in this report is defined as rock-like resistance to the advancement of the augers (ATV-mounted drill rig advancing 3-1/4" hollow-stem augers using carbide steel cutting teeth). This may indicate the presence of weathered bedrock, boulders, or rock remnants. A more accurate determination regarding the location of the top of rock cannot be made without performing rock coring.

7.0 GROUNDWATER

Groundwater observations were made in the test borings during drilling, at the completion of drilling, and at time intervals following the completion of drilling. Observed groundwater depths are noted at the bottoms of test boring logs included in the Appendix. It is our experience that groundwater seepage can occur at the fill soil/native soil/bedrock interfaces, within fill soil deposits, and along the bedding planes within the bedrock. There may be seasonal fluctuations of the groundwater table based on temperatures and/or precipitation amounts. Groundwater levels may also be affected by construction activities or other site specific factors. Therefore, it should be noted that future groundwater levels may be encountered at different depths than encountered within our test borings.

8.0 PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

8.1 General Items

The preliminary conclusions and recommendations of this report have been derived by relating the general principles of the discipline of Geotechnical Engineering to the proposed EQ tank site outlined in the Project Characteristics section of this report. We understand that the design of the EQ tank is in the preliminary stage and, therefore, the final type, size, location, and elevation of the proposed structure have yet to be determined. After the site and design option for the structure is chosen, the grading plan developed, and the structural loads are determined, additional geotechnical explorations will be required to supplement the findings of this study.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic materials in the soil, bedrock, surface water, groundwater or air, on or below or around this site.

We completed the test borings for our preliminary evaluation of the site conditions and for the formulation of the preliminary conclusions and recommendations of this report. We assume no responsibility for the interpretation or extrapolation of the information by others.

Based on our engineering reconnaissance of the proposed site, the preliminary test borings, visual examination of the samples, laboratory testing of the soil samples, and our experience as Consulting Soil and Foundation Engineers in Kentucky, we have reached the preliminary conclusions and make the preliminary recommendations in this report.

From a geotechnical standpoint, the site can be developed for the proposed EQ tanks. In our opinion, the construction of a structure bearing below grade at the proposed site will be influenced significantly by the elevation and competency of the bedrock materials. Additionally, any structure (or portions thereof) designed to bear on a shallow foundation will be affected by the thickness and consistency of the fill, sediment, and/or native soil materials that are present above the bedrock surface. Preliminary conclusions and recommendations regarding site selection, earthwork, foundations, pipelines, and seismic concerns are presented in the following paragraphs.

8.2 Proposed Site

As noted in Section 2.0, the Proposed Site (primary) is located on the current LFUCG East Hickman Pump Station site. The results of our subsurface investigation indicate that the existing pump station site is underlain primarily by undocumented fill materials overlying native soils and bedrock. The bedrock was encountered at depths of approximately 5.0 and 6.0 feet below the top of the ground surface at TB-101 and TB-102, respectively. Groundwater was encountered within TB-102 at an approximate depth of 5.2 feet 14 days after completion of drilling.

As previously noted, one of the proposed options includes structures that may be built on the adjacent partially wooded property to the south of the East Hickman Pump Station site (Alternate 1). The Alternate 1 site is underlain by undocumented fill soils, relatively soft sediments, and native cohesive soils overlying the bedrock. Bedrock was encountered at

approximate depths of 10.5 and 11.0 feet below the ground surface within TB-103 and TB-104, respectively. Groundwater was encountered within TB-104 (at the completion of drilling) at an approximate depth of 3.0 feet below the ground surface.

Based on the results of the preliminary subsurface explorations, the unweathered bedrock encountered appears to be suitable for bearing of structural mat or deep foundation elements. The undocumented fill soils, sediments, and native soils are variable in thickness, composition and strength and are susceptible to consolidation due to induced loads. As such, it is our opinion that the fill, soft sediments, and medium stiff native soil deposits are not suitable for supporting proposed shallow-bearing EQ basin or pump station structures without risk of damaging differential settlements. In our opinion, any shallow foundations for structures bearing at-grade should be deepened to bear on the underlying stiff native clay soils or on bedrock. Alternatively, relatively short, reinforced concrete drilled shafts bearing in the bedrock may be used to support structural mat foundations. Additionally, the unsuitable overburden soils may be excavated and replaced with suitable compacted and tested fill soils in order to support shallow/spread footings for above-grade structures.

The deeper soil profile encountered at the Alternate 1 site would have to either be shored or laid back to maintain a stable excavation during construction. Sufficient space would be required around the proposed structure location(s) for laid back excavations, and if so, this would be expected to be more economical than a vertically shored excavation. The overburden materials are relatively weak and inconsistent in composition and consistency, with layers of soft sediments within the profile, so temporary layback slopes would need to be relatively flat, probably 2 horizontal to 1 vertical (2H:1V) or flatter.

As noted above, groundwater was encountered at depths of about 5 feet and 3 feet in TB-102 and TB-104 (respectively), so dewatering may be necessary. However, it should be noted that groundwater was only encountered in TB-104 (at the completion of drilling) at an approximate depth of 3.0 feet below the ground surface due to the introduction of water to aid in the rock coring process. In our opinion, groundwater may have an effect on the proposed construction. The Contractor should be prepared for surface and subsurface

infiltration during significant rain events during construction and must be prepared to remove seepage that accumulates in excavations. We recommend that good surface drainage be provided on the site both during construction and permanently thereafter in order to mitigate surface water infiltration.

Any structure(s) bearing below grade at this proposed site would likely have to be designed to resist buoyant uplift forces. The uplift forces should be determined based on the higher of the groundwater level or the 100-year flood level of the nearby creek adjacent to the site. The uplift forces should be resisted with the weight of the structure, the buoyant weight of soil above the structure (or appurtenances), and/or tie-down anchors extending through the foundation and into the limestone bedrock.

8.3 Karst

Based on the KGS mapping mentioned previously, there is low to high potential for karst features (such as sinkholes, cavities, or voids) to be encountered at and near the bedrock surface in the general vicinity of the proposed project sites. Open voids were not encountered during the rock coring at the proposed site, however, the presence of karst in the limestone bedrock could have implications for deep foundation design and construction, and should be further evaluated as part of the final geotechnical exploration for this project.

While the risk of future problems on any site underlain by carbonate limestone bedrock cannot be completely eliminated, it is possible to reduce the potential through control of surface water seepage. It is very important that adequate, positive drainage be established around the structure to promote the rapid drainage of surface water away from the structure. Finish grading in grass or landscaped areas should be sloped down and away from the structure at 5 percent for at least 10 feet, and then at least 2 percent thereafter. Storm water on pavements should be collected in a storm sewer system and properly disposed. All roof drainage and flows from air conditioning units, etc., should be piped and discharged directly into the storm sewer facilities. All underground piping should be leak-proofed. All utility trenches should be backfilled with compacted cohesive

on-site soils or low permeability flowable fill. Backfilling utility trenches and pouring footings should be completed as quickly as possible.

8.4 Seismic Liquefaction and Densification Potential

Seismic considerations for the proposed site include liquefaction and seismic densification potential in loose granular soils. Liquefaction occurs when saturated fine sands attempt to densify during shaking and there is an increase in the pore water pressure. The increased pore pressure causes a decrease in shear strength and increases the risk of bearing capacity failure or lateral spreading. Additional settlement within the sands typically follows the dissipation of the pore pressure. Seismic densification occurs when earthquake shaking densifies unsaturated loose sands, similar to the manner in which a vibratory compactor densifies a granular fill.

No loose, granular soils were encountered within the fill materials, sediments, and native soils at the proposed project sites. The generally cohesive nature of the soils encountered at the Proposed Site indicates that there is a low potential for liquefaction in the design earthquake event at these locations.

Determination of additional seismic design parameters such as Site Classification should be performed during the final geotechnical exploration when the preliminary bearing elevations of the proposed structure are available.

8.5 Pipelines

Pipelines for the proposed structure at the project site will be supported in the same variable soil types as described in Section 6.0. The fluid-filled pipelines should weigh less than the soils that are excavated to install the pipes. Therefore, the pipe foundation soils should not be loaded by the pipes to amounts greater than they have been loaded to in the past, so special foundation considerations should not be necessary. It may be necessary to locally remove and replace soft clays or silts below pipe level with a mat of compacted select material to provide a uniform working surface for pipe construction.

We anticipate that new pipelines will include both low-pressure gravity lines and higher-pressure force mains. The capacity of the various soils types to provide thrust restraint at bends in larger-diameter pressurized pipes will have to be considered. Concrete thrust blocks appropriately sized for the bearing capacity of the soils will be required for non-restrained-joint pressure pipe. Alternatively, restrained-joint pressure pipe can be used to reduce the size of, or eliminate, large concrete thrust blocks.

9.0 FINAL GEOTECHNICAL EXPLORATION

The opinions and conclusions presented in this report are preliminary. We recommend that they be used to select a site and design option layout for the proposed EQ basin and pump station. We also recommend that we be retained to participate in the site layout and grading selection process. The final design of the selected structure options, grading, pipelines, and pavements should be preceded by final geotechnical explorations that include additional test borings at proposed structure, pipeline, and pavement locations.

APPENDIX

ASFE Report Information

Tabulation of Laboratory Tests

Test Boring Logs

Soil Classification Sheet

Bedrock Weathering and Strength Classification Sheet

Boring Plan, Drawing No. 130007LE-1

Important Information about Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective; all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE THE GEOPROFESSIONAL BUSINESS ASSOCIATION

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THELEN ASSOCIATES, INC.
125 TRADE STREET
SUITE D
LEXINGTON, KENTUCKY 40511-2616

PRELIMINARY GEOTECHNICAL EXPLORATION
LFUCG EAST HICKMAN PUMP STATION
LEXINGTON, KENTUCKY
130007LE

TABULATION OF LABORATORY TESTS

Boring Number	Sample Number	Depth, ft.		Moisture Content, %	Atterberg Limits, %			USCS Classification
		From	To		LL	PL	PI	
101	1B	0.6	1.5	21.6	43	27	16	ML
	2	2.5	4.0	22.1				
102	1	0.0	1.5	15.3				
	2	2.5	4.0	28.2				
103	2	2.5	4.0	23.4				
	3	5.0	6.5	23.2				
	4	7.5	9.0	27.7	48	30	18	ML
104	2	2.5	4.0	28.0				
	3	5.0	6.5	29.8				
	4	7.5	9.0	24.7				

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Cincinnati, Ohio
Dayton, Ohio

LOG OF TEST BORING

CLIENT: Hazen and Sawyer, P.C.
PROJECT: Prelim. Geotechnical Exploration, LFUCG Tank Site Evaluations
Lexington, Kentucky
LOCATION OF BORING: As shown on Boring Plan, Drawing No. 130007LE-1

BORING #: 101
PROJECT #: 130007LE
PAGE #: 1 of 1

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Condition	Sample Number	Sample Type	SPT* Blows/6" / Rock Core RQD (%)	Recovery (in.)	Recovery (%)
957.5	Ground Surface	0.0	0						
956.9	TOPSOIL with clay mix.	0.6							
955.5	Mixed brown, moist, medium stiff FILL, clayey silt, trace brick, trace rock fragments, trace of organics, trace crushed limestone aggregate (ML).	2.0		I	1A 1B	DS	4-5-6	18	100
	Brown, moist, stiff SILTY CLAY, iron oxide stains, trace roots, trace chert fragments.			I	2	DS	5-6-5	18	100
952.5		5.0	5						
	Light brown to gray, hard, LIMESTONE, fine to coarse-grained, thin to thick bedded, with shale stringers, streaks, and partings. Top 10" slightly weathered, water stained, and fractured.			I	3	RC	RQD-33%	59	98
947.5		10.0	10						
	Bottom of test boring at 10.0 feet.		15 20 25 30						

Datum: Mean Sea Level
Surface Elevation: 957.5 ft.
Date Started: 1/10/2013
Date Completed: 1/10/2013
Hammer Weight: 140 lb.
Hammer Drop: 30 in.
Pipe Size: 2 in. O.D.
Hole Diameter: 8 in.
Rock Core Diameter: 1.875 in.
Boring Method: HSA-3.25
Drill Rig: CME 550X
Foreman: L. Wanstrath
Engineer: L. Czor

BORING METHOD
HSA = Hollow Stem Augers
CFA = Continuous Flight Augers
DC = Driving Casing
MD = Mud Drilling

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
DS = Driven Split Spoon
PT = Pressed Shelby Tube
RC = Rock Core

SAMPLE CONDITIONS
D = Disintegrated
I = Intact
U = Undisturbed
L = Lost

GROUNDWATER DEPTH
First Noted: Dry, Core @ 5.0 ft.
At Completion: 2.5 ft.
After: --
Backfilled: Immed.

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

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Lexington, Kentucky
LOCATION OF BORING: As shown on Boring Plan, Drawing No. 130007LE-1

BORING #: 102
PROJECT #: 130007LE
PAGE #: 1 of 1

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Condition	Sample Number	Sample Type	SPT* Blows/6" / Rock Core RQD (%)	Recovery (in.)	Recovery (%)
948.1	Ground Surface	0.0	0						
	Mixed brown, moist, stiff FILL, silty clay with roots, and limestone fragments.			I	1	DS	5-13-22	8	44
946.1		2.0							
	Mixed brown and gray, moist, medium stiff FILL, silty clay with wood and limestone fragments, little sand.			I	2	DS	15-8-5	18	100
943.6		4.5							
	Brown, moist, medium stiff SILTY CLAY with sand and limestone fragments.		5						
942.1		6.0		I	3	DS	30-50/4"	8	44
941.6	Gray LIMESTONE (bedrock).	6.5							
	Auger refusal and and bottom of test boring at 6.5 feet.		10						
	Note: Piezometer installed to 6.5 feet in depth.		15						
			20						
			25						
			30						

Datum: Mean Sea Level
Surface Elevation: 948.1 ft.
Date Started: 1/10/2013
Date Completed: 1/10/2013
Hammer Weight: 140 lb.
Hammer Drop: 30 in.
Pipe Size: 2 in. O.D.
Hole Diameter: 8 in.
Rock Core Diameter: --
Boring Method: HSA-3.25
Drill Rig: CME 550X
Foreman: L. Wanstrath
Engineer: L. Czor

BORING METHOD
HSA = Hollow Stem Augers
CFA = Continuous Flight Augers
DC = Driving Casing
MD = Mud Drilling

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
DS = Driven Split Spoon
PT = Pressed Shelby Tube
RC = Rock Core

SAMPLE CONDITIONS
D = Disintegrated
I = Intact
U = Undisturbed
L = Lost

GROUNDWATER DEPTH
First Noted: Dry
At Completion: Dry
After: 14 days 5.2 ft.
Backfilled: Immed.

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

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LOG OF TEST BORING

CLIENT: Hazen and Sawyer, P.C.
PROJECT: Prelim. Geotechnical Exploration, LFUCG Tank Site Evaluations
Lexington, Kentucky
LOCATION OF BORING: As shown on Boring Plan, Drawing No. 130007LE-1

BORING #: 103
PROJECT #: 130007LE
PAGE #: 1 of 1

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Condition	Sample Number	Sample Type	SPT* Blows/6" / Rock Core RQD (%)	Recovery (in.)	Recovery (%)
954.3	Ground Surface	0.0	0						
952.3	Mixed brown, trace gray, moist, stiff FILL, silty clay, little rock fragments, trace organics (wood fragments), trace construction debris.	2.0		I	1	DS	3-4-5	18	100
949.8	Brown and orange brown, moist, stiff SILTY CLAY, trace chert, little iron oxide stains, trace weathered shale.	4.5		I	2	DS	5-6-5	18	100
947.3	Brown, moist, medium stiff SILTY CLAY, trace iron oxide stains.	7.0	5	I	3	DS	4-4-4	18	100
943.8	Brown, moist, stiff CLAYEY SILT with chert fragments and chert sand (ML).	10.5	10	I	4	DS	3-4-6	18	100
	Split spoon refusal at 10.0 feet. Auger refusal and and bottom of test boring at 10.5 feet.			I	5	DS	50/0"	0	
			15						
			20						
			25						
			30						

Datum: Mean Sea Level
Surface Elevation: 954.3 ft.
Date Started: 1/10/2013
Date Completed: 1/10/2013
Hammer Weight: 140 lb.
Hammer Drop: 30 in.
Pipe Size: 2 in. O.D.
Hole Diameter: 8 in.
Rock Core Diameter: --
Boring Method: HSA-3.25
Drill Rig: CME 550X
Foreman: L. Wanstrath
Engineer: L. Czor

BORING METHOD
HSA = Hollow Stem Augers
CFA = Continuous Flight Augers
DC = Driving Casing
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SAMPLE TYPE
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SAMPLE CONDITIONS
D = Disintegrated
I = Intact
U = Undisturbed
L = Lost

GROUNDWATER DEPTH
First Noted: Dry
At Completion: Dry
After: --
Backfilled: Immed.

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

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LOG OF TEST BORING

CLIENT: Hazen and Sawyer, P.C.
PROJECT: Prelim. Geotechnical Exploration, LFUCG Tank Site Evaluations
Lexington, Kentucky
LOCATION OF BORING: As shown on Boring Plan, Drawing No. 130007LE-1

BORING #: 104
PROJECT #: 130007LE
PAGE #: 1 of 1

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Condition	Sample Number	Sample Type	SPT* Blows/6" / Rock Core RQD (%)	Recovery (in.)	Recovery (%)
943.3	Ground Surface	0.0	0						
941.3	Mixed brown, moist, medium stiff FILL, silty clay with trace roots, rock fragments and iron oxide stains.	2.0		I	1	DS	2-4-5	18	100
938.8	Gray and brown, moist, soft CLAYEY SILT with organics (sediment).	4.5		I	2	DS	4-5-5	18	100
936.3	Brown and gray, very moist, soft CLAYEY SILT with medium sand particles, trace organics (sediment).	7.0	5	I	3	DS	1-1-1	18	100
932.3	Brown and gray, moist, medium stiff SILTY CLAY with limestone fragments, iron oxide stains, trace sand.	11.0		I	4	DS	2-3-4	18	100
931.8	Gray LIMESTONE (bedrock).	11.5	10	I	5	DS	4-5-50/2"	12	86
925.6	Gray, hard LIMESTONE, fine to coarse-grained, thin to thick bedded, with shale stringers, streaks, and partings.	17.7	15	I	6	RC	RQD-53%	71	95
	Bottom of test boring at 17.7 feet.		20						
			25						
			30						

Datum: Mean Sea Level
Surface Elevation: 943.3 ft.
Date Started: 1/10/2013
Date Completed: 1/10/2013
Hammer Weight: 140 lb.
Hammer Drop: 30 in.
Pipe Size: 2 in. O.D.
Hole Diameter: 8 in.
Rock Core Diameter: 1.875 in.
Boring Method: HSA-3.25
Drill Rig: CME 550X
Foreman: L. Wanstrath
Engineer: L. Czor

BORING METHOD
HSA = Hollow Stem Augers
CFA = Continuous Flight Augers
DC = Driving Casing
MD = Mud Drilling

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
DS = Driven Split Spoon
PT = Pressed Shelby Tube
RC = Rock Core

SAMPLE CONDITIONS
D = Disintegrated
I = Intact
U = Undisturbed
L = Lost

GROUNDWATER DEPTH
First Noted 11.0 ft., Core @ 11.5 ft.
At Completion 3.0 ft.
After --
Backfilled Immed.

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

THELEN ASSOCIATES, INC.
Geotechnical • Testing Engineers
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Lexington, Kentucky
Cincinnati, Ohio
Dayton, Ohio

SOIL CLASSIFICATION SHEET

NON COHESIVE SOILS
(Silt, Sand, Gravel and Combinations)

Density

Very Loose	- 5 blows/ft. or less
Loose	- 6 to 10 blows/ft.
Medium Dense	- 11 to 30 blows/ft.
Dense	- 31 to 50 blows/ft.
Very Dense	- 51 blows/ft. or more

Relative Properties

Descriptive Term	Percent
Trace	1 – 10
Little	11 – 20
Some	21 – 35
And	36 – 50

Particle Size Identification

Boulders	- 8 inch diameter or more	
Cobbles	- 3 to 8 inch diameter	
Gravel	- Coarse	- 3/4 to 3 inches
	- Fine	- 3/16 to 3/4 inches
Sand	- Coarse	- 2mm to 5mm (dia. of pencil lead)
	- Medium	- 0.45mm to 2mm (dia. of broom straw)
	- Fine	- 0.075mm to 0.45mm (dia. of human hair)
Silt		- 0.005mm to 0.075mm (Cannot see particles)

COHESIVE SOILS
(Clay, Silt and Combinations)

Consistency	Field Identification	Unconfined Compressive Strength (tons/sq. ft.)
Very Soft	Easily penetrated several inches by fist	Less than 0.25
Soft	Easily penetrated several inches by thumb	0.25 – 0.5
Medium Stiff	Can be penetrated several inches by thumb with moderate effort	0.5 – 1.0
Stiff	Readily indented by thumb but penetrated only with great effort	1.0 – 2.0
Very Stiff	Readily indented by thumbnail	2.0 – 4.0
Hard	Indented with difficulty by thumbnail	Over 4.0

Classification on logs are made by visual inspection.

Standard Penetration Test – Driving a 2.0" O.D., 1 3/8" I.D., sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30 inches. It is customary to drive the spoon 6 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the tests are recorded for each 6 inches of penetration on the drill log (Example – 6/8/9). The standard penetration test results can be obtained by adding the last two figures (i.e. 8+9=17 blows/ft.). Refusal is defined as greater than 50 blows for 6 inches or less penetration.

Strata Changes – In the column "Soil Descriptions" on the drill log, the horizontal lines represent strata changes. A solid line (————) represents an actually observed change; a dashed line (— — — —) represents an estimated change.

Groundwater observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc., may cause changes in the water levels indicated on the logs.

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Rock Weathering and Strength Classification Sheet

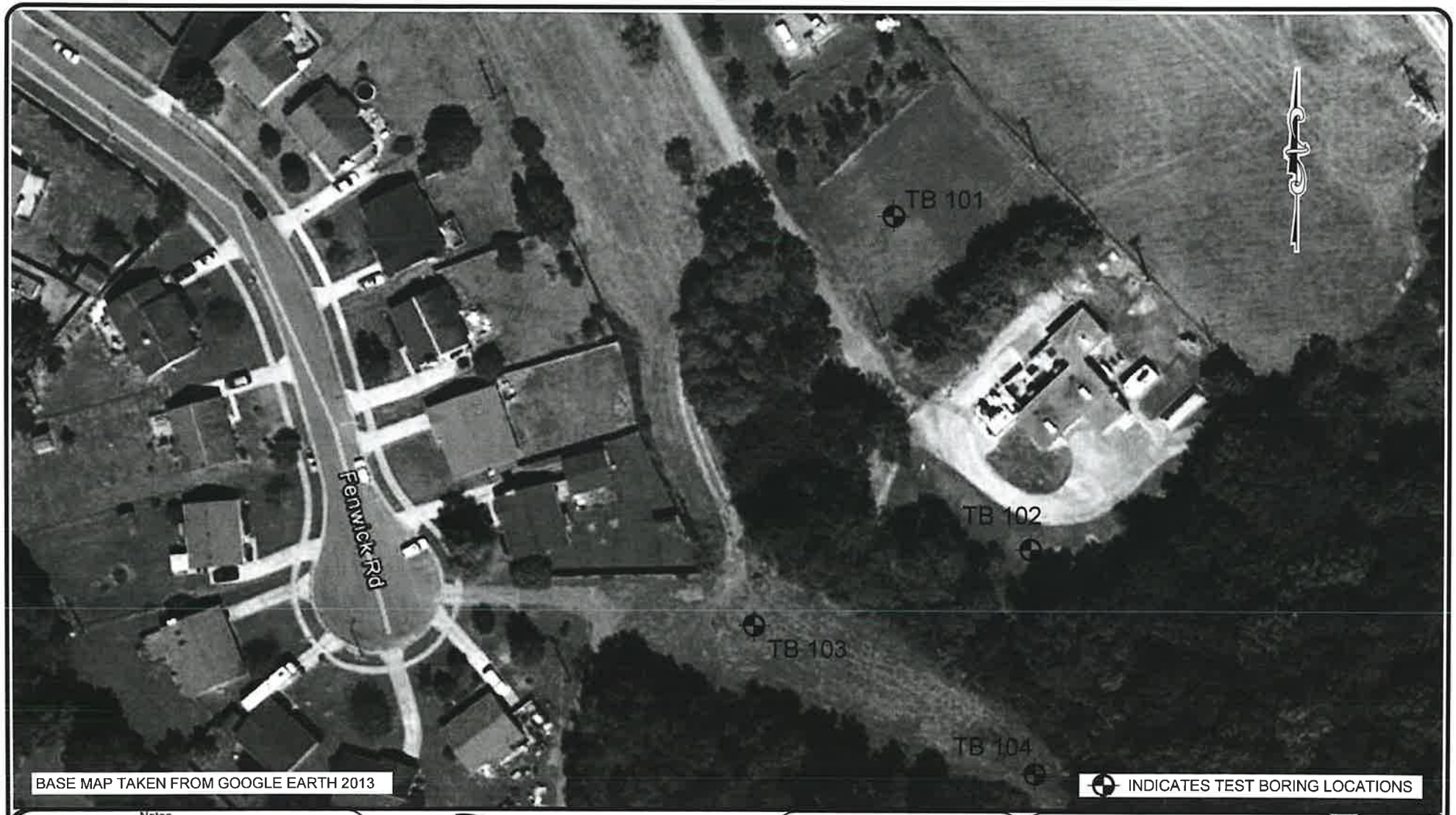
Rock Weathering

Descriptions	Field Identification
Unweathered	No visible sign of rock material weathering, perhaps slight discoloration on major discontinuity surfaces.
Slightly Weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally than it its fresh condition.
Moderately Weathered	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones.
Highly to Extremely Weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.
Residual Soil	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.

Rock Strength

Descriptions	Field Identification	Strength (psi*)
Extremely Weak	Indented by thumbnail	40-150
Very Weak	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife.	150-700
Weak	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer.	700-4000
Medium Strong	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with a single blow of a geological hammer.	4000-7000
Strong	Specimen requires more than one blow of a geological hammer to fracture.	7000-15,000
Very Strong	Specimen requires many blows with a geological hammer to fracture.	15,000-36,000
Extremely Strong	Specimen can only be chipped with geological hammer.	>36,000

*Approximate range of uniaxial compressive strength



Notes

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Erlanger, Kentucky • Cincinnati, Ohio • Dayton, Ohio

Title: TEST BORING PLAN

Client: Hazen and Sawyer, P.C.

Project: Prelim. Geotechnical Exploration
LFUCG Tank Site Evaluations
East Hickman EQ Site

Location: Lexington, Kentucky

Scale: 1"=50"

Date: 1/9/2013

Drawing No : 130007LE-1

SECTION 00321 – FINAL GEOTECHNICAL INVESTIGATION REPORT

1.01 FINAL GEOTECHNICAL INVESTIGATION REPORT

The final geotechnical report titled "Geotechnical Investigation, East Hickman Wet Weather Storage Facility, Lexington Fayette Urban County Government, Project Number 16-122G" as investigated and written by Greenbaum Associates, Inc. and dated December 5, 2016, has been included in this specification section. The geotechnical report shall be used as a reference for the execution of this work and all recommendations included therein shall be followed in full.

END OF SECTION

GREENBAUM ASSOCIATES, INC.
GEOTECHNICAL & MATERIALS ENGINEERS
994 Longfield Avenue
Louisville, Kentucky 40215
502/361-8447
FAX 502/361-4793

December 5, 2016

Mr. Kurt Zehnder, P. E.
GRW Engineers, Inc.
801 Corporate Drive
Lexington, KY 40503

Re: Geotechnical Investigation
East Hickman Wet Weather Storage Facility
Lexington Fayette Urban County Government
Project Number 16-122G

Dear Mr. Zehnder:

Attached is the report of the geotechnical investigation that we carried out for the East Hickman Wet Weather Storage Facility.

Limestone bedrock is shallow at this site. The pump station will need to bear on rock. The wet weather storage tank may bear on soil or rock depending on its bearing elevation. Foundation design criteria are provided for both in the report.

If you have any questions in regard to this report, please call.

Sincerely,

GREENBAUM ASSOCIATES, INC.

Sandor R. Greenbaum

Sandor R. Greenbaum, P.E.
Principal Engineer

GEOTECHNICAL INVESTIGATION

FOR

EAST HICKMAN WET WEATHER STORAGE FACILITY

LEXINGTON FAYETTE URBAN COUNTY GOVERNMENT

FOR

GRW ENGINEERS, INC.

801 CORPORATE DRIVE

LEXINGTON, KENTUCKY 40503

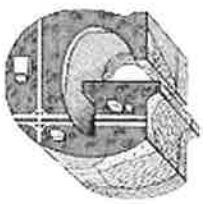
BY

GREENBAUM ASSOCIATES, INC.

994 LONGFIELD AVENUE

LOUISVILLE, KENTUCKY 40215

DECEMBER 5, 2016



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- 5.3 Drilled Pier Foundations
  - 5.3.1 Design of Rock Bearing Drilled Piers
  - 5.3.2 Construction Methods for Drilled Piers
- 5.4 Rock Anchors
- 5.5 Site Preparation and Earthwork
- 5.6 Earth Pressures
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- 5.8 Limitations

APPENDIX

Important Information about your Geotechnical Engineering Report (1 sheet)

Site Location Plan (1 sheet)

Boring Location Plan (1 sheet)

Soil Description Terminology/Rock Quality Determination (1 sheet)

Test Boring Reports (4 sheets)

Classification of Soils for Engineering Reports (1 sheet)

Grain Size Distribution (1 sheet)

Atterberg Limits Test (1 sheet)

1.0 Introduction

Lexington Fayette Urban County Government intends to build the East Hickman Wet Weather Storage Facility on a site just west of Lexington Reservoir Number 4. This facility is to include a replacement pump station and a 4 million gallon wet weather storage tank. The site is in a valley and is gently sloping, the tank site being wooded. The proposed tank and pump station locations are shown on the attached Boring Location Plan. A Site Location Plan is also included in the appendix.

We were contracted by GRW Engineers, Inc. to carry out a geotechnical investigation directed at determining foundation support characteristics of the materials upon which this tank and pump station will be supported. Work was coordinated through Mr. Kurt Zehnder, P.E. of GRW Engineers, Inc.

2.0 General Geology

The soils in the area of this facility are shown by the Kentucky Geological Survey to be residuum. Residuum is the residual product of weathering of the local bedrock.

Bedrock is shown by the Geological Survey to be the Tanglewood Limestone Number 2. This Limestone is described by the Kentucky Geological Survey as follows:

> Limestone (calcarenite), medium-light-gray to medium-brownish-gray, fossil-fragmental, fine- to coarse-grained, sparry calcite cemented, partly phosphatic; very thin to thin even beds, partly crossbedded, irregularly bedded in part; colonial corals occur locally in lower half. Unit is thickest in northwest, intertongues with Millersburg Member to east and with Clays Ferry Formation to south.

3.0 Investigation

One boring was carried out below the footprint of the proposed pump station by standard penetration procedures to refusal on bedrock, and then was continued to 61 feet by rotary coring procedures. Three borings were carried out around the perimeter of the proposed wet weather storage tank by standard penetration procedures to refusal on bedrock and then by rotary coring procedures

to 25 feet depth. CME-550 all-terrain-vehicle mounted drill rigs were used to carry out the borings through the use of 3-¼ inch inside diameter hollow stem augers, a cathead and safety hammer in the case of the boring at the pump station and an automatic hammer in the case of the borings for the tank. The boring at the pump station was staked in advance of our arrival. The center of the tank was staked in advance of our arrival and boring locations were measured by pulling off a 70 foot radius from that stake.

The standard penetration procedure involves driving a standard 2-inch diameter split spoon in the formation at selected intervals using a 140-pound hammer falling through 30 inches. The blow counts for each 6 inches of drive, to a total of 18 inches, are recorded and the number of blows for the 12 inches after the first 6 inches is a standard measure of the condition of the soil. As the split spoon is removed from the ground, it retrieves a sample of the soil in a disturbed condition. Nevertheless, this sample is suitable for certain classification tests and is representative of the soils at the depth tested.

An NQ double tube, wireline core barrel with a diamond drill bit was used to core apparent rock when auger refusal was encountered. The double tube core barrel itself minimizes the erosive action of the drilling fluid on the core and thereby improves core recovery. A swivel type double tube core barrel was used. The core barrel consists of a core barrel head, an outer barrel, an inner core recovery tube, a reaming shell, a core lifter and a coring bit. In operation, the inner tube remains stationary while the outer barrel is rotated. This minimizes the possibility of core disturbance through torsional forces and thereby improves recovery. Water passages direct the flow of the drilling fluid into the annular space between the two tubes and vents provide for the exit of the water from the barrel. The inner tube assembly is suspended from the outer tube head in such manner that downward force can be applied to both tubes while only the outer tube is rotated.

Soil samples were returned to the laboratory where a program of testing was carried out. This testing included a grain size analysis, an Atterberg Limits test and natural moisture determinations on almost all of the soil samples recovered.

Grain size determination arrives at a curve of grain size against that fraction of the soil that is finer than that particular grain size. It also allows the determination of the clay fraction, silt fraction, sand fraction, etc. in any particular soil sample. Based on this division of grain sizes, the field soils classifications are refined and the boring logs adjusted. In the case of fine grained soils, the soils are largely silt and clay; thus requiring that the soils be suspended in an aqueous medium and the rate at which the particles drop out is measured in order to arrive at the grain size distribution. Silt and clay grains are so fine that sieve analysis

alone will not function in this range. The coarse fraction of this sample is separated from the fine and run through a nest of sieves in order to further detail the grain size distribution in the coarse range.

The Atterberg Limits determination arrives at those moisture contents at which the soil turns from a solid state to a plastic condition (the Plastic Limit) and then from a plastic condition to a liquid condition (The Liquid Limit). The points in question are arrived at by standard procedures that accept specific cohesive and flow properties of the soil as standards for these limits. Knowing the moisture content of the soil in relation to these limits provides a broad measure of the soil strength and soil characteristics. The arithmetic difference between these two limits is called the Plasticity Index and all three together are used for classifying the soils in a number of standard systems.

The natural moisture determination arrives at the in-situ moisture content of the soil and is useful for correlating the strength of various samples of like texture and in conjunction with the Atterberg limits, gives a strong measure of the strength range the soils are likely to be found in.

4.0 Findings

4.1 Boring Results

The table below provides a tabulation of N-values as determined by the Standard Penetration Test and corrected for the energy of the automatic hammer where appropriate. Depth to auger refusal is also indicated.

Depth	B-1	B-2	B-3	B-4
	Pump Station	Wet Weather Storage Tank		
2 – 3.5 feet	6	8	8	8
5 – 6.5 feet	50/0"	10	14	16
Auger Refusal	6.0'	9.7'	9.0'	9.3'

4.1.1 Pump Station

This site is covered by about 6 inches of topsoil. Below this we found a mixture of coarse limestone and lean clay, perhaps shot rock. Moist, brown lean clay with limestone was encountered at 5 feet depth with limestone bedrock encountered at 6 feet depth.

Bedrock was found to be limestone with shale seams. A ~1-inch thick clay seam was encountered at 10.3 feet depth, but other than that singular clay seam the bedrock is intact. All of the 10 core runs recovered 100 percent of the rock cored and Rock Quality Designation (RQD) was found to be 55 to 100.

No groundwater was encountered in the boring at the pump station location, however groundwater should be expected to reach the level of the bedrock surface on a periodic basis.

4.1.2 Wet Weather Storage Tank

This site is covered by about 4 to 6 inches of topsoil. Below this we found moist, medium stiff to stiff lean clay with sand. Limestone bedrock with shale seams was encountered between 9.0 and 9.7 feet depth. Clay seams were encountered in boring B-4 down to 11.5 feet depth. Core recovery of rock core taken from all three borings was found to be 100 percent. Rock Quality Designation was found to range from 34 to 68.

Groundwater was encountered at 6 to 8 feet depth in the borings at the wet weather storage tank location, however this water was probably due to the area being inundated with water for a considerable period just prior to drilling as a result of a water main break. However, it should be expected that groundwater will be present at the bedrock surface on a periodic basis.

4.2 Laboratory Results

A sample of soil was tested and classified and was found to be lean clay. The results of this testing is summarized below with more detailed results provided in the appendix of this report.

Soil Sample	Grain Size Distribution			Atterberg Limits			Soil Classification	
	Percent Sand	Percent Silt	Percent Clay	Liquid Limit	Plastic Limit	Plasticity Index	Unified	AASHTO
B-4 @ 2' – 3.5'	23	39	38	39	22	17	CL	A-6

4.3 Seismicity

By the 2012/2015 edition of the Kentucky Building Code, this is a very dense soil and soft rock profile, site class C for a soil bearing structure or a rock profile, site class B for a structure bearing on rock. The Spectral Response Acceleration Coefficients as provided by U.S.G.S., FEMA Design Parameters are:

	S_S	S_{MS}	S_{DS}	S_1	S_{M1}	S_{D1}
Rock Bearing Foundations	0.190 g	0.190 g	0.126 g	0.091 g	0.091 g	0.061 g
Soil Bearing Foundations	0.190 g	0.227 g	0.152 g	0.091 g	0.155 g	0.104 g

5.0 Recommendations

5.1 Pump Station Foundations

This pump station will bear in unweathered bedrock well below any weathered zones such as the clay seam encountered at 10.3 feet depth. Rock bearing foundations may be designed based on an allowable net bearing capacity of up to 40,000 pounds per square foot.

The design of this pump station should take into account that water will be at the level of the bedrock surface on a periodic basis. Bedrock was found to be six feet below the ground surface in the boring at the location of the proposed pump station.

Once foundation bearing surfaces are exposed, an engineer or senior engineering technician from this office should be present to view all bearing surfaces. If unacceptable strata are encountered, undercut will need to extend to competent strata or to a level determined to be acceptable by the geotechnical engineer and should be refilled with lean concrete.

Rock bearing foundations must be at least 12 inches wide. Bedrock is not frost susceptible, so there is no minimum bearing depth for rock bearing foundations.

Settlement of foundations designed based on the above criteria should be well below that which is considered acceptable for this type of construction; that is total and differential settlement should be less than one-quarter inch.

For shallow foundations, friction along the base of the footing can be used to resist lateral forces. A friction coefficient of 0.55 may be used, which assumes that the footing concrete is placed directly against the natural cut faces. The coefficient of friction value recommended is an ultimate value and a minimum factor of safety of 1.5 must be applied when determining the allowable sliding resistance.

5.2 Wet Weather Storage Tank Foundations

This tank may bear either on soil or rock. Soils above four feet depth as measured from existing grade are competent to support foundations designed based on an allowable net bearing capacity of 2,000 pounds per square foot while foundations bearing below that level may be designed based on an allowable net bearing capacity of 3,000 pounds per square foot. Undercut to the four foot level and refill with material compacted in accordance with the requirements outlined is section 5.3 of this report will provide an allowable net bearing of 3,000 pounds per square foot for foundations bearing at a higher level.

Rock bearing foundations may be designed based on an allowable net bearing capacity of up to 6,000 pounds per square foot. This takes into account that occasional clay seams may be present in the shallow bedrock. Bedrock was found to be about 9 to 10 feet deep. If a crevice is present in the rock, it may be lined with non-woven geotextile and refilled with Kentucky Number 57 stone, placed and compacted with a vibratory compactor in two foot lifts. If this higher bearing value is required at a higher elevation, the soil may be removed down to rock and the excavation may then be refilled with either Dense Graded Aggregate or Kentucky Number 57 Stone to the bearing level. Rock bearing drilled piers are discussed in section 5.4.

Once foundation bearing surfaces are exposed, an engineer or senior engineering technician from this office should be present to view all bearing surfaces. If unacceptable strata are encountered, undercut will need to extend to competent strata or to a level determined to be acceptable by the geotechnical engineer and should be refilled with lean concrete.

Soil bearing foundations exposed to weather must bear at least 30 inches below finished grade in order to insulate the bearing strata from freezing. Interior foundations protected from freezing are exempt from this requirement. Continuous soil bearing footings must be at least 16 inches wide and isolated footings must be at least 24 inches wide. Rock bearing foundation must be at least 12 inches wide. Bedrock is not frost susceptible, so there is no minimum bearing depth for rock bearing foundations.

Settlement of soil bearing foundations designed based on the above criteria should be below that which is considered acceptable for this type of construction; that is total settlement should be less than one inch and differential settlement should be less than three quarters of an inch. Settlement of rock bearing foundations designed based on the above criteria should be well below that which is considered acceptable for this type of construction; that is total and differential settlement should be less than one-quarter inch.

For shallow soil bearing foundations, friction along the base of the footing can be used to resist lateral forces. A friction coefficient of 0.35 may be used, which assumes that the footing concrete is placed directly against the natural cut faces. A friction coefficient of 0.55 may be used for rock bearing foundations. The coefficient of friction value recommended is an ultimate value and a minimum factor of safety of 1.5 must be applied when determining the allowable sliding resistance.

5.3 Drilled Pier Foundations

Drilled pier foundations may be used to support the wet weather storage tank, if desired, though this is unlikely to be the least expensive foundation given the depth to bedrock.

5.3.1 Design of Rock Bearing Drilled Piers

Drilled piers socketed into rock will have an allowable concrete rock adhesion of 0.05 times the lesser of the concretes ultimate compressive strength or that of the intact rock. Concrete is likely to have a compressive strength (fc') of not more than 5,000 pounds per square inch (psi), which is less than the strength of the intact limestone and is similar to the strength of the intact shale. Concrete-rock adhesion will therefore be 36 kips per square foot (ksf) for 5,000 psi concrete and 29 ksf for 4,000 psi concrete. In addition, drilled piers will have an end bearing support. Drilled piers may be designed based on an allowable net bearing capacity of 4 ksf in addition to skin friction developed on the shaft for compression loading, but not in the case of uplift. In no case should a rock socket be less than 6 feet.

Drilled piers must be at least 24-inches in diameter, however, the first eight drilled piers should be at least 30 inches in diameter and must be cased to allow a five foot test hole to be drilled below the bearing surface of these drilled piers. These test holes should be distributed across the tank footprint to delineate and lateral variation in bedrock condition. The test holes must be at least 1.5-inches in diameter and a Senior Engineering Technician from this office must be present to examine the sides of the test hole using a hooked end feeler rod to determine the presence of voids or clay seams. If a void or clay seam is found to extend around

the entire perimeter of the test hole, that drilled pier will have to be drilled to below that level to reach a competent bearing stratum below the the void or clay seam encountered. At that point another five foot test hole should be drilled and examined to ensure no further voids or clay seams are present at greater depth. If the first eight test holes do not encounter voids or clay seams, then no further test holes will be required. If voids or clay seams are encountered in one or more of the test holes, further test holes may be required with drilled piers to allow access.

Pricing should take into consideration the possibility of additional test holes and additional rock removal.

Settlement of rock bearing drilled piers designed based on the above criteria should be well below that which is considered acceptable for this type of construction; that is total settlement should be ¼ inch or less.

5.3.2 Construction Methods for Drilled Piers

Drilled pier construction should conform to the following:

- During excavation of the shaft, the must be held plumb. When obstructions are encountered there is tendency for the shaft to veer out of plumb, so this is especially important where obstructions are encountered.
- If the sides of the hole will remain intact, it is not necessary to install a temporary casing in the hole unless personnel must enter the hole. However, if the sides of the shaft tend to collapse into the hole or if the rock bottom cannot be cleaned sufficiently, it may be necessary to install a temporary casing.
- Temporary casing may be required if water flows into the hole at such a rate that water cannot be limited to a depth of less than two inches. In this case it will be necessary to install a temporary casing and seal the hole by pressing or turning the casing into the rock to limit flow to a degree sufficient that pumping can control the flow. Once the casing is installed, the pump may be placed at the bottom of the hole to remove water, removing the pump immediately before concreting such that water in the hole never exceeds two inches in depth.
- Once the Geotechnical Engineer has approved the shaft for placement, the reinforcing steel may be installed in the shaft, providing the necessary clear cover. Once the reinforcing steel is placed, the concrete must be placed the same day. The Geotechnical Engineer should view the bottom again immediately before concreting.

- Concrete should be placed using a tremie hose or may be pumped to prevent segregation of the concrete during placement. Concrete should have a slump of 4 to 7 inches to ensure that it completely fills the shaft.

5.4 Rock Anchors

Rock anchors may be used to resist uplift due to buoyancy for both the wet weather storage tank and the pump station. In the case of the pump station, this structure is so deep that rock is unweathered and the bond zone can begin at the exposed rock surface. The ultimate bond strength of this limestone is 200 pounds per square inch to which a factor of safety of 2.0 should be applied. This is the same on the case of the wet weather storage tank with the exception that any bond developed in the top three feet of rock should be neglected due to the fact that clay seams may be present.

To protect the rock anchor against corrosion, the bar should be epoxy coated or galvanized and centralizers should be used to ensure that there is at least 1 inch of cover by grout.

Two rock anchors on opposite sides of the structure should be test loaded in tension to twice the design capacity of the anchor in accordance with ASTM D4435, "Standard Test Method for Rock Bolt Anchor Pull Test".

5.5 Site Preparation and Earthwork

All fill should be placed in lifts not exceeding 8 inches in uncompacted thickness and must be compacted to at least 98 percent of the soils maximum dry density as determined by the Standard Proctor (ASTM D-698). Soil moisture content should be within 2 percent of optimum as determined from the Standard Proctor.

Soil from any off-site borrow sources should be tested and approved by this office prior to being used on the site. Satisfactory borrow materials are those falling in one of the following classifications: GC, SM, SC, ML, or CL. Soil types MH, CH and OH soils and peat are unsatisfactory borrow materials.

The site should be maintained in a well-drained condition both during and after construction. Site grading should provide for drainage of surface run-off away from the tank and pump station.

The placement of compacted fill should be carried out by an experienced excavator with the proper materials. The excavator must be prepared to adapt his procedures, equipment and materials to the type of project, to weather conditions, and the structural requirements of the engineer. Methods and materials used in summer may not be applicable in winter; soil used in proposed fill may require wetting or drying for proper placement and compaction. Conditions may also vary during the course of a project or in different areas of this site. These needs should be addressed in the project drawings and specifications.

During freezing conditions, the fill must **not** be frozen when delivered to the site. It also must not be allowed to freeze during or after compaction. Since the ability to work the soil while keeping it from freezing depends in part on the soil type, the specifications should require the contractor to submit a sample of his proposed fill before construction starts, for laboratory testing. If the soil engineer determines that it is not suitable, it should be rejected. In general, silty sand, clayey sand, and cohesive/semi-cohesive soils should not be used as fill under freezing conditions. All frozen soil of any type should be rejected for use as compacted fill.

It is important that compacted fill be protected from freezing after it is placed. The excavator should be required to submit a plan for protecting the soil. The plan should include details on the type and amount of material (straw, blankets, extra loose fill, topsoil, etc.) proposed for use as frost protection. The need to protect the soil from freezing is ongoing throughout construction and applies both before **and** after concrete is placed, until backfilling for final frost protection is completed. Foundations placed on frozen soil can experience heaving and significant settlement, rotation, or other movement as the soil thaws. Such movement can also occur if the soil is allowed to freeze **after** the concrete is placed and then allowed to thaw. The higher the percentage of fines (clay and silt) in the fill, the more critical is the need for protection from freezing.

The contractor should be required to adjust the moisture content of the soil to within a narrow range near the optimum moisture content (as defined by the applicable Proctor or AASHTO Test). In general, fill should be placed within 2% of optimum moisture. The need for moisture control is more critical as the percentage of fines increases. Naturally occurring cohesive/semi-cohesive soil are often much wetter than the optimum. Placing and attempting to compact such soils to the specified density may be difficult. Even if compacted to the specified density, excessively wet soils may not be suitable as pavement subgrades due to pumping under applied load. This is especially true when wet cohesive/semi-cohesive soil is used as backfill in utility trenches and like situations. Excessively wet soil in thick fill sections may cause post-construction settlement beyond that estimated for fill placed at or near (±2%) the optimum moisture content.

5.6 Earth Pressures

Any retaining walls should be constructed with a drainage blanket of sand or a synthetic drainage material. Synthetic drainage media should be available from suppliers of geotextile. The wall should be drained at its base by a perforated PVC underdrain or weepholes at a spacing of not more than 10 feet. Where a relatively thin drainage blanket is used, the retaining wall should be designed based on a coefficient of active earth pressure (K_a) of 0.36 and a soil unit weight (γ_w) of 130 pounds per cubic foot. This results in an equivalent fluid pressure of 47 pounds per cubic foot. Where granular backfill completely fills the area defined by a plane extending upward from the base of the wall at a 45 degree angle, the retaining wall may be designed based on a coefficient of active earth pressure (K_a) of 0.27 and a soil unit weight (γ_w) of 130 pounds per cubic foot. This results in an equivalent fluid pressure of 35 pounds per cubic foot.

However, where the wall is restrained from movement, the wall must be designed based on the "at rest" earth pressure. The coefficient of "at rest" earth pressure (K_0) is 0.47 with a soil unit weight (γ_w) of 130 pounds per cubic foot in the case of a thin drainage blanket behind the wall, resulting in an equivalent fluid of 61 pounds per cubic foot unit weight. Where granular backfill completely fills the area defined by a plane extending upward from the base of the wall at a 45 degree angle, the retaining wall may be designed based on a coefficient of "at rest" earth pressure (K_0) of 0.43 and a soil unit weight (γ_w) of 130 pounds per cubic foot. This results in an equivalent fluid pressure of 56 pounds per cubic foot.

The table below summarizes the design earth pressures.

	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)	Coefficient of Earth Pressure at Rest (K_0)	Equivalent Fluid Pressure on Cantilever Walls	Equivalent Fluid Pressure on Braced Walls
Fill Material/Local Soils	0.36	2.77	0.47	47 pcf	61 pcf
Granular Backfill	0.27	3.69	0.43	35 pcf	56 pcf

Surcharge above the wall will add additional load. A uniform surcharge must be multiplied by the appropriate coefficient of earth pressure to determine the additional load applied to the wall.

Any retaining wall design must use appropriate factors of safety. It is critical that drainage be provided as mentioned earlier in this section in order to avoid

hydrostatic pressure. Hydrostatic pressure would increase pressure against the wall substantially.

5.7 Temporary Earth Slopes or Cuts

Temporary earth cuts necessary to construct foundations or utility lines should be no deeper than 4 feet without benching or sloping. Cuts deeper than this should be sloped no steeper than one horizontal to one vertical or should have benches every 2 feet of height equating to this slope. If vertical faces deeper than 4 feet are used, bracing designed for short term loads may be used. Excavations should comply with OSHA regulations. If soft soils are encountered, Greenbaum Associates, Inc. should view the cut face prior to personnel entering the excavation.

5.8 Limitations

We strongly recommend that bearing surfaces and compaction be monitored by Greenbaum Associates, Inc. Our technicians will be available to further assist you in providing these and other normally specified quality control services. The report is preliminary until such time as these examinations are completed to confirm conditions consistent with those discovered in the investigation.

The conclusions and recommendations offered in this report are based on the subsurface conditions encountered in the borings. No warranties can be made regarding the continuity of conditions between or beyond borings. If, during construction, soil conditions are encountered that differ from those indicated in this report, a representative of Greenbaum Associates, Inc. should inspect the site to determining if design modification is required.

This study was directed a specific pump station and wet weather storage tank at this location to be constructed within a reasonably short period after this study. Use for any other location, structures or substantial changes in construction period may invalidate the recommendations. The geotechnical engineer should be consulted relative to any substantial change in these.

This study is directed at mechanical properties of the soils and includes no sampling, testing or evaluation for environmental considerations.

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

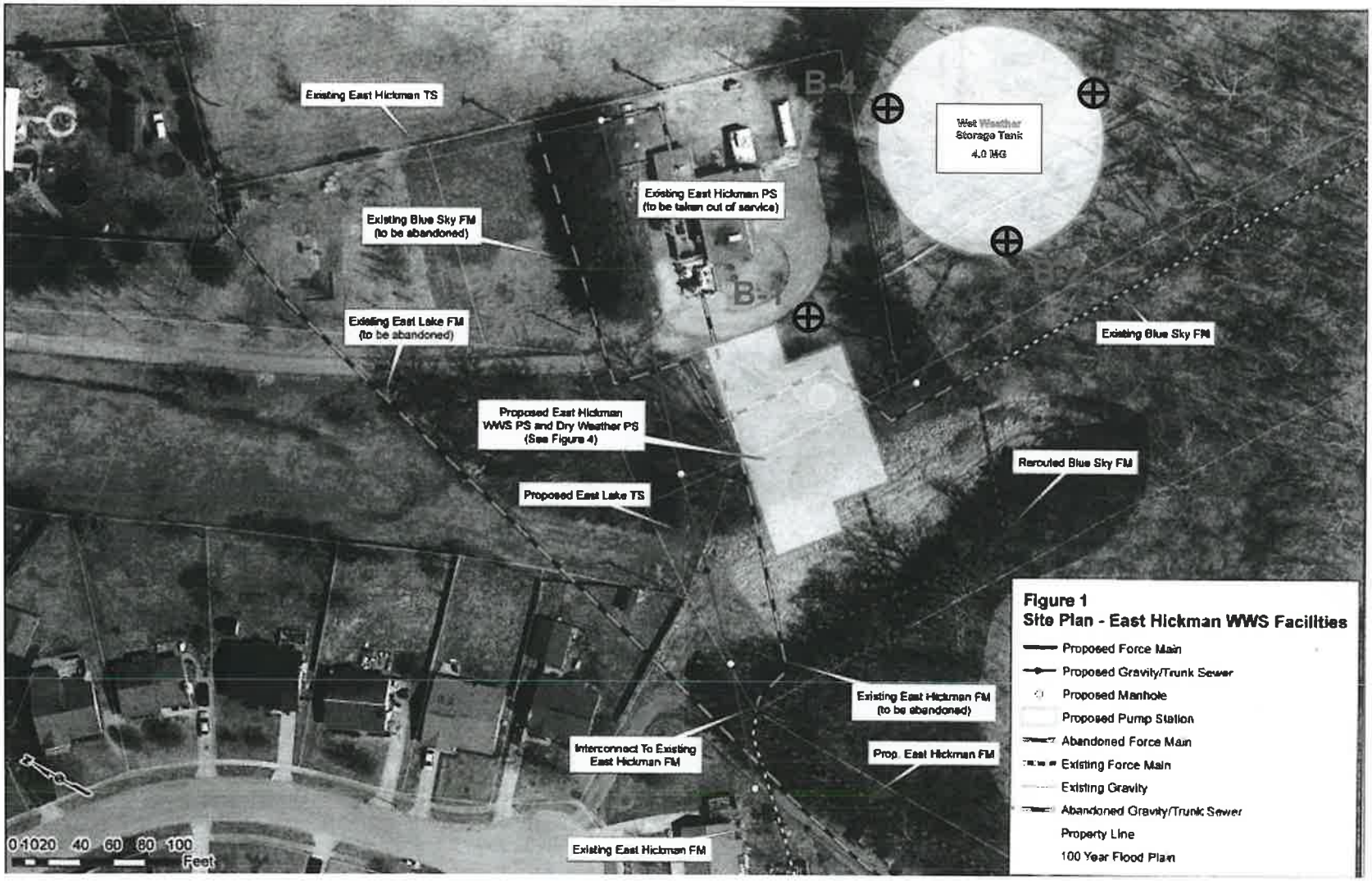
GEOPROFESSIONAL BUSINESS ASSOCIATION

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GRW Engineers, Inc.	Greenbaum Associates, Inc.	**Site Location Plan** East Hickman Wet Weather Storage Facility Lexington Fayette Urban County Government Greenbaum Project Number: 16-122G



GRW Engineers, Inc.	Greenbaum Associates, Inc.	**Boring Location Plan** East Hickman Wet Weather Storage Facility Lexington Fayette Urban County Government Greenbaum Project Number: 16-122G

SOIL DESCRIPTION TERMINOLOGY

Soils are identified and classified in this report according the the Unified Classification System with the following modifiers:

RELATIVE DENSITY OF GRANULAR SOILS

Description	Blows/Foot
Very Loose	0 to 4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	50 to 80
Extremely Dense	80+

CONSISTENCY OF COHESIVE SOILS

Description	N-value	q_u (tsf)
Very Soft	0 to 2	0 to 0.25
Soft	3 to 4	0.26 to 0.50
Medium Stiff	5 to 8	0.51 to 1.0
Stiff	9 to 15	1.1 to 2.0
Very Stiff	16 to 30	2.1 to 4.0
Hard	>30	4.1 to 8.0
Very Hard		8.1+

PARTICAL SIZES

Components		Size or Sieve No.
Boulders		over 12 inches
Cobbles		3 to 12 inches
Gravel -	Coarse	$^3/_4$ to 3 inches
	Fine	No. 4 to $^3/_4$ inch
Sand -	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40
Fines (silt and clay)		Finer than No. 200

SOIL MOISTURE

	Descriptive Term
Dry	Dry of Standard Proctor Optimum
Damp	Moist (sand only)
Moist	Near Standard Proctor Optimum
Wet	Wet of Standard Proctor Optimum
Saturated	Free Water in Sample

ROCK DESCRIPTION TERMINOLOGY

The Rock Quality Determination (Deere et. Al., 1969) method of determining rock quality as reported here was obtained by summing up the total length of core recovered in each run, counting only those pieces of core which are four inches (10 cm.) in length or longer and which are hard and sound. The sum is then represented as a percentage over the length of the run. If the core is broken by handling or by the drilling process, the fresh broken pieces are fitted together and counted as one piece provided that they the requisite length of four inches (10 cm.). RQD is reported as a percentage.

RELATIONSHIP BETWEEN RQD AND ROCK QUALITY

RQD (%)	Description of Rock Quality
0 to 25	Very Poor
26 to 50	Poor
51 to 75	Fair
76 to 90	Good
91 to 100	Excellent

Greenbaum Associates Inc
Louisville, Ky 40215 502-361-8447

Client: GRW Engineers, Inc.
Project: LFUCG East Hickman Wet Weather Storage Facility, Lexington, KY
Project No.: 16-122G

HOLE No. B-1

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **948.5** Station: **n/a**

Drilling Equipment: **CME-550 equipped with Safety Hammer** Drilling Method: **3 1/4 Inch Hollow Stem Auger**

Depth to water immediately: **Dry** Overburden: **6** Rock: **54** Total Depth: **60.0**

Logged By: **S. Greenbaum** Driller: **M. Wells** Date Logged: **6/3/16 - 6/7/16**

DEPTH (feet)	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)
0	SPT	0		Topsoil (6 inches) (OL) Coarse Limestone Pieces with Lean Clay	948.5
5	SPT	0		Moist, Brown Lean Clay with Limestone (CL) AUGER REFUSAL @ 6.0 FEET	945
	NX	98	37		940
10	NX	100	68	Limestone, Thin- to Medium-Bedded, Light Gray, with Occasional Dark Gray Beds (CL) Weathered Shale, Light Brown (3 inches) Limestone	935
15	NX	100	93	Brown Clay (10.3 to 10.4 ft.) Limestone, Medium- to Thick-Bedded, with Dark Gray Limestone Beds Limestone	930
20	NX	100	89		925
25	NX	100	95		920
30	NX	100	75		915
35	NX	100	83	Limestone, Thin- to Medium-Bedded, Light Gray, with Thin, Dark Gray Shale Seams	910
40	NX	100	55		905
45	NX	100	74		900
50	NX	100	100		895
55	NX	100	89		890
60				TERMINATED @ 61.0 FEET	

STANDARD PENETRATION TEST (blows/ft)
MC
PL LL
10 20 30 40 50 60 70 80 90

N VALUE: 6, 50/1"

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-1**

LOG WITH WELL AND SPT GRAPH 16-122.GPJ 08-053.GPJ 1/16/17

Greenbaum Associates Inc
Louisville, Ky 40215 502-361-8447

Client: GRW Engineers, Inc.
Project: LFUCG East Hickman Wet Weather Storage Facility, Lexington, KY
Project No.: 16-122G

HOLE No. B-2

Sheet 1 of 1

Boring Location: See Boring Location Plan Surface Elevation: 941.3 Station: n/a
Drilling Equipment: CME-550 equipped with Automatic Hammer Drilling Method: 3 1/4 Inch Hollow Stem Auger
Depth to water immediately: 6.0 Overburden: 9.7 Rock: 15.3 Total Depth: 25.0
Logged By: S. Greenbaum Driller: Geodrill Date Logged: 10/7/16 - 10/7/16

DEPTH (feet)	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	N VALUE
				Topsoil (4 inches)	941.3	
				Moist, Medium Stiff, Brown Lean Clay with Sand (OL/CL)		
	SPT	100			940	6
5	SPT	100		Same, Stiff (CL)	935	8
10				AUGER REFUSAL @ 9.7 FEET		
				Medium Gray Limestone		
				Dark Gray Shale		
				Medium Gray, Thick Bedded Limestone		
				Dark Gray Shale		
				Medium Gray, Thick Bedded Limestone		
15	NX	100	63		930	
					925	
20				Dark Gray Shale	920	
				Medium Gray, Thin- to Medium-Bedded Limestone		
	NX	100	59	Dark Gray Limestone		
				Medium Gray Limestone		
				Dark Gray Shale		
25				Medium Gray, Medium Bedded Limestone with Dark Gray Layering		
				TERMINATED @ 25.0 FEET		

STANDARD PENETRATION TEST (blows/ft)
PL — MC — LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. B-2

LOG WITH WELL AND SPT GRAPH 16-122.GPJ 08-053.GPJ 1/15/17

Greenbaum Associates Inc
Louisville, Ky 40215 502-361-8447

Client: GRW Engineers, Inc.
Project: LFUCG East Hickman Wet Weather Storage Facility, Lexington, KY
Project No.: 16-122G

HOLE No. B-3

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **940.3** Station: **n/a**
Drilling Equipment: **CME-550 equipped with Automatic Hammer** Drilling Method: **3 1/4 Inch Hollow Stem Auger**
Depth to water immediately: **8.0** Overburden: **9** Rock: **16** Total Depth: **25.0**
Logged By: **S. Greenbaum** Driller: **Geodrill** Date Logged: **10/7/16 - 10/7/16**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)
0					Topsoil (4 inches) OL	940.3
					Moist, Medium Stiff, Brown Lean Clay CL	940
		SPT	89			
					Same, Stiff, Reddish Brown CL	
5		SPT	89			935
10					AUGER REFUSAL @ 9.0 FEET	930
					Medium Gray Limestone	
					Dark Gray Shale	
					Medium Gray Limestone	
					Dark Gray Shale	
					Medium Gray Limestone	
		NX	100	50	Dark Gray Shale	
15					Medium Gray Limestone	925
					Dark Gray Shale	
					Medium Gray Limestone	
					Dark Gray Shale	
					Medium Gray, Thin- to Thick-Bedded Limestone	
20						920
					Dark Gray Shale	
		NX	100	42	Medium Gray Limestone	
					Medium Gray, Thin- to Thick-Bedded Limestone with Dark Gray Layering	
25					TERMINATED @ 25.0 FEET	

STANDARD PENETRATION TEST (blows/ft)
PL — MC — LL
10 20 30 40 50 60 70 80 90

N VALUE
6
11

LOG WITH WELL AND SPT GRAPH 16-122.GPJ 08-053.GPJ 1/16/17

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. B-3

Greenbaum Associates Inc
Louisville, Ky 40215 502-361-8447

Client: GRW Engineers, Inc.
Project: LFUCG East Hickman Wet Weather Storage Facility, Lexington, KY
Project No.: 16-122G

HOLE No. B-4

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **941.8** Station: **n/a**
Drilling Equipment: **CME-550 equipped with Automatic Hammer** Drilling Method: **3 1/4 Inch Hollow Stem Auger**
Depth to water immediately: **6.5** Overburden: **9.3** Rock: **15.7** Total Depth: **25.0**
Logged By: **S. Greenbaum** Driller: **Geodrill** Date Logged: **10/7/16 - 10/7/16**

DEPTH (feet)	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)
0				Topsoil (3 inches)	OL	941.8
	SPT	100		Moist, Medium Stiff, Brown Lean Clay with Sand	CL	940
				Same, Stiff, Brown and Gray Mottled, with Ferromagnesian Nodules	CL	
5	SPT	100				935
10				AUGER REFUSAL @ 9.3 FEET		
				Medium Gray Limestone	CL	
				Brown Lean Clay	CL	
				Medium Gray Limestone		930
				Brown Lean Clay		
				Medium Gray, Thin- to Medium-Bedded Limestone		
15	NX	100	66	Dark Gray Shale		925
				Medium Gray, Thin- to Thick-Bedded Limestone		
20						920
	NX	100	34	Medium Gray, Thin- to Thick-Bedded Limestone with Dark Gray Layering		
				Medium Gray, Thin- to Thick-Bedded Limestone		
25				TERMINATED @ 25.0 FEET		

STANDARD PENETRATION TEST (blows/ft)
PL — MC — LL
10 20 30 40 50 60 70 80 90

N VALUE: 6, 12

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

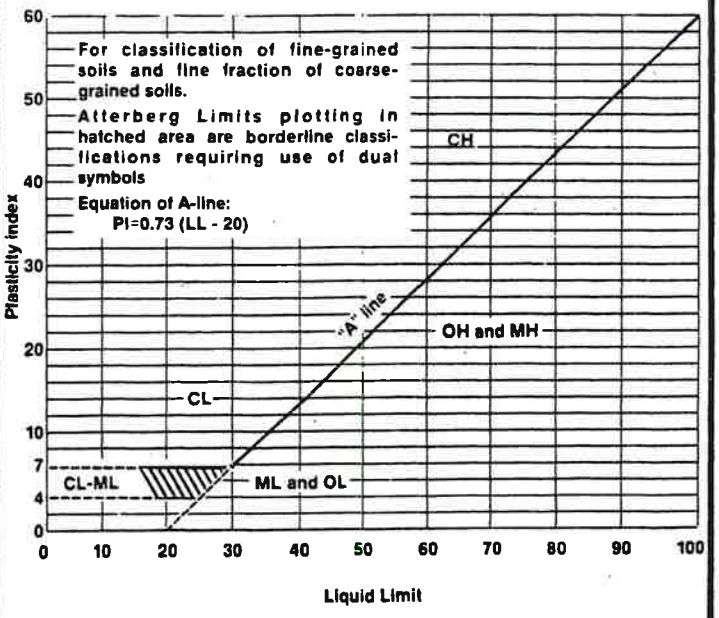
DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. B-4

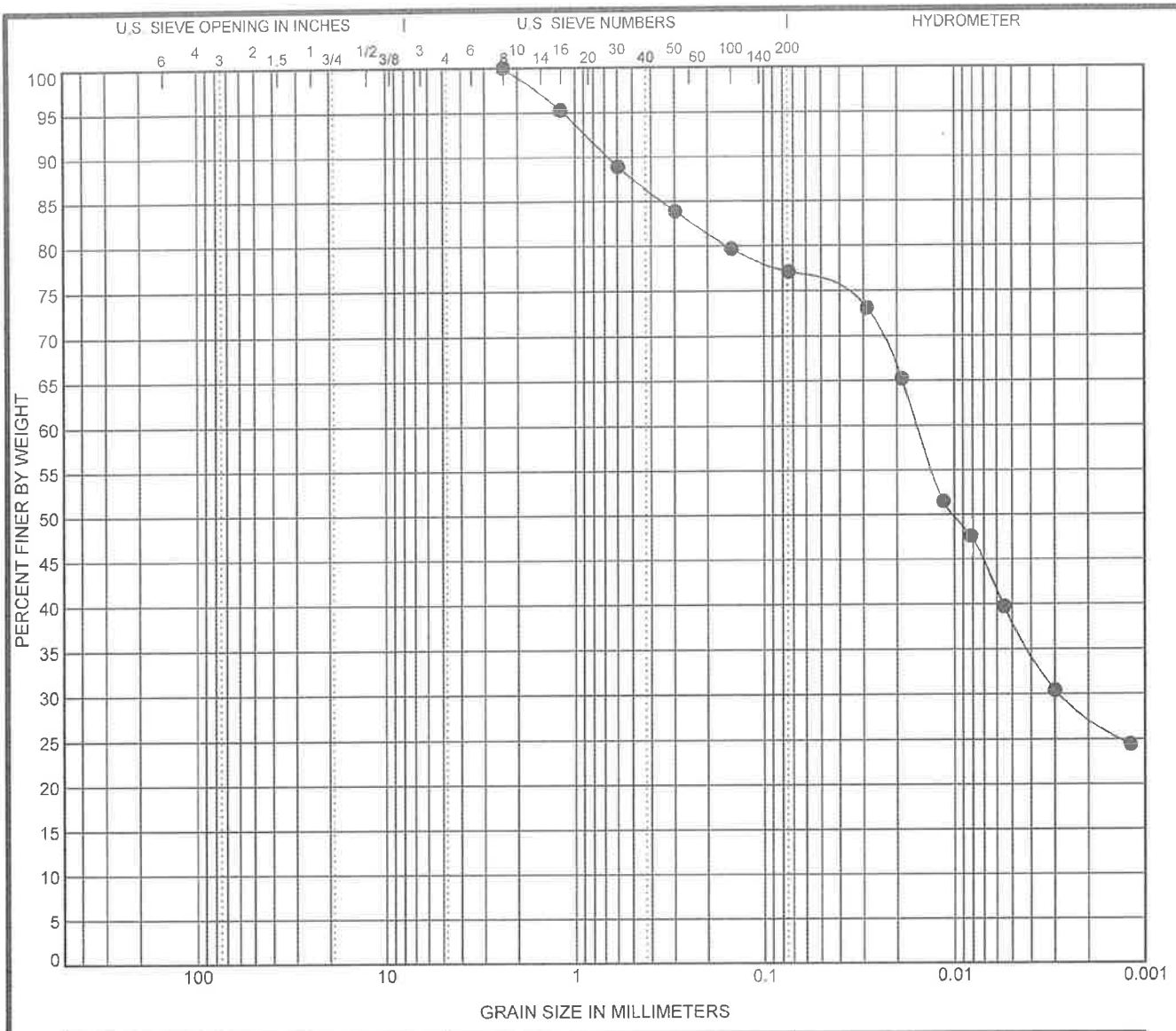
LOG WITH WELL AND SPT GRAPH 16-122.GPJ 08-053.GPJ 1/10/17

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES
(ASTM: D 2487 and 2488)

Major divisions			Group symbols	Typical names	Laboratory classification criteria	
Coarse-grained soils (More than half of material is *larger* than No. 4 sieve size)	Gravels (More than half of coarse fraction larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 per cent ..... GW, GP, SW, SP; More than 12 per cent ..... GM, GC, SM, SC; 5 to 12 per cent ..... *Borderline* cases requiring dual symbols	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} X D_{60}}$ between 1 and 3
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW
		Gravels with fines (Appreciable amount of fines)	GM d	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 *are borderline* cases requiring use of dual symbols
			GM u			
			GC	Clayey gravels, gravel-sand-clay mixtures	Atterberg limits below "A" line or P.I. greater than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} X D_{60}}$ between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM d	Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in hatched zone with P.I. between 4 and 7 *are borderline* cases requiring use of dual symbols.
			SM u			
			SC	Clayey sands, sand-clay mixtures	Atterberg limits below "A" line or P.I. greater than 7	
Fine-grained soils More than half of material is *smaller* than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
			OL	Organic silts and organic silty clays of low plasticity		
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
			CH	Inorganic clays of high plasticity, fat clays		
			OH	Organic clays of medium to high plasticity, organic silts		
	Highl organic soils		Pt	Peat and other highly organic soil		



Plasticity Chart



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
B-4	3.0	**LEAN CLAY with SAND(CL)**	**39**	**22**	**17**		

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
B-4	3.0	**2.38**	**0.016**	**0.003**		**0.0**	**22.8**	**38.9**	**38.3**

Greenbaum Associates Inc
Louisville, Ky 40215
502-361-8447

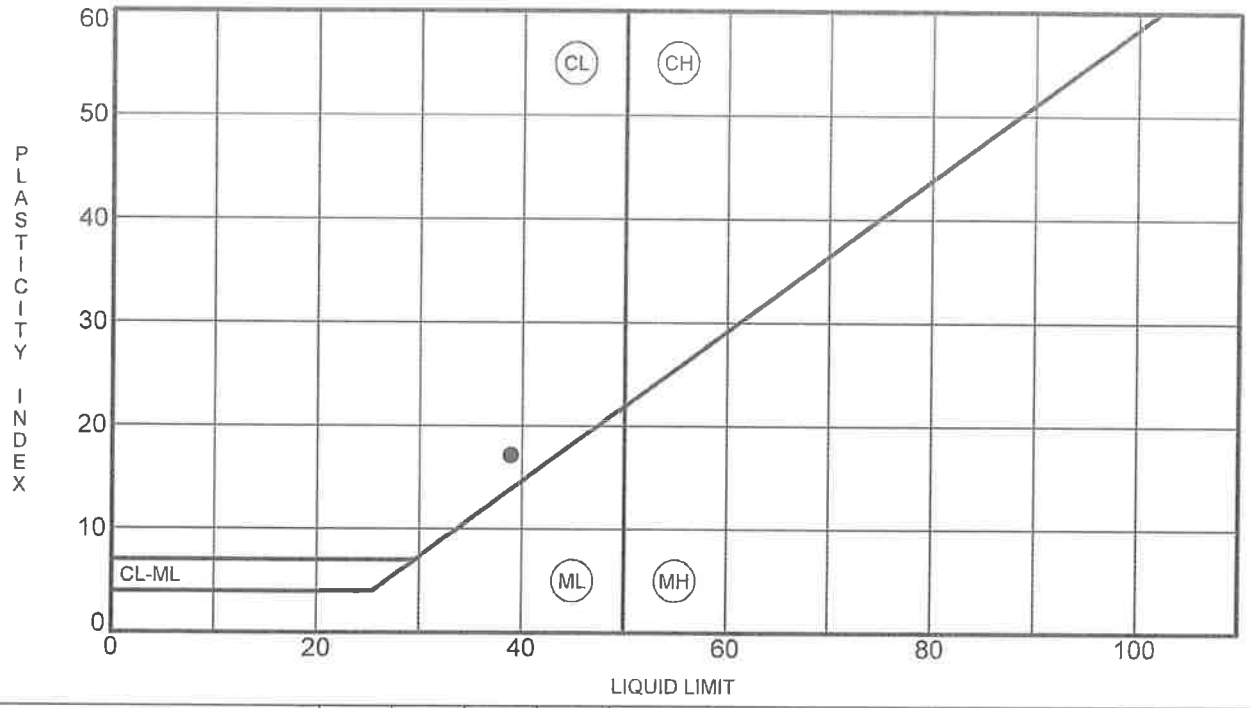
GRAIN SIZE DISTRIBUTION

Project: LFUCG East Hickman Wet Weather Storage Facilit

Location: Lexington, KY

Number: 16-122G

US GRAIN SIZE 16-122.GPJ GREENBAUM.GDT 1/16/17



Specimen Identification		LL	PL	PI	Fines	Classification
● **B-4**	**3.0**	**39**	**22**	**17**	**77**	**LEAN CLAY with SAND(CL)**

Greenbaum Associates Inc
Louisville, Ky 40215
502-361-8447

ATTERBERG LIMITS' RESULTS

Project: LFUCG East Hickman Wet Weather Storage Facilit

Location: Lexington, KY

Number: 16-122G

US ATTERBERG LIMITS 16-122.GPJ GREENBAUM.GDT 1/16/17

PRELIMINARY GEOTECHNICAL EXPLORATION REPORT LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT EAST HICKMAN PUMP STATION LEXINGTON, KENTUCKY

Prepared for: **Hazen and Sawyer, P.C.**
Thelen Project No.: **130007LE**

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October 9, 2013

Hazen and Sawyer, P.C.
444 Lewis Hargett Circle, Suite 260
Lexington, Kentucky 40503

Attention: Mr. John Steinmetz, P.E.

Re: Preliminary Geotechnical
Exploration Report
Lexington-Fayette Urban Co. Govt.
East Hickman Pump Station
Lexington, Kentucky

Ladies and Gentlemen:

Contained herein are the results of preliminary geotechnical services performed for a study related to the design and construction at the proposed equalization tank site in Lexington, Kentucky. Hazen and Sawyer, P.C. is performing civil engineering design services for the proposed site as part of the Lexington-Fayette Urban County Government sanitary sewer improvement program. These services were performed in accordance with our Proposal-Agreement K213002 dated January 2, 2013. Authorization to proceed was provided by a signed Proposal-Agreement between Hazen and Sawyer and Thelen Associates, Inc.

We are enclosing with this report a reprint of "Important Information About Your Geotechnical Engineering Report" published by ASFE, Professional Firms Practicing in the Geosciences, which our firm would like to introduce to you at this time.

We appreciate the opportunity to provide the geotechnical services related to the proposed equalization basin(s) site selection. Should you have any questions concerning the information, conclusions or recommendations contained in this report, please do not hesitate to contact us.

Respectfully submitted,
THELEN ASSOCIATES, INC.

Lee J. Czor, P.E.
Senior Geotechnical Engineer

STATE OF KENTUCKY
LEE J. CZOR 24747
LICENSED PROFESSIONAL ENGINEER

LJC:dld
130007LE

Copies submitted: Hazen and Sawyer, P.C. (2 mailed / 1 email)

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October 9, 2013

PRELIMINARY GEOTECHNICAL EXPLORATION REPORT
LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT
EAST HICKMAN PUMP STATION
LEXINGTON, KENTUCKY

1.0 INTRODUCTION

Presented herein are the results of our Preliminary Geotechnical Exploration completed for the proposed Equalization (EQ) tank site to be constructed as part of the Lexington-Fayette Urban County Government (LFUCG) sanitary sewer improvement program. We understand that EQ tank structure may be constructed at the potential site described in the Project Characteristics section below. Our services for this project included a site reconnaissance at the site by our Senior Geotechnical Engineer, the drilling of four (4) preliminary test borings to evaluate the subsurface profiles at the location, laboratory soil sample review, preliminary engineering analyses, and preparation of this preliminary report. The preliminary findings, conclusions, and recommendations of this report are intended to assist in evaluating the site in light of the subsurface information obtained within the test borings.

2.0 PROJECT AND SITE CHARACTERISTICS

The potential EQ tank site is located at the site of the existing East Hickman pump station southeast of the intersection of Alumni Drive and Buckhorn Drive in Lexington, Kentucky. The site is bounded on the east by the Lexington Reservoir No. 4, a wooded area to the south, and by residential areas to the west and north. The property is currently accessed using a service road from Buckhorn Drive. The existing ground surface elevations vary across the site from about elevation 962 feet nearest Buckhorn Drive to a low of about 946 feet to the east of the existing pump station. As noted, the existing East Hickman Pump

Station is located on this site and contains several structures that bear at- and below-grade as well as piping and additional utility infrastructure required for the operations of the pump station.

Additionally, an alternate site to the south of the existing pump station (Alternate 1) is being considered for use. This site is primarily grass covered and partially wooded. The ground surface elevations vary from about 956 feet at the west end of the Alternate 1 site to about 942 feet at the east end of the site.

3.0 GEOLOGIC RESEARCH

Available United States Geological Survey (USGS) and Kentucky Geologic Service (KGS) maps were consulted to provide the following geologic descriptions of the proposed tank site. According to the USGS 7.5 minute geologic map of the Coletown Quadrangle (1967, GQ-647), the proposed project site is underlain by Ordovician Age bedrock of the Tanglewood Member of the Lexington Limestone. The Tanglewood Member is described on the map as Limestone (calcarenite), medium-light-gray to medium-brownish-gray in color, fine- to coarse-grained, sparry calcite cemented, very thin to thin even beds, partly cross-bedded, irregularly bedded in part. Structure contours drawn on the base of the Brannon Limestone Member of the Lexington Limestone show the bedrock to be relatively horizontal, with a regional dip in the project vicinity of less than one percent to the west-northwest. The Bryan Station Fault Zone, which trends from northeast to southwest, is shown on the mapping approximately 11,000 feet to the northwest of the proposed project site. Additionally, several smaller, unnamed faults are shown on the mapping to the south between 1 and 2 miles from the project site. According to the KGS mapping, the underlying Tanglewood Member bedrock within the project vicinity has a high to very high karst potential. No sinkholes have been mapped in the immediate vicinity of the proposed project site.

4.0 FIELD EXPLORATION

Our fieldwork for this project included a site reconnaissance by a Senior Geotechnical Engineer as well as the drilling of four (4) preliminary test borings. The test boring locations were selected by Thelen, and were staked in the field and surveyed for location

and elevation by Thelen personnel. The test boring locations and elevations were then plotted on the site and topographic maps provided by Hazen & Sawyer. These drawings were used to create the Proposed Site Boring Plan (Drawing 130007LE-1) included in the report Appendix.

The test borings were made with an ATV-mounted drill rig advancing hollow-stem augers. Sampling was accomplished ahead of the augers with a standard 2-inch outside diameter (O.D.) split spoon sampler driven with a 140-pound weight falling 30-inches. This procedure is described as the standard drive sample method (ASTM D1586) and results in the standard penetration test. Upon encountering the top of rock, rock coring operations were then performed in two (2) of the test boring locations (using an NXM core barrel per ASTM D2113) to approximate depths between 5 and 10 feet below the top of bedrock. Additionally, a groundwater observation well was installed at one (1) of the test borings. Observations for groundwater were made in the borings during, at the completion of, and at selected time intervals after completion of drilling.

Representative portions of the split spoon samples were selected by the Drilling Technician and sealed in properly labeled glass jars for return to our laboratory. The rock core samples were stored in labeled rock core boxes for transport to our materials testing facility. As the test borings proceeded, the Drilling Technician prepared field logs documenting the subsurface profile and noting soil and bedrock descriptions, stratifications, groundwater levels, standard penetration test resistance, and other pertinent data.

5.0 LABORATORY TESTING AND REVIEW

Following the completion of the test borings, the samples were returned to our Soil Mechanics Laboratory where they were reviewed and visually classified by the Project Geotechnical Engineer. Representative samples were selected for moisture content determinations and Atterberg limits testing. Soil classifications were developed in accordance with the Unified Soil Classification System (USCS). Thelen personnel performed laboratory testing in accordance with applicable ASTM methods for soil

testing. The results of these tests are included in the Tabulation of Laboratory Tests in the Appendix.

Final test boring logs were prepared based on the Drilling Technician's field logs, the Engineer's visual classification of the samples and the laboratory testing. Copies of the test boring logs can be found in the Appendix along with a "Soil Classification Sheet" and a "Rock Weathering and Strength Classification Sheet" which describes the terms and symbols used on the boring logs.

The dashed lines on the test boring logs identify the changes between the soil and/or bedrock types, which were determined by interpolation between samples and should be considered approximate. Only changes that occur within samples can be precisely determined and are indicated by solid lines on the logs. The transition between soil and bedrock types may be abrupt or gradual.

A Rock Quality Designation (RQD) was recorded for each bedrock coring run. The RQD is defined as the sum of the lengths of all pieces of intact core longer than 4 inches in a coring run, divided by the total length of the run. This value is then multiplied by one hundred to express the result as a percentage. The RQD provides a qualitative indication of rock quality. RQD values are presented on the Logs of Test Boring sheets in the Appendix to this report. Table 1 included below shows the correlation of RQD values with Rock Mass Quality.

TABLE 1. RELATION OF RQD TO IN SITU ROCK QUALITY*

RQD Percent	Rock Mass Quality
90-100	Excellent
75-90	Good
50-75	Fair
25-50	Poor
0-25	Very Poor

***From Naval Facilities Engineering Command, NAVFAC D.M. 7-1 (1982)**

It should be noted that the "Top of Rock" and "Auger Refusal" as determined in the rock-line soundings are defined as rock-like resistance to the advancement of the augers (Track-mounted drill rig advancing 3-1/4" continuous flight augers using carbide steel cutting teeth). This may indicate the presence of weathered bedrock, boulders, or rock remnants. A more accurate determination regarding the location of the top of rock cannot be made without performing rock coring.

6.0 SUBSURFACE CONDITIONS

Four (4) test borings (TB-101 through TB-104) were advanced at this proposed site on January 10, 2013. TB-101 and TB-102 were advanced at the primary portion of the site. TB-103 and TB-104 were competed at the Alternate 1 portion of the site. The locations of the test borings are shown on the Boring Plan, Drawing 130007LE-1, and are included in the Appendix to this report. The subsurface profile at this site generally consists of an intermittent layer of topsoil (encountered in TB-101) overlying fill materials, native silty/clayey soils, sediments (encountered in TB-104), and bedrock.

The fill materials primarily consisted of CLAYEY SILT/SILTY CLAY, with varying amounts of brick, roots, rock fragments, organic material, and crushed limestone aggregate. The fill materials were encountered at the ground surface or below the topsoil layer in each of the test borings in thicknesses ranging from approximately 2.0 to 4.5 feet, with an average thickness of approximately 2.6 feet. The consistency of the fill materials ranged from medium stiff to stiff. SPT "N" values ranged from 9 blows per foot (bpf) to 35 bpf, with an average value of about 15 bpf. Laboratory testing of three (3) jar samples of these fill soils indicated moisture content values of 21.6, 28.2 and 15.3 percent. Atterberg limits testing of one (1) representative sample of the fill materials from TB-101 yielded a liquid limit of 43 percent, a plastic limit of 27 percent, and a corresponding plasticity index of 16 percent. This material was classified as ML according to the Unified Soil Classification System (USCS).

A layer of sediment material was encountered below the fill at the TB-104 location between approximate depths of 2.0 and 7.0 feet. These sediments are described as brown to gray, moist to very moist, soft, CLAYEY SILT with medium sand particles. The

consistency of the materials was soft with SPT "N" values of 2 and 10 bpf. Laboratory moisture content testing of two (2) samples of this material yielded moisture content values of 28.0 and 29.8 percent.

A layer of native (residual) silty clay/clayey silt soils was encountered in each of the test borings below either the fill materials or sediments, and above the bedrock. This material was encountered in TB-101, TB-102, and TB-103 below the fill materials and in TB-104 below the sediments mentioned above. The material generally consists of brown to orange-brown and gray, moist, medium stiff to stiff SILTY CLAY and CLAYEY SILT with varying amounts of chert, weathered shale and limestone fragments and exhibits iron oxide staining. The material was encountered in thicknesses ranging from approximately 1.5 to 8.5 feet, with an average thickness of approximately 4.3 feet. SPT "N" values ranged from 8 to 11 bpf, with an average value of about 10 bpf. Laboratory testing of five (5) jar samples of these soils yielded moisture content values ranging from 22.1 to 27.7 percent, with an average value of 24.2 percent. Atterberg limits testing of one (1) representative sample of the native materials from TB-103 yielded a liquid limit of 48 percent, a plastic limit of 30 percent, and a corresponding plasticity index of 18 percent. This material was classified as ML according to the USCS.

The top of bedrock was encountered in TB-101 and TB-104 at depths of approximately 5.0 feet and 11.0 feet, respectively. Rock cores were advanced in these test borings to overall depths of 10.0 feet and 17.7 feet, respectively. Auger refusal was encountered in TB-102 and TB-103 at depths of 6.5 feet and 10.5 feet, respectively.

The bedrock core samples recovered generally consist of LIMESTONE. The limestone is described as light brown to gray, fine to coarse grained, thin to thick bedded, zones slightly weathered, with shale stringers, streaks, and partings. The recovery of the core runs was between 95 and 98 percent. The RQD values of the samples from TB-101 and TB-104 were 33 and 53 percent, respectively; corresponding to Rock Mass Quality values of "Poor" and "Fair".

Please note that auger refusal as used in this report is defined as rock-like resistance to the advancement of the augers (ATV-mounted drill rig advancing 3-1/4" hollow-stem augers using carbide steel cutting teeth). This may indicate the presence of weathered bedrock, boulders, or rock remnants. A more accurate determination regarding the location of the top of rock cannot be made without performing rock coring.

7.0 GROUNDWATER

Groundwater observations were made in the test borings during drilling, at the completion of drilling, and at time intervals following the completion of drilling. Observed groundwater depths are noted at the bottoms of test boring logs included in the Appendix. It is our experience that groundwater seepage can occur at the fill soil/native soil/bedrock interfaces, within fill soil deposits, and along the bedding planes within the bedrock. There may be seasonal fluctuations of the groundwater table based on temperatures and/or precipitation amounts. Groundwater levels may also be affected by construction activities or other site specific factors. Therefore, it should be noted that future groundwater levels may be encountered at different depths than encountered within our test borings.

8.0 PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

8.1 General Items

The preliminary conclusions and recommendations of this report have been derived by relating the general principles of the discipline of Geotechnical Engineering to the proposed EQ tank site outlined in the Project Characteristics section of this report. We understand that the design of the EQ tank is in the preliminary stage and, therefore, the final type, size, location, and elevation of the proposed structure have yet to be determined. After the site and design option for the structure is chosen, the grading plan developed, and the structural loads are determined, additional geotechnical explorations will be required to supplement the findings of this study.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic materials in the soil, bedrock, surface water, groundwater or air, on or below or around this site.

We completed the test borings for our preliminary evaluation of the site conditions and for the formulation of the preliminary conclusions and recommendations of this report. We assume no responsibility for the interpretation or extrapolation of the information by others.

Based on our engineering reconnaissance of the proposed site, the preliminary test borings, visual examination of the samples, laboratory testing of the soil samples, and our experience as Consulting Soil and Foundation Engineers in Kentucky, we have reached the preliminary conclusions and make the preliminary recommendations in this report.

From a geotechnical standpoint, the site can be developed for the proposed EQ tanks. In our opinion, the construction of a structure bearing below grade at the proposed site will be influenced significantly by the elevation and competency of the bedrock materials. Additionally, any structure (or portions thereof) designed to bear on a shallow foundation will be affected by the thickness and consistency of the fill, sediment, and/or native soil materials that are present above the bedrock surface. Preliminary conclusions and recommendations regarding site selection, earthwork, foundations, pipelines, and seismic concerns are presented in the following paragraphs.

8.2 Proposed Site

As noted in Section 2.0, the Proposed Site (primary) is located on the current LFUCG East Hickman Pump Station site. The results of our subsurface investigation indicate that the existing pump station site is underlain primarily by undocumented fill materials overlying native soils and bedrock. The bedrock was encountered at depths of approximately 5.0 and 6.0 feet below the top of the ground surface at TB-101 and TB-102, respectively. Groundwater was encountered within TB-102 at an approximate depth of 5.2 feet 14 days after completion of drilling.

As previously noted, one of the proposed options includes structures that may be built on the adjacent partially wooded property to the south of the East Hickman Pump Station site (Alternate 1). The Alternate 1 site is underlain by undocumented fill soils, relatively soft sediments, and native cohesive soils overlying the bedrock. Bedrock was encountered at

approximate depths of 10.5 and 11.0 feet below the ground surface within TB-103 and TB-104, respectively. Groundwater was encountered within TB-104 (at the completion of drilling) at an approximate depth of 3.0 feet below the ground surface.

Based on the results of the preliminary subsurface explorations, the unweathered bedrock encountered appears to be suitable for bearing of structural mat or deep foundation elements. The undocumented fill soils, sediments, and native soils are variable in thickness, composition and strength and are susceptible to consolidation due to induced loads. As such, it is our opinion that the fill, soft sediments, and medium stiff native soil deposits are not suitable for supporting proposed shallow-bearing EQ basin or pump station structures without risk of damaging differential settlements. In our opinion, any shallow foundations for structures bearing at-grade should be deepened to bear on the underlying stiff native clay soils or on bedrock. Alternatively, relatively short, reinforced concrete drilled shafts bearing in the bedrock may be used to support structural mat foundations. Additionally, the unsuitable overburden soils may be excavated and replaced with suitable compacted and tested fill soils in order to support shallow/spread footings for above-grade structures.

The deeper soil profile encountered at the Alternate 1 site would have to either be shored or laid back to maintain a stable excavation during construction. Sufficient space would be required around the proposed structure location(s) for laid back excavations, and if so, this would be expected to be more economical than a vertically shored excavation. The overburden materials are relatively weak and inconsistent in composition and consistency, with layers of soft sediments within the profile, so temporary layback slopes would need to be relatively flat, probably 2 horizontal to 1 vertical (2H:1V) or flatter.

As noted above, groundwater was encountered at depths of about 5 feet and 3 feet in TB-102 and TB-104 (respectively), so dewatering may be necessary. However, it should be noted that groundwater was only encountered in TB-104 (at the completion of drilling) at an approximate depth of 3.0 feet below the ground surface due to the introduction of water to aid in the rock coring process. In our opinion, groundwater may have an effect on the proposed construction. The Contractor should be prepared for surface and subsurface

infiltration during significant rain events during construction and must be prepared to remove seepage that accumulates in excavations. We recommend that good surface drainage be provided on the site both during construction and permanently thereafter in order to mitigate surface water infiltration.

Any structure(s) bearing below grade at this proposed site would likely have to be designed to resist buoyant uplift forces. The uplift forces should be determined based on the higher of the groundwater level or the 100-year flood level of the nearby creek adjacent to the site. The uplift forces should be resisted with the weight of the structure, the buoyant weight of soil above the structure (or appurtenances), and/or tie-down anchors extending through the foundation and into the limestone bedrock.

8.3 Karst

Based on the KGS mapping mentioned previously, there is low to high potential for karst features (such as sinkholes, cavities, or voids) to be encountered at and near the bedrock surface in the general vicinity of the proposed project sites. Open voids were not encountered during the rock coring at the proposed site, however, the presence of karst in the limestone bedrock could have implications for deep foundation design and construction, and should be further evaluated as part of the final geotechnical exploration for this project.

While the risk of future problems on any site underlain by carbonate limestone bedrock cannot be completely eliminated, it is possible to reduce the potential through control of surface water seepage. It is very important that adequate, positive drainage be established around the structure to promote the rapid drainage of surface water away from the structure. Finish grading in grass or landscaped areas should be sloped down and away from the structure at 5 percent for at least 10 feet, and then at least 2 percent thereafter. Storm water on pavements should be collected in a storm sewer system and properly disposed. All roof drainage and flows from air conditioning units, etc., should be piped and discharged directly into the storm sewer facilities. All underground piping should be leak-proofed. All utility trenches should be backfilled with compacted cohesive

on-site soils or low permeability flowable fill. Backfilling utility trenches and pouring footings should be completed as quickly as possible.

8.4 Seismic Liquefaction and Densification Potential

Seismic considerations for the proposed site include liquefaction and seismic densification potential in loose granular soils. Liquefaction occurs when saturated fine sands attempt to densify during shaking and there is an increase in the pore water pressure. The increased pore pressure causes a decrease in shear strength and increases the risk of bearing capacity failure or lateral spreading. Additional settlement within the sands typically follows the dissipation of the pore pressure. Seismic densification occurs when earthquake shaking densifies unsaturated loose sands, similar to the manner in which a vibratory compactor densifies a granular fill.

No loose, granular soils were encountered within the fill materials, sediments, and native soils at the proposed project sites. The generally cohesive nature of the soils encountered at the Proposed Site indicates that there is a low potential for liquefaction in the design earthquake event at these locations.

Determination of additional seismic design parameters such as Site Classification should be performed during the final geotechnical exploration when the preliminary bearing elevations of the proposed structure are available.

8.5 Pipelines

Pipelines for the proposed structure at the project site will be supported in the same variable soil types as described in Section 6.0. The fluid-filled pipelines should weigh less than the soils that are excavated to install the pipes. Therefore, the pipe foundation soils should not be loaded by the pipes to amounts greater than they have been loaded to in the past, so special foundation considerations should not be necessary. It may be necessary to locally remove and replace soft clays or silts below pipe level with a mat of compacted select material to provide a uniform working surface for pipe construction.

We anticipate that new pipelines will include both low-pressure gravity lines and higher-pressure force mains. The capacity of the various soils types to provide thrust restraint at bends in larger-diameter pressurized pipes will have to be considered. Concrete thrust blocks appropriately sized for the bearing capacity of the soils will be required for non-restrained-joint pressure pipe. Alternatively, restrained-joint pressure pipe can be used to reduce the size of, or eliminate, large concrete thrust blocks.

9.0 FINAL GEOTECHNICAL EXPLORATION

The opinions and conclusions presented in this report are preliminary. We recommend that they be used to select a site and design option layout for the proposed EQ basin and pump station. We also recommend that we be retained to participate in the site layout and grading selection process. The final design of the selected structure options, grading, pipelines, and pavements should be preceded by final geotechnical explorations that include additional test borings at proposed structure, pipeline, and pavement locations.

APPENDIX

ASFE Report Information

Tabulation of Laboratory Tests

Test Boring Logs

Soil Classification Sheet

Bedrock Weathering and Strength Classification Sheet

Boring Plan, Drawing No. 130007LE-1

Important Information about Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE THE GEOPROFESSIONAL BUSINESS ASSOCIATION

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

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IIGER01125.0MRP

THELEN ASSOCIATES, INC.
125 TRADE STREET
SUITE D
LEXINGTON, KENTUCKY 40511-2616

PRELIMINARY GEOTECHNICAL EXPLORATION
LFUCG EAST HICKMAN PUMP STATION
LEXINGTON, KENTUCKY
130007LE

TABULATION OF LABORATORY TESTS

Boring Number	Sample Number	Depth, ft.		Moisture Content, %	Atterberg Limits, %			USCS Classification
		From	To		LL	PL	PI	
101	1B	0.6	1.5	21.6	43	27	16	ML
	2	2.5	4.0	22.1				
102	1	0.0	1.5	15.3				
	2	2.5	4.0	28.2				
103	2	2.5	4.0	23.4				
	3	5.0	6.5	23.2				
	4	7.5	9.0	27.7	48	30	18	ML
104	2	2.5	4.0	28.0				
	3	5.0	6.5	29.8				
	4	7.5	9.0	24.7				

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Dayton, Ohio

LOG OF TEST BORING

CLIENT: Hazen and Sawyer, P.C.
BORING #: 101
PROJECT: Prelim. Geotechnical Exploration, LFUCG Tank Site Evaluations
PROJECT #: 130007LE
Lexington, Kentucky
PAGE #: 1 of 1
LOCATION OF BORING: As shown on Boring Plan, Drawing No. 130007LE-1

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Condition	Sample Number	Sample Type	SPT* Blows/6" / Rock Core RQD (%)	Recovery (in.)	Recovery (%)
957.5	Ground Surface	0.0	0						
956.9	TOPSOIL with clay mix.	0.6							
955.5	Mixed brown, moist, medium stiff FILL, clayey silt, trace brick, trace rock fragments, trace of organics, trace crushed limestone aggregate (ML).	2.0		I	1A 1B	DS	4-5-6	18	100
952.5	Brown, moist, stiff SILTY CLAY, iron oxide stains, trace roots, trace chert fragments.	5.0	5	I	2	DS	5-6-5	18	100
947.5	Light brown to gray, hard, LIMESTONE, fine to coarse-grained, thin to thick bedded, with shale stringers, streaks, and partings. Top 10" slightly weathered, water stained, and fractured.	10.0	10	I	3	RC	RQD-33%	59	98
	Bottom of test boring at 10.0 feet.		15						
			20						
			25						
			30						

Datum: Mean Sea Level
Hammer Weight: 140 lb.
Hole Diameter: 8 in.
Drill Rig: CME 550X
Surface Elevation: 957.5 ft.
Hammer Drop: 30 in.
Rock Core Diameter: 1.875 in.
Foreman: L. Wanstrath
Date Started: 1/10/2013
Pipe Size: 2 in. O.D.
Boring Method: HSA-3.25
Engineer: L. Czor
Date Completed: 1/10/2013

BORING METHOD
HSA = Hollow Stem Augers
CFA = Continuous Flight Augers
DC = Driving Casing
MD = Mud Drilling

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
DS = Driven Split Spoon
PT = Pressed Shelby Tube
RC = Rock Core

SAMPLE CONDITIONS
D = Disintegrated
I = Intact
U = Undisturbed
L = Lost

GROUNDWATER DEPTH
First Noted: Dry, Core @ 5.0 ft.
At Completion: 2.5 ft.
After: --
Backfilled: Immed.

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

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Dayton, Ohio

LOG OF TEST BORING

CLIENT: Hazen and Sawyer, P.C.
PROJECT: Prelim. Geotechnical Exploration, LFUCG Tank Site Evaluations
Lexington, Kentucky
LOCATION OF BORING: As shown on Boring Plan, Drawing No. 130007LE-1

BORING #: 102
PROJECT #: 130007LE
PAGE #: 1 of 1

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Condition	Sample Number	Sample Type	SPT* Blows/6" / Rock Core RQD (%)	Recovery (in.)	Recovery (%)
948.1	Ground Surface	0.0	0						
	Mixed brown, moist, stiff FILL, silty clay with roots, and limestone fragments.			I	1	DS	5-13-22	8	44
946.1		2.0							
	Mixed brown and gray, moist, medium stiff FILL, silty clay with wood and limestone fragments, little sand.			I	2	DS	15-8-5	18	100
943.6		4.5							
	Brown, moist, medium stiff SILTY CLAY with sand and limestone fragments.		5	I	3	DS	30-50/4"	8	44
942.1		6.0							
941.6	Gray LIMESTONE (bedrock).	6.5							
	Auger refusal and and bottom of test boring at 6.5 feet.								
	Note: Piezometer installed to 6.5 feet in depth.		10						
			15						
			20						
			25						
			30						

Datum: Mean Sea Level
Surface Elevation: 948.1 ft.
Date Started: 1/10/2013
Date Completed: 1/10/2013
Hammer Weight: 140 lb.
Hammer Drop: 30 in.
Pipe Size: 2 in. O.D.
Hole Diameter: 8 in.
Rock Core Diameter: --
Boring Method: HSA-3.25
Drill Rig: CME 550X
Foreman: L. Wanstrath
Engineer: L. Czor

BORING METHOD
HSA = Hollow Stem Augers
CFA = Continuous Flight Augers
DC = Driving Casing
MD = Mud Drilling

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
DS = Driven Split Spoon
PT = Pressed Shelby Tube
RC = Rock Core

SAMPLE CONDITIONS
D = Disintegrated
I = Intact
U = Undisturbed
L = Lost

GROUNDWATER DEPTH
First Noted: Dry
At Completion: Dry
After: 14 days 5.2 ft.
Backfilled: Immed.

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

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Dayton, Ohio

LOG OF TEST BORING

CLIENT: Hazen and Sawyer, P.C.
PROJECT: Prelim. Geotechnical Exploration, LFUCG Tank Site Evaluations
Lexington, Kentucky
LOCATION OF BORING: As shown on Boring Plan, Drawing No. 130007LE-1

BORING #: 103
PROJECT #: 130007LE
PAGE #: 1 of 1

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Condition	Sample Number	Sample Type	SPT* Blows/6" / Rock Core RQD (%)	Recovery (in.)	Recovery (%)
954.3	Ground Surface	0.0	0						
952.3	Mixed brown, trace gray, moist, stiff FILL, silty clay, little rock fragments, trace organics (wood fragments), trace construction debris.	2.0		I	1	DS	3-4-5	18	100
949.8	Brown and orange brown, moist, stiff SILTY CLAY, trace chert, little iron oxide stains, trace weathered shale.	4.5		I	2	DS	5-6-5	18	100
947.3	Brown, moist, medium stiff SILTY CLAY, trace iron oxide stains.	7.0	5	I	3	DS	4-4-4	18	100
943.8	Brown, moist, stiff CLAYEY SILT with chert fragments and chert sand (ML).	10.5	10	I	4	DS	3-4-6	18	100
	Split spoon refusal at 10.0 feet. Auger refusal and and bottom of test boring at 10.5 feet.			I	5	DS	50/0"	0	
			15						
			20						
			25						
			30						

Datum: Mean Sea Level
Surface Elevation: 954.3 ft.
Date Started: 1/10/2013
Date Completed: 1/10/2013
Hammer Weight: 140 lb.
Hammer Drop: 30 in.
Pipe Size: 2 in. O.D.
Hole Diameter: 8 in.
Rock Core Diameter: --
Boring Method: HSA-3.25
Drill Rig: CME 550X
Foreman: L. Wanstrath
Engineer: L. Czor

BORING METHOD
HSA = Hollow Stem Augers
CFA = Continuous Flight Augers
DC = Driving Casing
MD = Mud Drilling

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
DS = Driven Split Spoon
PT = Pressed Shelby Tube
RC = Rock Core

SAMPLE CONDITIONS
D = Disintegrated
I = Intact
U = Undisturbed
L = Lost

GROUNDWATER DEPTH
First Noted: Dry
At Completion: Dry
After: --
Backfilled: Immed.

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

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LOG OF TEST BORING

CLIENT: Hazen and Sawyer, P.C.
PROJECT: Prelim. Geotechnical Exploration, LFUCG Tank Site Evaluations
Lexington, Kentucky
LOCATION OF BORING: As shown on Boring Plan, Drawing No. 130007LE-1

BORING #: 104
PROJECT #: 130007LE
PAGE #: 1 of 1

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Condition	Sample Number	Sample Type	SPT* Blows/6" / Rock Core RQD (%)	Recovery (in.)	Recovery (%)
943.3	Ground Surface	0.0	0						
941.3	Mixed brown, moist, medium stiff FILL, silty clay with trace roots, rock fragments and iron oxide stains.	2.0		I	1	DS	2-4-5	18	100
938.8	Gray and brown, moist, soft CLAYEY SILT with organics (sediment).	4.5		I	2	DS	4-5-5	18	100
936.3	Brown and gray, very moist, soft CLAYEY SILT with medium sand particles, trace organics (sediment).	7.0	5	I	3	DS	1-1-1	18	100
932.3	Brown and gray, moist, medium stiff SILTY CLAY with limestone fragments, iron oxide stains, trace sand.	11.0		I	4	DS	2-3-4	18	100
931.8	Gray LIMESTONE (bedrock).	11.5	10	I	5	DS	4-5-50/2"	12	86
925.6	Gray, hard LIMESTONE, fine to coarse-grained, thin to thick bedded, with shale stringers, streaks, and partings.	17.7	15	I	6	RC	RQD-53%	71	95
	Bottom of test boring at 17.7 feet.		20						
			25						
			30						

Datum: Mean Sea Level
Surface Elevation: 943.3 ft.
Date Started: 1/10/2013
Date Completed: 1/10/2013
Hammer Weight: 140 lb.
Hammer Drop: 30 in.
Pipe Size: 2 in. O.D.
Hole Diameter: 8 in.
Rock Core Diameter: 1.875 in.
Boring Method: HSA-3.25
Drill Rig: CME 550X
Foreman: L. Wanstrath
Engineer: L. Czor

BORING METHOD
HSA = Hollow Stem Augers
CFA = Continuous Flight Augers
DC = Driving Casing
MD = Mud Drilling

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
DS = Driven Split Spoon
PT = Pressed Shelby Tube
RC = Rock Core

SAMPLE CONDITIONS
D = Disintegrated
I = Intact
U = Undisturbed
L = Lost

GROUNDWATER DEPTH
First Noted 11.0 ft., Core @ 11.5 ft.
At Completion 3.0 ft.
After --
Backfilled Immed.

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

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SOIL CLASSIFICATION SHEET

NON COHESIVE SOILS
(Silt, Sand, Gravel and Combinations)

Density

Very Loose	- 5 blows/ft. or less
Loose	- 6 to 10 blows/ft.
Medium Dense	- 11 to 30 blows/ft.
Dense	- 31 to 50 blows/ft.
Very Dense	- 51 blows/ft. or more

Relative Properties

Descriptive Term	Percent
Trace	1 – 10
Little	11 – 20
Some	21 – 35
And	36 – 50

Particle Size Identification

Boulders	- 8 inch diameter or more	
Cobbles	- 3 to 8 inch diameter	
Gravel	- Coarse	- 3/4 to 3 inches
	- Fine	- 3/16 to 3/4 inches
Sand	- Coarse	- 2mm to 5mm (dia. of pencil lead)
	- Medium	- 0.45mm to 2mm (dia. of broom straw)
	- Fine	- 0.075mm to 0.45mm (dia. of human hair)
Silt		- 0.005mm to 0.075mm (Cannot see particles)

COHESIVE SOILS
(Clay, Silt and Combinations)

Consistency	Field Identification	Unconfined Compressive Strength (tons/sq. ft.)
Very Soft	Easily penetrated several inches by fist	Less than 0.25
Soft	Easily penetrated several inches by thumb	0.25 – 0.5
Medium Stiff	Can be penetrated several inches by thumb with moderate effort	0.5 – 1.0
Stiff	Readily indented by thumb but penetrated only with great effort	1.0 – 2.0
Very Stiff	Readily indented by thumbnail	2.0 – 4.0
Hard	Indented with difficulty by thumbnail	Over 4.0

Classification on logs are made by visual inspection.

Standard Penetration Test – Driving a 2.0" O.D., 1 3/8" I.D., sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30 inches. It is customary to drive the spoon 6 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the tests are recorded for each 6 inches of penetration on the drill log (Example – 6/8/9). The standard penetration test results can be obtained by adding the last two figures (i.e. 8+9=17 blows/ft.). Refusal is defined as greater than 50 blows for 6 inches or less penetration.

Strata Changes – In the column "Soil Descriptions" on the drill log, the horizontal lines represent strata changes. A solid line (————) represents an actually observed change; a dashed line (— — — —) represents an estimated change.

Groundwater observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc., may cause changes in the water levels indicated on the logs.

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Rock Weathering and Strength Classification Sheet

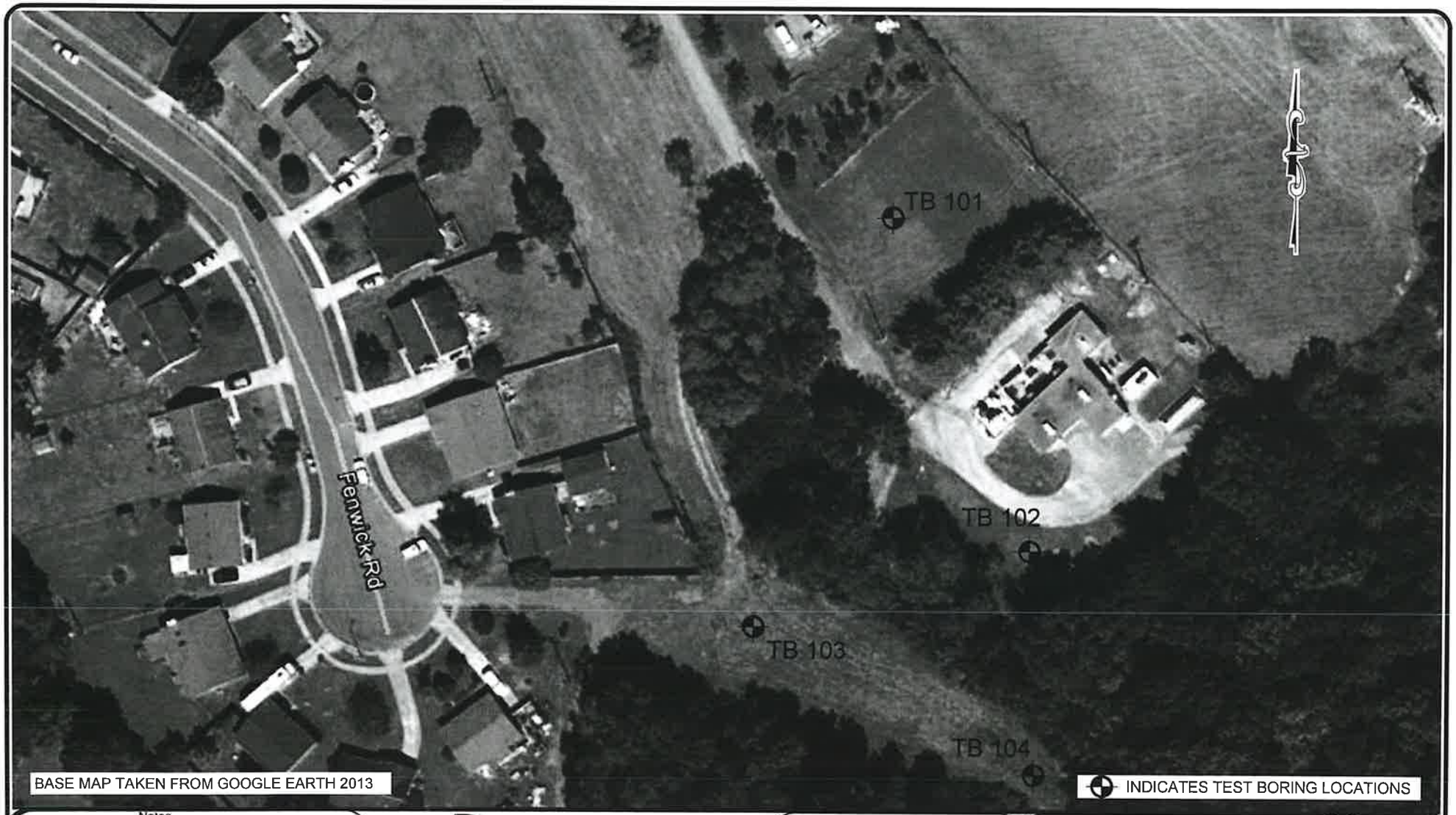
Rock Weathering

Descriptions	Field Identification
Unweathered	No visible sign of rock material weathering, perhaps slight discoloration on major discontinuity surfaces.
Slightly Weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally than it its fresh condition.
Moderately Weathered	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones.
Highly to Extremely Weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.
Residual Soil	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.

Rock Strength

Descriptions	Field Identification	Strength (psi*)
Extremely Weak	Indented by thumbnail	40-150
Very Weak	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife.	150-700
Weak	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer.	700-4000
Medium Strong	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with a single blow of a geological hammer.	4000-7000
Strong	Specimen requires more than one blow of a geological hammer to fracture.	7000-15,000
Very Strong	Specimen requires many blows with a geological hammer to fracture.	15,000-36,000
Extremely Strong	Specimen can only be chipped with geological hammer.	>36,000

*Approximate range of uniaxial compressive strength



Notes

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Erlanger, Kentucky • Cincinnati, Ohio • Dayton, Ohio

Title: TEST BORING PLAN

Client: Hazen and Sawyer, P.C.

Project: Prelim. Geotechnical Exploration
LFUCG Tank Site Evaluations
East Hickman EQ Site

Location: Lexington, Kentucky

Scale: 1"=50"

Date: 1/9/2013

Drawing No.: 130007LE-1

Submittal Stamp Page

GRW Project No. 4509-01

Project:
East Hickman Wet Weather Storage Facilities
LFUCG, Lexington, KY

Contractor:
Judy Construction Company
P.O. Box 457
Cynthiana, KY 41031

Copies	Submittal Number	Submittal Description
1	11420-01	Mechanical Screens

Contractor Certification Statement

By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with the contract drawings, specifications, other applicable approved shop drawings and all contract requirements.

Paul Lawrence
Signature

6/21/18
Date

Contractor Stamp

Specification Section 11240
Shop Drawing # 11240-01
JUDY CONSTRUCTION COMPANY
By: PL **Date:** 6/21/18

☐ **Reviewed**
☐ **Reviewed As Noted**

GRW Engineering Stamp

☐ REVIEWED ■ FURNISH AS CORRECTED
☐ REJECTED ☐ REVISE AND RESUBMIT
☐ SUBMIT SPECIFIED ITEM

This review is only for general conformance with the design concept and the information given in the Construction Documents. Corrections or comments made on the shop drawings during this review do not relieve the Contractor from compliance with the requirements of the plans and specifications. Review of a specific item shall not include review of an assembly of which the item is a component. The Contractor is responsible for: dimensions to be confirmed and correlated at the job site: information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences and procedures of construction; coordination of the Work with that of all other trades and performing all Work in a safe and satisfactory manner.

engineering | architecture | geospatial

Date: 7/26/2018
By: BMG

Comments:

Increase space between the unit and discharge piping on adjacent unit to 36" minimum to allow adequate maintenance access.

See Field Order No. 2 for distance between gates.

See notes on drawings.

HUBER TECHNOLOGY
WASTE WATER Solutions

SUBMITTAL

City of Lexington, KY
East Hickman Wet Weather Storage Facility and Pump Stations
in accordance with Specification Section 11420
Mechanical Screens & Screenings Compactors

Equipment:
(2x) HUBER Multi-Rake Bar Screen RakeMax® Size: 8320x975x6 mm @ 85°
(2x) HUBER Wash & Press WAP® Size: 4

Manufacturer:
Huber Technology, Inc.
9735 NorthCross Center Court, Suite A
Huntersville, NC 28078
Contact: Scott Maultsby
Ph: (704) 949-1010 Fax: (704) 949-1020

Elemech, Inc.
2275 White Oaks Circle
Aurora, IL 60504
Ph: (630) 499-7080 Fax: (630) 499-7760

Contractor:
Judy Construction Company
103 South Church Street
Cynthiana, KY 41031
Contact: Paul Lawrence
Ph: (859) 234-6900 Fax: (859) 234-3480

Engineer:
GRW Engineers, Inc.
801 Corporate Drive
Lexington, KY 40503
Contact: P. Benton Hanson
Ph: (859) 223-3999 Fax: (859) 223-8917

Representative:
Pelton Environmental Products
8638 Cotter Street
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April 2018

HUBER TECHNOLOGY
WASTE WATER Solutions

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City of Lexington, KY
East Hickman Wet Weather Storage Facility and Pump Stations
in accordance with Specification Section 11420
Mechanical Screens & Screenings Compactors

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TAB 1

Certificate

Standard	**ISO 9001:2015**
Certificate Registr. No.	**01 100 1700023**

Certificate Holder: **Huber SE**
Industriepark Erasbach A1
92334 Berching
Germany

Scope: Development, manufacture and sales of machine equipment and plant for water, wastewater, sludge for municipalities and industries

Proof has been furnished by means of an audit that the requirements of ISO 9001:2015 are met.

Validity: The certificate is valid from 2017-08-13 until 2020-08-12.
First certification 2017

2017-07-20

TÜV Rheinland Cert GmbH
Am Grauen Stein · 51105 Köln

www.tuv.com

IAF

DAkkS Deutsche Akkreditierungsstelle D-ZM 16031-01-00

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Precisely Right.

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INTECHNICA
FUTURE SECURE BUSINESS GROWTH

Certificate

ISO 14001

The accredited environmental verifier

REINHARD MIRZ

herewith confirms that

HUBER SE

at the site

Industriepark Erasbach A1, 92334 Berching

fulfils the requirements of an environmental management system in accordance with the ISO 14001+Cor.1:2009.

The environmental policy, the environmental management system, the environmental effects, the environmental documentation, the environmental objectives and the methodology and the environmental audit were checked in accordance with the ISO 14001+Cor.1:2009.

Nuremberg, June 18th 2015

Dipl.-Phys. Reinhard Mirz
Environmental Verifier
Permit-No. DE-V-0260

Dr. Reiner Beer
Environmental Verifier Organisation
INTECHNICA CERT GmbH, DE-V-0279

Intechnica Cert GmbH

The certificate No. UGA 247-2015 is valid until May 29th 2018

HUBER TECHNOLOGY
WASTE WATER Solutions

Certificate
Pickling Plant HUBER SE

We confirm with this certificate that

- All HUBER SE stainless steel products are acid treated in a pickling bath and passivated in the fully automatic pickling plant installed in the Hans Huber SE factory.
- The pickling tank size is 12m x 3m x 3m to ensure the treatment of even big equipment parts. Later welding work at the time of machine assembly can be avoided.
- The pickling process consists of preliminary washing, pickling and secondary washing. The plant is operated fully automatically.
- The pickling plant is operated as a circulation system and equipped with a state-of-the-art wastewater treatment plant. The corresponding threshold values are met considerably.

Only these measures ensure the material retains its excellent properties and remains corrosion-resistant according to its material quality.

The pickling process is annually inspected by an external environmental verifier. The pickling process is further monitored continuously by the operator himself, additionally by external maintenance specialists and the local authorities.

Nürnberg, May 17th 2016

Dipl.-Phys. R. Mirz
Environmental Verifier DE-V-0260

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Sitz der Gesellschaft / Headquarters: Berching · AG Nürnberg / Register of companies: HRB 25558
Vorstand / Board: Georg Huber (Vorsitzender / CEO), Dr.-Ing. Oliver Rong (stellvertretender Vorsitzender / Vice CEO), Dr.-Ing. Johann Grienberger, Rainer Köhler
Aufsichtsratsvorsitzender / Chairman of the Supervisory Board: Karl-Josef Huber
USt (VAT)-IdNr.: DE 812353219
Bank: HypoVereinsbank Neumarkt (BLZ 760 200 70) 5 008 409 · SWIFT-BIC: HYVEDEMM460 · IBAN: DE 30 7602 0070 0005 0084 09



TECHNICAL MEMORANDUM

Surface Treatment of Stainless Steel

Currently Huber Technology processes up to >5000 metric tons of stainless steel per year. All finished products made of stainless steel have to undergo an appropriate surface treatment: pickling and passivation of the surface. In order to guarantee a constant and consistent treatment, pickling and passivation have to take place in a pickling bath using the full immersion method. The actual pickling process takes place in a pickling pool with a volume of 160 m^3. This pool volume is necessary in order to pickle even the largest items with the bath method. In the pickling bath processing-related material changes and alterations (caused by edging, welding, or caused by the contact with other materials) are reversed.

Especially ferritic inclusions, chromium-carbide formations and changes in the crystalline surface structures are eliminated. Thus, later occurring types of corrosion that are associated with stainless steel, in particular inter-crystalline corrosion, grain border corrosion and contact corrosion are avoided.

The pickling solution consists of nitric acid and hydrofluoric acid. The nitric acid serves for the oxidation of undesired materials and inclusions, while the hydrofluoric acid has the purpose of keeping the developing oxides in solution. The content of the etching bath gets constantly circulated while being kept at a constant temperature of 20 - 30° C through a heat exchanger. The bath is continuously kept free of mechanical pollution by the action of a filter. The pickling bath is always kept closed. It is opened only for loading and unloading. Before the cover is removed waste air is sucked off through slots on the side. The waste air is first cleaned by passing it through filters before it is released into the atmosphere. Thus, the formation of foul smelling odors is prevented.

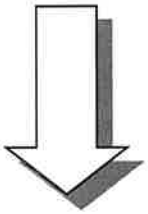
In a section next to the pickling plant, the pickled stainless steel items are passivated and cleaned off acid residues using spray- and steam pressure installations. The flushing water is collected in a collection pool. Later, it is centrally removed from there. First the flushing water is neutralized with calcium hydroxide. The addition of the neutralization agent takes places in portions while the pH of the flushing solution is continuously monitored. Once neutralized, the flushing water is passed through a heavy metal separator where heavy metals are secreted through the action of four consecutive inclined treatment groups that have flocculation compounds (polyacrylamid, polyacrylate) added to them. The heavy metals are removed and drained in a chamber filter press. The filter cake is disposed of in a hazardous waste facility. Finally, the cleaned waste water can be taken from the neutralization plant. Once again, the pH of the water is measured automatically and is recorded.

Additional samples that are examined for their pH-values and heavy metal contents are taken discontinuously from the effluent stream. In this manner, a supplementary running control is guaranteed. The bottom and the side walls of the entire pickling- and passivation bath are coated with shock-resistant and acid-proof plastic so as to avoid that water from the bath sprays outside. Only with this plant it is possible to achieve a professional, necessary surface treatment of stainless steel. And it is possible that the surface treatment of Huber stainless steel products which have their use in the environmental protection field, can take place in an ecologically-sound manner.

Learn more about Huber's experience with stainless steel at link at . . .
www.huber-technology.com/about-huber/our-manufacturing-quality.html

Time flow of a pickling process

PRIMARY CLEANING



PICKLING PROCESS

			Duration[1)]
FIRST step	pickling	- Filling the acid into the pickling tank	1 hour
		- Pickling	2.5 hours (2-4 hours)
		- Pump off into the acid tanks	1 hour
SECOND step	washing	- Filling the pickling tank with wash water	1 hour
		- Washing	0.2 hours (0-1.25 hours)
		- Pump off into the wash water tanks	1 hour

SECONDARY CLEANING

[1)] The pickling and washing times are variable and depend on the other parameters.

City of Lexington, KY
East Hickman Wet Weather Storage Facility and Pump Stations
in accordance with Specification Section 11420
Mechanical Screens & Screenings Compactors

LIMITED WARRANTY: Huber warrants that the equipment and components furnished will be free from defects in workmanship and materials and perform the general process function intended, solely under the conditions defined by Huber for a period of (a) twelve (12) months from completion of installation, start-up or owner acceptance of the equipment assuming the equipment is accepted by the owner within 6 months of delivery or (b) eighteen (18) months from the date of delivery to Purchaser, whichever date comes first. Huber will replace, modify or repair, at its sole option, any such defective component or equipment at no charge provided that Huber is notified promptly in writing of any claimed defect. If requested by Huber, any such defective part or component shall be returned to Huber, freight prepaid. Huber will provide on-site Field Service when reasonably assured of payment therefore if this warranty does not apply or when such service is required in its judgments. This warranty does not apply to any defect or malfunction arising out of failure to store, install, operate or maintain the equipment in accordance with instructions by Huber. Warranty shall be voided for any misuse of equipment; operation under conditions other than those defined by Huber in its operation and maintenance (O&M) manuals for said equipment, or gross operator negligence. Any unauthorized modification or alteration of the equipment or repair or replacement of components may void this warranty, at the sole option of Huber. For any billable repairs completed outside of the initial warranty period, a sixty (60) day guarantee on work performed and parts supplied will apply.

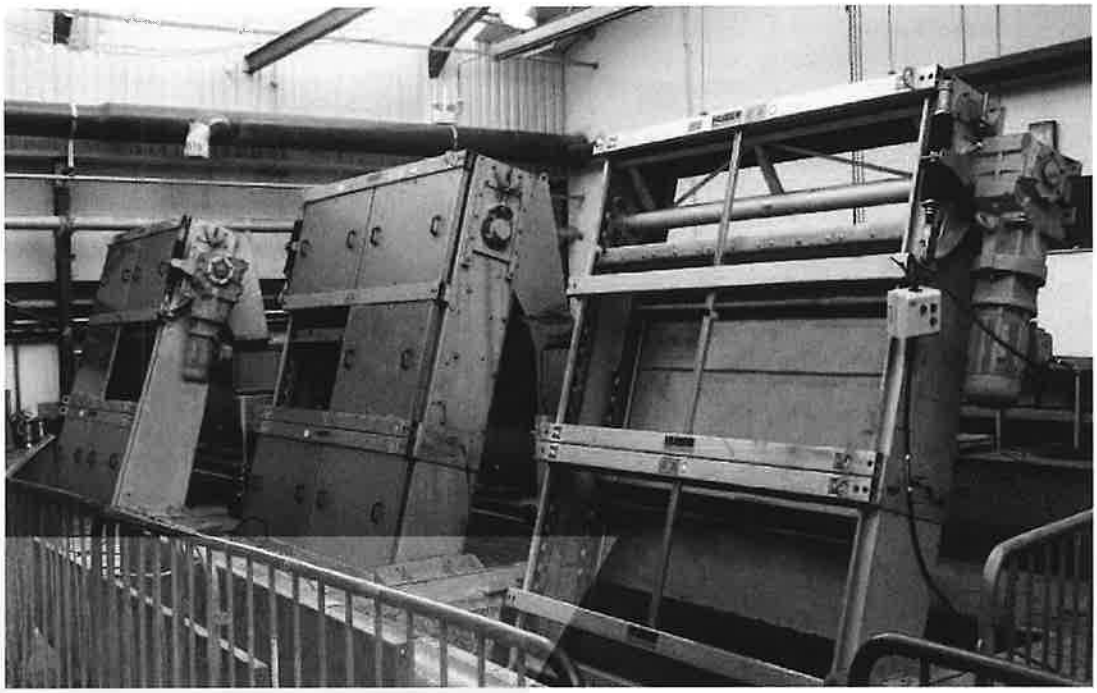
HUBER TECHNOLOGY INC. MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED, WITH REGARD TO THE DESIGN, SALE, MERCHANTABILITY OR FITNESS OF THE GOODS FOR A PARTICULAR PURPOSE OR USE EXCEPT AS EXPRESSLY SET FORTH IN HUBER'S TERMS AND CONDITIONS. HUBER IS NOT SUBJECT TO ANY OTHER OBLIGATIONS OR LIABILITIES ARISING OUT OF BREACH OF CONTRACT OR WARRANTY, TORT CLAIMS INCLUDING NEGLIGENCE AND STRICT LIABILITY, OR ANY OTHER THEORIES OF LAW. HUBER IS UNDER NO EVENT LIABLE FOR ANY SPECIFIC, INDIRECT, INCIDENTAL OR CONSEQUENTIAL LOSS, DAMAGES, EXPENSE, INJURY, DISMEMBERMENT, OR DEATH OF ANY KIND WHATSOEVER.

Extended Warranty

No extended warranty has been included in this project.

HUBER TECHNOLOGY
WASTE WATER Solutions

Multi-Rake Bar Screen RakeMax®



Sturdy bar screen with traveling rakes:

– for coarse to fine screening
– for combined or separate sewer systems
– for deep and very deep channels
– for high screenings loads

Features

The RakeMax® is a bar screen with a spacing from $^1/_4$" to 6" (6 to 150 mm). Its bars have either a streamlined tear drop profile (spacing ≤ 12 mm) or a rectangular shape (spacing > 12 mm).

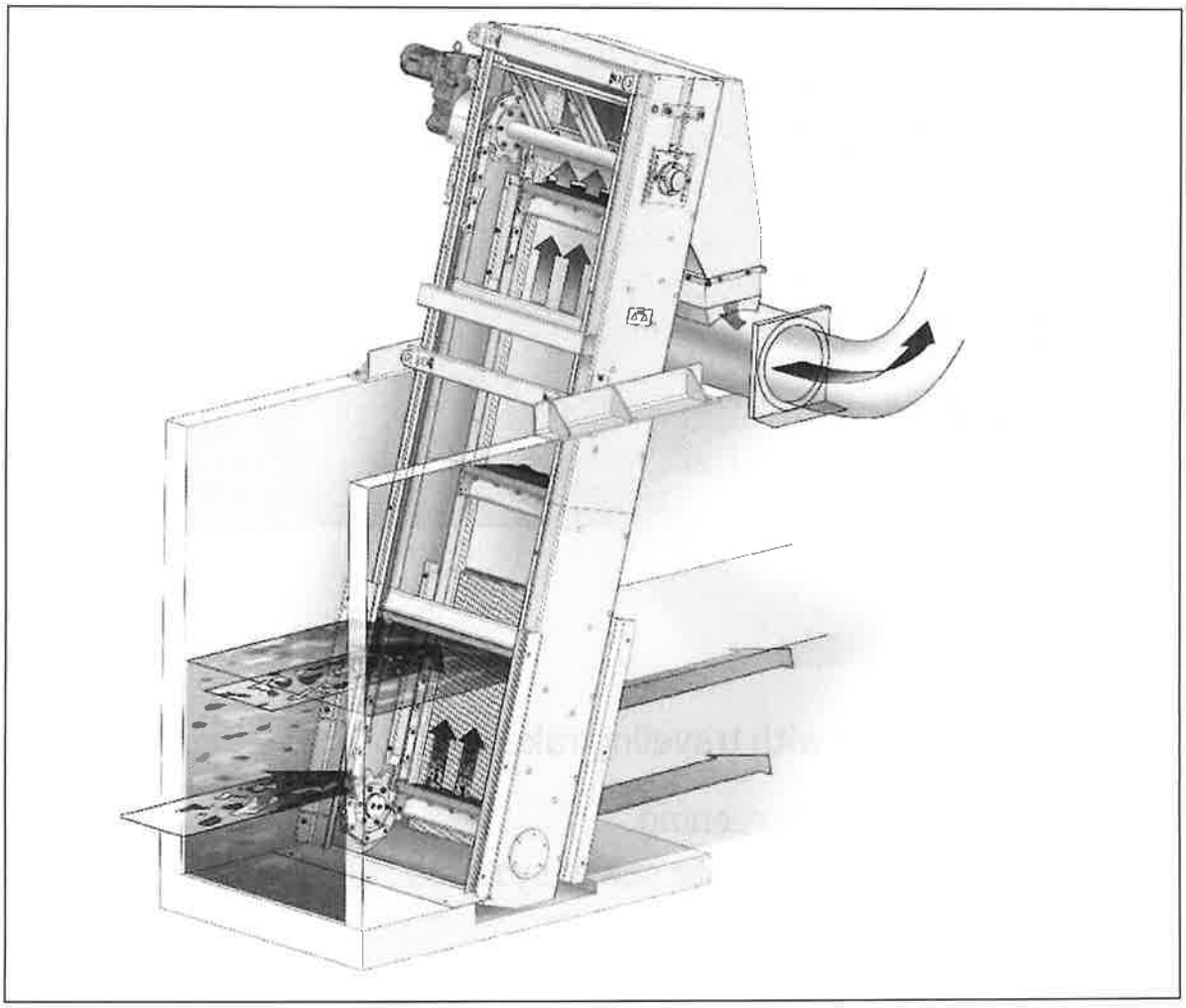
The bar rack is an integral part of the sturdy frame, which ensures perfect meshing of the rake teeth with the bar spaces. Positive and reliable cleaning is thus guaranteed.

A multitude of rake bars are bolted at selectable distances to a pair of drive chains. With short distances between its rakes, the RakeMax® is able to remove extremely high screenings loads. The rake blades are made of sections that are bolted to the rake bars, thus facilitating easy replacement of a segment in case that its teeth should become damaged or worn.

Chain rollers, made of wear-resistant polyamide, guide the chains exactly within the frame. The chains are driven by a pair of cogwheels. The plastic rollers also prevent wear between the chains and the cogwheels. The drive is connected with the frame through a spring; if the torque exceeds a certain value, due to any obstruction in the bar rack, a switch is pushed and the movement is reversed back and forth until the obstruction is loosened. Should the obstruction persist several reversals, an alarm is triggered. Self-destruction of the screen is thus prevented.

Chains and cogwheels are made of hardened, zinc galvanized and chromated steel to combine great wear-resistance with excellent corrosion-protection. They are also available in stainless steel. The maintenance-free ceramic bearings of the lower cogwheels are well-proven in thousands of ROTAMAT® installations.

The RakeMax® has a small height above the operating floor. In spite of its outstanding discharge height of up to 65 ft (20 m) above the channel floor, the RakeMax® fits into virtually any building.



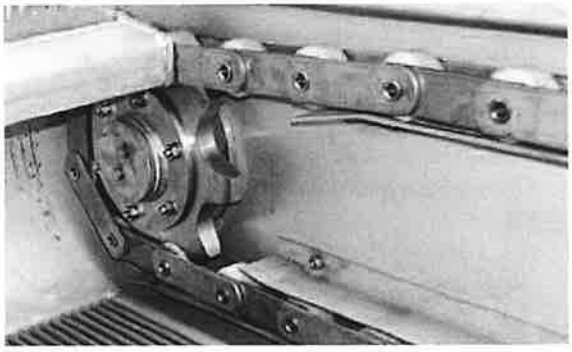
Benefits

- Fine to coarse screen with low head loss
- Removal of extremely high screenings loads
- Unimpaired by grit
- Low height above operating level
- Enclosure prevents odor nuisance
- Frame-mounted bar rack for exact rake engagement and reliable cleaning
- Mechanical overload-prevention and automatic reverse
- Easily accessible chain tensioning system
- Independently replaceable rake bars and blade sections
- Well-proven, maintenance-free lower ceramic bearings
- Sturdy design, excellent manufacturing with small tolerances
- Made of stainless steel, pickled in an acid bath for perfect finishing and corrosion protection

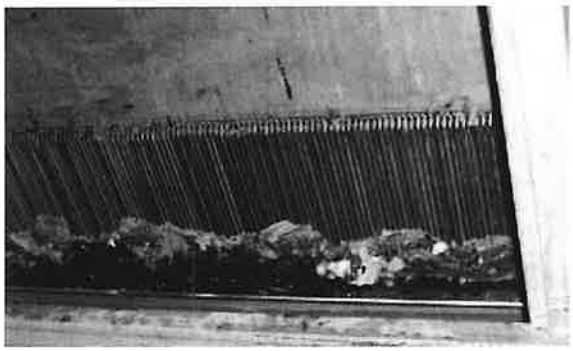
Details



Traveling rakes are bolted to the drive chains; individual sections of the rake blades can be exchanged in case that teeth should become damaged or worn; the ceramic bearings are maintenance-free (no lubrication)



Cog wheel and chain are made of hardened, wear-resistant steel that is zinc -galvanized and chromated for long-term corrosion protection; alternatively, wheels and chains can be made of stainless steel



Bar rack with a spacing of 1/4 inch (6 mm); the bars have a streamlined tear drop profile resulting in low head loss and avoiding jamming; RakeMax screens are unimpaired by grit and gravel

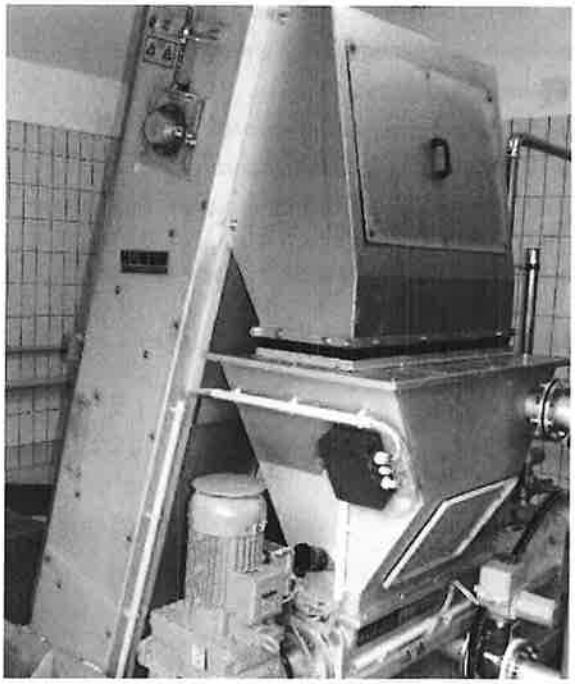


A torque restrictor reliably protects the screen against damage. The screen's controls combine reliability with adjustability.

Installation Examples



60 ft long and 6 ft wide RakeMax after successful factory testing

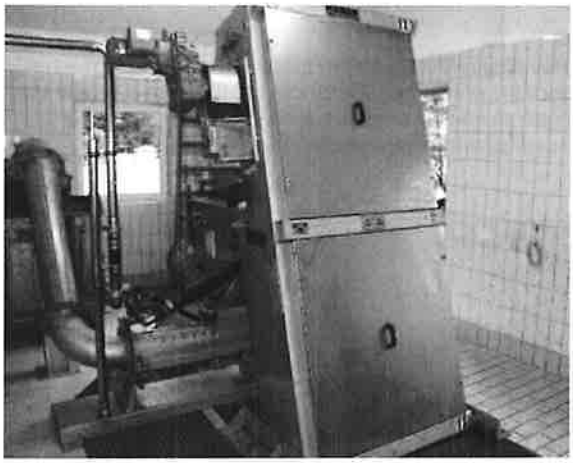


Complete enclosure for odor control; the chain tensioning system at the side of the frame is easily accessible

Applications

The RakeMax® is the ideal screen for the following applications:

- Combined sewer systems
- Deep to very deep channels
- High screenings loads
- Combined sewer overflows (CSO) and sanitary sewer overflows (SSO)



1/4 inch (6 mm) RakeMax feeding into a Super-Launder Washpress WAP/SL for perfect screenings washing and compaction

Dimensions

Bar spacing:	1/4" to 6" (6 to 150 mm)
Channel width:	Up to 13.1 ft (4 m)
Discharge height above channel floor:	Up to 65 ft (20 m)
Inclination:	70° to 80°

HUBER TECHNOLOGY, Inc.

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Subject to technical modification
0,15 / 5 – 9.2010 – 8.2004

HUBER Multi-Rake Screen
RakeMax®

HUBER Multi-Rake Bar Screen RakeMax® Installation Reference List

product
RAKEMAX
size
<ALL>
field selection
bar spacing [mm], heating, width [mm], J-design, hybrid

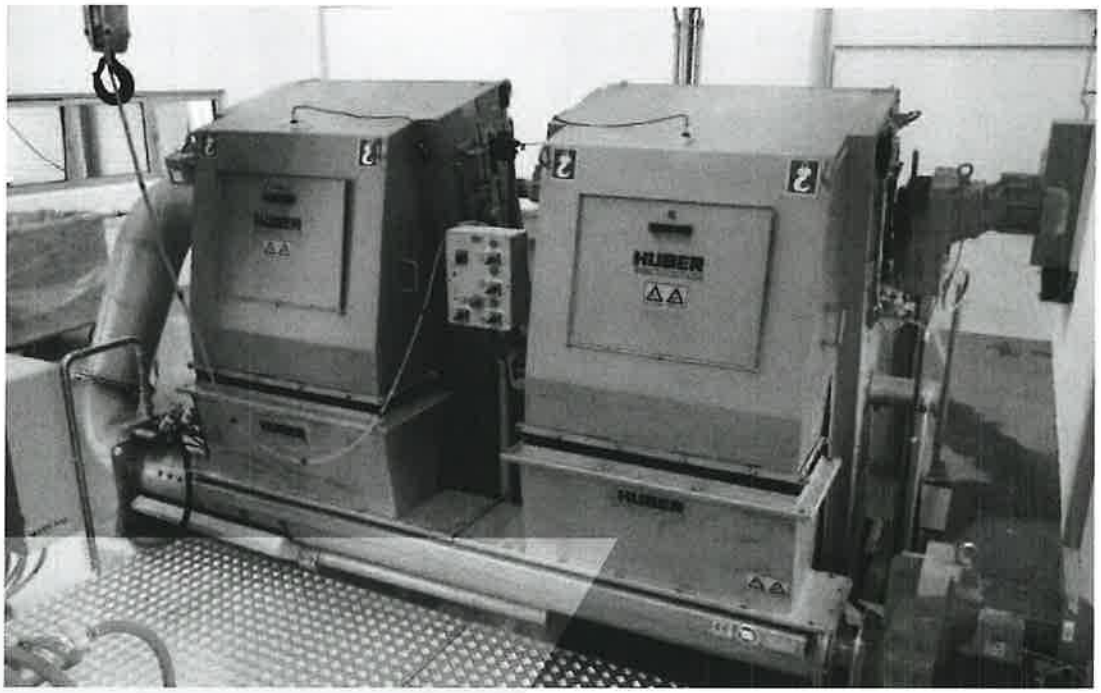
date of order	order no	size	project	country	quantity	bar spacing [mm]	heating	width [mm]	J-design	hybrid
10/06/2005	285531	4300	Heart of the Valley / WI, USA	United States	1.00	6		1252		
06/04/2007	287119	5300	Havre, City of, MT; US	United States	1.00	6		352		
06/21/2007	287173	4300	MILTON PRISON Lift Stat. FL,US	United States	1.00	12		352		
10/08/2007	287516	10300	Coyote Springs - Moapa, NV, US	United States	1.00	6		652		
05/05/2008	288115	8300	Meriden, City of / CT, US	United States	1.00	20		952		
05/05/2008	288115	8300	Meriden, City of / CT, US	United States	1.00	20		952		
05/05/2008	288115	4300	Meriden, City of / CT, US	United States	1.00	12		952		
05/05/2008	288115	4300	Meriden, City of / CT, US	United States	1.00	12		952		
05/15/2008	288156	6300	Clearwater - Marshall St	United States	2.00	6		752		
05/20/2008	288178	5300	Maunabo - WAP / P.R., US	United States	1.00	5		452		
08/07/2008	288433	4300	Rocky River / OH, US	United States	5.00	19		1852		
02/19/2009	288945	6300	Halls Mill / AL, US	United States	1.00	25		1152		
02/19/2009	288945	6300	Halls Mill / AL, US	United States	1.00	25		1152		
03/16/2009	289008	6300	Lititz / PA, US	United States	1.00	6		652		
03/30/2009	289061	8300	Cactus / TX, US	United States	1.00	6		1252		
03/30/2009	289061	5300	Cactus / TX, US	United States	1.00	6		452		
04/16/2009	289105	6300	Central Weber / UT, US	United States	2.00	10		1552		
04/30/2009	289143	5300	Hagerstown / MD, US	United States	2.00	10		2152		
07/16/2009	289380	3300	Seacoast Utilities / FL, US	United States	2.00	12		952		
08/20/2009	289474	5300	Milton, FL;US	United States	1.00	6		352		
11/17/2009	289731	7300	Richmond / KY, US	United States	1.00					
12/11/2009	289809	4300	SJRA No. 2 / TX, US	United States	1.00	6				
01/13/2010	289867	10300	Auburn / IN, US	United States	1.00	6		1552		
01/13/2010	289867	9300	Auburn / IN, US	United States	2.00	6		652		
02/10/2010	289935	2300	Rattlesnake / OH, US	United States	1.00	6		652		
03/11/2010	290031	6300	Reaney Street / PA, US	United States	1.00	25		1552		
04/22/2010	290170	9300	Linda / CA, US	United States	1.00	6		952		
05/27/2010	290270	22300	Louisville / KY, US	United States	3.00	13				
05/31/2010	290273	5300	York City / PA, US	United States	2.00	6				
06/24/2010	290351	3300	Williamston / SC, US	United States	1.00	6		352		
06/28/2010	290358	10300	Great Falls / MT, US	United States	2.00	8		952		
09/14/2010	290577	9300	Auburn / IN, US	United States	2.00	6				
09/14/2010	290579	10300	Auburn / IN, US	United States	1.00	6				
09/27/2010	290597	6300	Ina Road / AZZ, US	United States	1.00	40				
10/12/2010	290643	3300	Oaklodge / OR, US	United States	2.00	6		752		
10/28/2010	290685	11300	Belleville / IL, US	United States	1.00	20		1552		
10/28/2010	290685	13300	Belleville / IL, US	United States	1.00	20		1552		
11/30/2010	290772	3300	Key West / FL, US	United States	1.00	12		652		
01/13/2011	290897	9300	Narrows Rd PS / KY, US	United States	1.00	25		752		
04/29/2011	291186	8300	Mooresville / NC, US	United States	1.00	25		352		
07/07/2011	291381	4300	Rochester / NH, US	United States	1.00	6		952		
07/27/2011	291451	6300	Guadalupe / CA, US	United States	1.00	6		452		
09/28/2011	291624	5300	Jones Island-Milwaukee / WI,US	United States	5.00	6		1852		
09/28/2011	291624	5300	Jones Island-Milwaukee / WI,US	United States	3.00	6		2152		
09/29/2011	291625	5300	Quincy / IL, US	United States	3.00	20		1852		
09/29/2011	291626	6300	Beardstown / IL, US	United States	1.00					
10/07/2011	291625	5300	Quincy / IL, US	United States	3.00	20		1852		
10/07/2011	291626	6300	Beardstown / IL, US	United States	1.00	50		752		
12/05/2011	291836	2300	Niwot / CO, US	United States	1.00	6		252		
01/10/2012	291897	3300	Rapid City / SD, US	United States	2.00	6		1052		
01/12/2012	291914	8300	Mayaguez / PR, US	United States	2.00	25		255		
01/12/2012	291916	5300	Plattsburg / NYY, US	United States	1.00	6		952		
01/12/2012	291916	5300	Plattsburg / NYY, US	United States	1.00	6		952		
01/17/2012	291929	5300	Ft Lauderdale / FL, US	United States	1.00	6		1152		
01/17/2012	291929	5300	Ft Lauderdale / FL, US	United States	3.00	6		1152		
01/26/2012	291954	9300	Charlotte-Irwin Creek / NC, US	United States	2.00	6		1252		
02/16/2012	292010	8300	San Leandro / CA, US	United States	2.00	10		752		
02/29/2012	291836	2300	Niwot / CO, US	United States	1.00	6		252		
02/29/2012	292033	4300	Stony Brook / NJ, US	United States	2.00	6		952		
02/29/2012	292039	12300	Fishing River-Kansas City / MO	United States	2.00	6		652		
02/29/2012	292040	2300	Snohomish / WA, US	United States	1.00	6		1352		
03/23/2012	292105	3300	Columbiana County / OH, US	United States	1.00	6		352		
04/27/2012	292189	11300	Swift Creek PS/Cary / NC, US	United States	1.00	20		1252		
06/14/2012	292315	10300	Morganton / NC, US	United States	2.00	6		1052		
07/31/2012	292438	8300	Cleveland / OH, US	United States	7.00	20		2452		
08/07/2012	292462	4300	Marengo / IL, US	United States	1.00	6		652		
09/24/2012	292584	4300	Springfield / OH, US	United States	1.00	12		652		
09/24/2012	292584	4300	Springfield / OH, US	United States	2.00	12		652		
10/29/2012	292683	4300	Port Angeles / WA, US	United States	2.00	6		652		
10/30/2012	292684	5300	Camp Pendleton / CA, US	United States	2.00	10		452		
04/10/2013	293177	4300	Brookings WWTP / SD, US	United States	1.00	10				
04/25/2013	293208	8300	Lewisville / TX, US	United States	1.00	20				
08/13/2013	293519	8300	Chambersburg, PA; US	United States	1.00	6	Yes	1852		

08/19/2013	293525	2300	Houlton, ME; US	United States	1.00	6		652		
08/26/2013	293541	6300	Madison, WI MMSD PS#18; US	United States	2.00	25		1252		
09/02/2013	293558	11300	Chester-Ridley Creek / PA, US	United States	1.00	6		652		
09/02/2013	293558	11300	Chester-Ridley Creek / PA, US	United States	1.00	6		652		
09/12/2013	293596	4300	Davis / CA, US	United States	2.00	6		452		
10/25/2013	293742	7300	Pelican Rapids / MN, US	United States	1.00	6		352		
11/06/2013	293773	8300	Hollywood / FL, US	United States	2.00	6		2152		
12/03/2013	293833	4300	Albuquerque / NM, US	United States	5.00	6		1052		
12/05/2013	293840	10300	Stillwater / OK, US	United States	2.00	6		752		
01/15/2014	13000057	8300	Columbia, SC - Quail Lane PS, US	United States	2.00	12		1352		
01/15/2014	13000059	3300	Gogebic / MI, US	United States	1.00	6		752		
01/28/2014	13000105	9300	Cary Avenue, US	United States	1.00	6		652		
01/28/2014	13000106	10300	Clavey Road, US	United States	1.00	6		1952		
01/28/2014	13000106	10300	Clavey Road, US	United States	1.00	6		1952		
01/29/2014	13000108	10300	Waukegan STP, US	United States	1.00	6		1852		
01/29/2014	13000108	10300	Waukegan STP, US	United States	1.00	6		1852		
01/29/2014	13000108	10300	Waukegan STP, US	United States	1.00	6		1852		
01/29/2014	13000108	10300	Waukegan STP, US	United States	1.00	6		1852		
03/12/2014	13000283	14300	Clarksburg / WV, US	United States	1.00	10		1252		
03/12/2014	13000283	14300	Clarksburg / WV, US	United States	1.00	10		1252		
05/14/2014	13000532	3300	Lawrenceville / NJ - ELSA, US	United States	2.00	12		952		
06/04/2014	13000635	4300	San Luis Obispo, CA; US	United States	2.00	6		652		
08/11/2014	13000953	4300	San Antonio / TX, US	United States	2.00	10		1252		
08/11/2014	13000953	4300	San Antonio / TX, US	United States	1.00	10		1952		
09/25/2014	13001114	4300	Naples / FL, US	United States	2.00	6		952		
09/30/2014	13001134	2300	Boulder / MT, US	United States	1.00	40		252		
10/13/2014	13001183	6300	Albermarle / NC, US	United States	1.00	10		952		
10/13/2014	13001183	7300	Albermarle / NC, US	United States	1.00	10		1552		
11/10/2014	13001310	4300	Seattle / WA - JBLM, US	United States	2.00	6		952		
11/19/2014	13001351	6300	Middlesex / NJ, US	United States	1.00	6	Yes	1552		
01/26/2015	13001631	3300	Campbell WWTP / OH, US	United States	1.00	10	Yes	352		
01/26/2015	13001631	4300	Campbell WWTP / OH, US	United States	1.00	10		852		
02/24/2015	13001760	6300	Marysville / CA, US	United States	1.00	6		652		
05/06/2015	13002059	2560	Lake Havasu / AZZ, US	United States	1.00	6		690		
05/13/2015	13002089	8300	Rock Creek / OR, US	United States	2.00	6		1552		
06/26/2015	13002252	9300	Trophy Club MUD / TX, US	United States	2.00	6		952		
06/29/2015	13002265	3300	Lynnewood / WA, US	United States	1.00	6		1152		
07/08/2015	13002314	4300	Deer Park / TX, US	United States	1.00	6		1252		
08/12/2015	13002470	3300	Bolivar / MO, US	United States	1.00	6		652		
08/13/2015	13002475	7300	Buckeye Lake / OH, US	United States	1.00	6	Yes	652		
08/20/2015	13002497	3200	Rocky Branch / MO, US	United States	1.00	6		690		
08/25/2015	13002512	8300	Marietta / SC, US	United States	1.00	6		452		
09/16/2015	13002595	4300	Green Bay, WI; US	United States	2.00	12		452		
12/07/2015	13002921	9300	Miamisburg / OH, US	United States	2.00	6		652		
12/17/2015	13002972	3200	Elizabeth City / NC, US	United States	1.00	6		690	Yes	
01/26/2016	13003098	9300	Mount Vernon / WA, US	United States	1.00	12		1052		
02/24/2016	13003216	8300	Farmington / CT, US	United States	1.00	6		952		
02/24/2016	13003216	8300	Farmington / CT, US	United States	1.00	6		952		
02/29/2016	13003237	10300	Greensborough / NC, US	United States	4.00	6		1252		
03/16/2016	13003306	6080	Lake Lakota / WA, US	United States	2.00	6		675	Yes	
04/14/2016	13003406	10300	Oshkosh / WI, US	United States	1.00	10		352		
04/20/2016	13003421	5300	Euclide / OH, US	United States	6.00	10		1552		
04/20/2016	13003423	15300	Clayton Atlanta / GA, US	United States	4.00	12		1552		
04/27/2016	13003447	7300	Lake Charles / LA, US	United States	2.00	10		952		
05/12/2016	13003504	4300	Santa Barbara / CA, US	United States	1.00	20		452		
05/31/2016	13003589	4300	Plum Island / SC, US	United States	2.00	6		1652		
06/09/2016	13003618	2560	Kingwood-Houston / TX, US	United States	1.00	6		775		
06/21/2016	13003670	15300	Nashua, NH; US	United States	1.00	10		1652		
06/21/2016	13003670	15300	Nashua, NH; US	United States	1.00	10		1652		
10/10/2016	13004103	3520	Portsmouth / MA, US	United States	2.00	6		675		
10/14/2016	13004135	2880	Oak Ridge/ TN, US	United States	1.00	6		375		
10/26/2016	13004172	4160	Fontana Mills, CA; US	United States	1.00	6		975		
10/28/2016	13004182	4300	Edson/AB, US	United States	2.00	6		652		
10/28/2016	13004183	2300	Bernardsville/NJ, US	United States	1.00	10	Yes	275	Yes	
11/03/2016	13004193	5120	Little Patuxent / MD, US	United States	3.00	6		675		
11/23/2016	13004270	6080	Eaton/OH, US	United States	1.00	6	Yes	475		
11/29/2016	13004291	2880	Radcliff/KYY, US	United States	1.00	6		375	Yes	
11/29/2016	13004298	2880	The Dalles/OR, US	United States	2.00	6		975		
12/20/2016	13004408	9920	Mustang Creek WWTP / TX, US	United States	1.00	12		675		
12/21/2016	13004418	2880	Oak Ridge 2nd Machine / TN, US	United States	1.00	6		375		
12/21/2016	13004427	6400	Oak Harbor/ WA, US	United States	1.00	10		975		
01/23/2017	13004487	3840	Brownsburg / IN, US	United States	1.00	6		675		
02/24/2017	13004645	4160	Riverbend / TX, US	United States	2.00	6		975		
03/28/2017	13004765	2560	East Hampton / CT, US	United States	1.00	6		475	Yes	
05/16/2017	13004979	2240	Martinez / TX, US	United States	1.00	6		375		
06/30/2017	13005213	4160	Hot Springs / AR, US	United States	2.00	6	Yes	1075	Yes	
08/28/2017	13005470	6080	Sand Island / HI, US	United States	1.00	12		1275		
08/31/2017	13005498	8960	Ajax Terrace-Roxbury / NJ, US	United States	1.00	10		975		
10/20/2017	13005668	6080	Baton Rouge NWWTP / LA, US	United States	3.00	6		975	Yes	
12/20/2017	13005930	3200	Winkler/ MB, US	United States	1.00	6	No	775		No
12/20/2017	13005930	3200	Winkler/ MB, US	United States	1.00	6	No	775		No
02/21/2018	13006156	5120	Pima County State Prison / AZZ, US	United States	1.00	25	No	375		No
02/27/2018	13006183	11840	Lexington / KYY, US	United States	1.00	6	No	675		Yes
02/27/2018	13006183	11840	Lexington / KYY, US	United States	1.00	6	No	675		No
03/20/2018	13006252	4160	Pasco County / FL, US	United States	1.00	10	No	775		No

03/20/2018	13006252	4160	Pasco County / FL, US	United States	1.00	10	No	775		No
					243					

HUBER TECHNOLOGY
WASTE WATER Solutions

HUBER WAP
Screening **W**ash **A**nd **P**ress



Washing, dewatering and compaction of screenings

- Dewatering performance of up to 40% DS
- Weight and volume reduction by up to 70%
- Sturdy machine, made of stainless steel

Features

Wet screenings drop directly from a screen or indirectly from a conveyor into the hopper of the WAP. A shafted and sturdy conveying and compacting screw at its bottom moves the screenings through a wash zone and into a press zone.

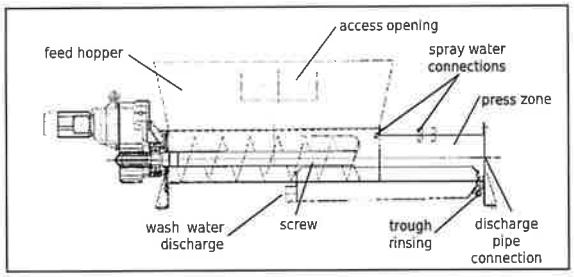
In the wash zone, several powerful water jets are directed on the screenings for intensive washing and rinsing. Service water can be used. Washing intensity and cycles are individually adjustable. Fecal and other organic matter are washed away. Wash water drains through perforations at the bottom of the wash zone.The screw pushes the washed screenings further into the press zone. Here the screenings form a plug. The screw forces this plug through a tube with a bend. High pressure is thus created by friction and distortion. Water is pressed through perforations in the tube. The screenings are dewatered and compacted to 30 - 40% DS.

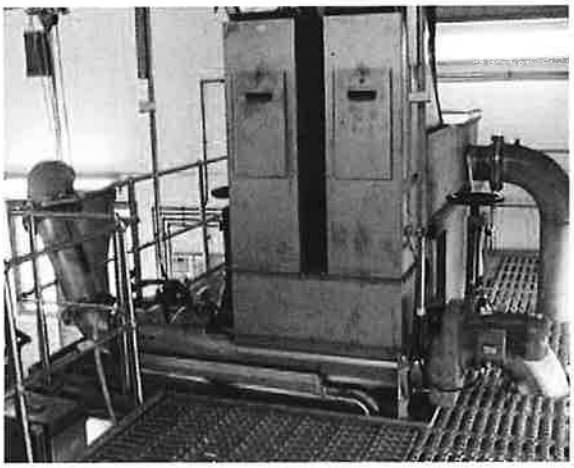
The plug of washed and compacted screenings is pushed through a slightly conical and inclined discharge pipe and drops into a container.

Wash water from the wash and press zones is collected in a trough. Another water connection permits rinsing of the trough. Polluted wash water is returned to the wastewater flow. Its high BOD content facilitates denitrification processes.

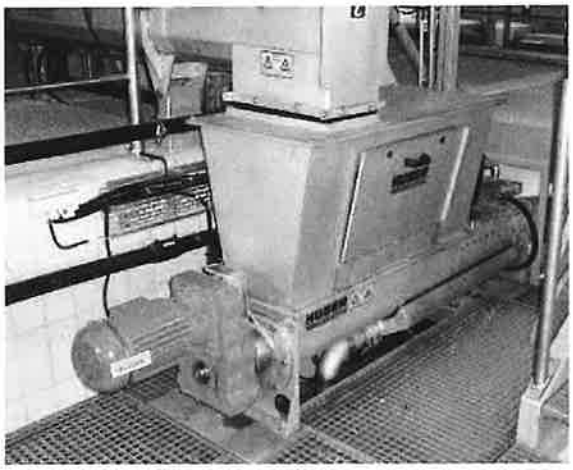
Benefits

- Dewatering performance of up to 40% DR (prior grinding does not improve the performance; grinder costs should be saved)
- Weight reduction up to 70%
- Capacity of up to 400 ft3/hr (12 m3/h) of wet screenings
- Designed to handle coarse material
- Service water can be used as wash water
- Hopper length can be adjusted to individual needs
- Completely made of stainless steel
- Passivated by full submergence in an acid bath for perfect finishing and corrosion protection





WAP saving screenings disposal costs



WAP with a large hopper, fed via a screw conveyor

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Subject to technical modification
0,0 / 3 – 11.2012 – 5.2011

HUBER Wash And Press WAP

HUBER Screenings Wash Press WAP® Installation Reference List

product
WAP
size
<ALL>
field selection
heating

date of order	order no	size	project	country	quantity	heating
02/26/1999	206180	2	Garden City, Kansas	United States	1.00	
04/13/1999	206301	1	Jacksonville	United States	1.00	
04/15/1999	206305	2	Merced	United States	1.00	
05/25/1999	206870	4	Springville/GSA	United States	1.00	
06/24/1999	206963	4	Meridian STP	United States	1.00	
07/21/1999	207076	2	Chambers Creek	United States	1.00	
10/27/1999	280161	1	Ho Chunk Lift Station	United States	1.00	
10/29/1999	280177	1	Marquette	United States	1.00	
12/01/1999	285031	4	Portland	United States	1.00	
01/19/2000	280303	1	City of Medford	United States	1.00	
04/03/2000	280964	1	Harris Country, USA	United States	1.00	
05/02/2000	281022	1	Wells	United States	1.00	
06/08/2000	281122	2	Magna Water Company, USA	United States	1.00	
06/15/2000	281125	1	Government Camp	United States	1.00	
07/11/2000	281181	1	Harris Country MUD 358, USA	United States	1.00	
07/13/2000	281192	4	Iron Bridge, FL	United States	2.00	
07/26/2000	281209	2	Guelph WWTP, CA	United States	2.00	
08/30/2000	281279	1	Niwot Sanitation District	United States	1.00	
09/29/2000	281315	2	Ashland	United States	1.00	
09/29/2000	281330	2	City of Sterling	United States	1.00	
10/13/2000	281363	1	Roxborough Park WWTP	United States	1.00	
10/14/2000	281400	1	Bastian VA WWTP-Coms Inc.	United States	1.00	
10/16/2000	281367	2	Payson City WWRG	United States	2.00	
11/22/2000	281485	2	Blue Springs Sni-A-Bar	United States	1.00	
12/01/2000	281499	4	Persigo	United States	1.00	
02/21/2001	281638	2	St.Simons Island	United States	1.00	
02/21/2001	281639	1	Ashland City	United States	1.00	
02/21/2001	281643	2	Burlington	United States	1.00	
03/05/2001	281657	2	Cedarburg WWTP	United States	1.00	
03/20/2001	281678	2	Duncan	United States	1.00	
03/20/2001	281678	2	Duncan	United States	1.00	
04/02/2001	281707	1	Kimberling City	United States	1.00	
04/06/2001	281727	1	City of Fruitland	United States	1.00	
04/10/2001	281732	2	Lick Creek WWTP	United States	1.00	
04/10/2001	281734	2	Aspen	United States	1.00	
04/11/2001	281737	2	Oconomowoc	United States	1.00	
05/07/2001	281797	4	Braintree, Quincy	United States	1.00	
05/09/2001	281789	2	Mountain Home AFB WWTP	United States	1.00	
05/21/2001	281800	2	St. Lucie West/FL	United States	1.00	
05/29/2001	281810	2	Lake Mills/WI	United States	1.00	
05/31/2001	281833	2	Flower Mound	United States	2.00	
05/31/2001	281839	1	Three Lakes	United States	1.00	
06/06/2001	281849	4	Leon Creek-San Antonio	United States	1.00	
06/22/2001	281881	2	Amherst	United States	1.00	
07/12/2001	281927	1	Greenville	United States	1.00	
07/31/2001	281970	2	Gardner	United States	1.00	
08/09/2001	282002	1	Rockwood	United States	1.00	
08/20/2001	282020	2	Valparaio - IN	United States	2.00	
08/21/2001	282026	2	Mamaroneck, NY	United States	1.00	
08/21/2001	282026	2	Mamaroneck, NY	United States	1.00	
08/28/2001	282047	2	Tellruide	United States	1.00	
08/29/2001	282054	4	El Paso	United States	2.00	
10/09/2001	282143	2	La Crosse/ WI	United States	1.00	

10/12/2001	282145	2	Spanish Fork	United States	2.00	
10/25/2001	282156	2	Payette / ID	United States	1.00	
11/21/2001	282213	2	Merced CA	United States	1.00	
12/18/2001	282283	2	Sandwich	United States	1.00	
12/21/2001	282303	2	Brawley CA WWTP	United States	1.00	
12/21/2001	282305	2	Jack s Creek Combs Inc.	United States	1.00	
02/26/2002	282393	2	Kihei WWRF	United States	1.00	
04/08/2002	282492	2	Danbury	United States	1.00	
04/23/2002	282525	1	Greenwood	United States	1.00	
04/23/2002	282526	1	Montague	United States	1.00	
05/21/2002	282570	2	Kihei WWRF	United States	1.00	
05/22/2002	282571	2	San Angelo WWTP	United States	1.00	
05/22/2002	282572	2	Morris IL Sewage TRMT	United States	1.00	
06/18/2002	282634	2	Ponderosa	United States	1.00	
06/28/2002	282664	1	Mt. Crested Butte	United States	1.00	
07/10/2002	282681	2	Pecan Creek	United States	1.00	
07/30/2002	282721	2	Wildcat	United States	1.00	
07/31/2002	282728	2	Midway, Des Moines	United States	2.00	
10/16/2002	282885	2	Montpelier	United States	1.00	
10/16/2002	282887	1	Old Town	United States	1.00	
10/17/2002	282891	2	Chesterton IL	United States	1.00	
10/18/2002	282906	2	Louisville	United States	1.00	
10/21/2002	282907	4	North Davis	United States	2.00	
10/28/2002	282928	1	Skowhegan	United States	1.00	
10/31/2002	282944	1	Groton	United States	1.00	
12/17/2002	283067	2	Durant	United States	1.00	
01/06/2003	283094	2	Pagosa Springs	United States	1.00	
01/16/2003	283127	1	Caribou	United States	1.00	
02/12/2003	283181	1	Bethel	United States	1.00	
02/20/2003	283189	4	Yonkers	United States	1.00	
02/20/2003	283189	4	Yonkers	United States	1.00	
04/04/2003	283270	2	Plum Creek	United States	1.00	
04/04/2003	283275	2	Hull	United States	1.00	
04/14/2003	283286	2	Reno	United States	1.00	
04/22/2003	283300	1	Post	United States	1.00	
04/23/2003	283311	2	Durham, Town of	United States	1.00	
05/06/2003	283348	1	Harris County	United States	1.00	
06/12/2003	283432	1	Dalhart	United States	2.00	
07/01/2003	283483	1	Rollinsford	United States	1.00	
07/01/2003	283485	1	Dale City	United States	1.00	
08/05/2003	283545	1	Los Alamos	United States	1.00	
08/06/2003	283551	2	Peru	United States	1.00	
08/08/2003	283547	1	Plymouth	United States	1.00	
08/19/2003	283559	1	Xenon	United States	1.00	
08/19/2003	283559	1	Xenon	United States	1.00	
09/02/2003	283594	1	Chimney Hill	United States	1.00	
09/03/2003	283593	1	Evans City of	United States	1.00	
10/27/2003	283736	2	Aberdeen	United States	1.00	
11/04/2003	283752	2	Pooler	United States	1.00	
11/05/2003	283753	2	Double Creek	United States	1.00	
12/04/2003	283819	1	Granbury	United States	1.00	
03/09/2004	284026	2	Grove	United States	1.00	
04/19/2004	284112	4	Meridian	United States	1.00	
04/22/2004	284128	1	Copperas Cove	United States	1.00	
05/28/2004	284201	2	Cleburne	United States	2.00	
06/03/2004	284208	1	Flintrock / TX, USA	United States	1.00	
06/07/2004	284218	1	Tonganoxie / KS, USA	United States	1.00	
07/14/2004	284316	2	Suffield WPCF / CT, USA	United States	1.00	
07/14/2004	284324	2	Peru-West Side WWTP / IL, USA	United States	1.00	
08/24/2004	284449	1	Shenandoah WWTP / TX, USA	United States	1.00	
09/27/2004	284509	1	Idaho Springs / CO, USA	United States	1.00	
10/04/2004	284546	1	Lewistown / MT, USA	United States	1.00	
10/12/2004	284550	1	Weatherford / TX, USA	United States	1.00	
10/12/2004	284551	2	Plum Creek, Castle Rock /	United States	1.00	
11/08/2004	284647	1	Green River / WI, USA	United States	1.00	

11/18/2004	284665	1	Hillsboro / TX, USA	United States	1.00	
02/15/2005	284856	2	El Paso - Northwest / TX, USA	United States	1.00	
02/22/2005	284875	1	Schuylkill Valley / PA, USA	United States	1.00	
03/15/2005	284917	2	Reno Stead / NV, USA	United States	2.00	
03/18/2005	284934	2	Scottsdale / AZ, USA	United States	1.00	
04/04/2005	284968	1	Steiner Ranch II / TX, USA	United States	1.00	
04/04/2005	284969	4	Deer Island / MA, USA	United States	2.00	
05/02/2005	285062	1	Oak Grove / MO, USA	United States	1.00	
05/18/2005	285102	2	Stewart Creek WWTP	United States	2.00	
06/09/2005	285160	1	Lockheed Martin Corp./ CO, USA	United States	1.00	
07/01/2005	285210	2	Jacksonville - Canada	United States	1.00	
08/17/2005	285362	2	Harris County, MUD #155 / TX,	United States	1.00	
09/08/2005	285411	2	Copperas Cove / TX, USA	United States	1.00	
10/06/2005	285531	2	Heart of the Valley / WI, USA	United States	1.00	
11/02/2005	285566	2	Sahaurita / AZ, USA	United States	1.00	
11/15/2005	285625	2	Polk County / FL, USA	United States	1.00	
12/06/2005	285697	1	Decherd / TN, USA	United States	1.00	
01/18/2006	285793	2	Dove Springs-Georgetown / TX,	United States	1.00	
01/18/2006	285800	1	Parkientenbos / Aruba, USA	United States	1.00	
01/18/2006	285801	1	Bubali / Aruba, USA	United States	1.00	
01/18/2006	285802	1	Zeewijk / Aruba, USA	United States	1.00	
01/19/2006	285804	4	Main Street / FL, USA	United States	1.00	
01/19/2006	285804	4	Main Street / FL, USA	United States	1.00	
02/01/2006	285850	1	Buckman Street II, JEA/FL, USA	United States	1.00	
03/13/2006	285928	1	Rhinelander / WI, US	United States	1.00	
04/03/2006	285963	2	Springfield / MO, USA	United States	1.00	
05/05/2006	286061	2	Warrington Lift Station / FL,	United States	1.00	
05/08/2006	286067	1	Lakeland - Scott s Creek / TN,	United States	1.00	
05/16/2006	286090	1	Mamaroneck / NY, USA	United States	1.00	
06/22/2006	286197	1	Royston / GA, USA	United States	1.00	
06/22/2006	286198	1	Timber Lane MUD-Spring/TX,USA	United States	1.00	
06/28/2006	286215	2	Texas City / TX, USA	United States	1.00	
07/03/2006	286229	2	Lexington / KY, USA	United States	3.00	
07/12/2006	286274	2	Main Street - WAP 2, Ecua-	United States	2.00	
08/01/2006	286347	2	Pickaway Corr I Orient/OH,USA	United States	1.00	
09/01/2006	286407	2	Dublin / GA, USA	United States	1.00	
09/01/2006	286409	4	Rialto WWTP, Bloomington / CA,	United States	1.00	
09/04/2006	286441	1	Canyon / TX, USA	United States	2.00	
10/05/2006	286517	4	Greenville, IL; US	United States	1.00	
12/08/2006	286666	2	Harris County MUD #358/TX, USA	United States	1.00	
12/18/2006	286685	6	Surprise, City of SPA, US	United States	1.00	
01/12/2007	286725	1	Harris County MUD #278/TX, USA	United States	1.00	
01/25/2007	286774	2	Lumberton/TX, US	United States	1.00	
02/01/2007	286799	2	Morris - East Plant / IL, US	United States	1.00	
03/14/2007	286902	1	Woodcreek / TX, USA	United States	1.00	
03/22/2007	286935	1	Mukwonago / WI, USA	United States	1.00	
04/25/2007	287005	2	Ellis Creek - Petaluma / CA,	United States	2.00	
05/29/2007	287101	2	Groton, Town of / CT, US	United States	1.00	
06/04/2007	287119	1	Havre, City of, MT; US	United States	1.00	
06/11/2007	287136	1	Tooele / UT, USA	United States	1.00	
06/11/2007	287137	1	Crockett / TX, USA	United States	1.00	
06/21/2007	287172	4	Roseburg / WA, USA	United States	1.00	
06/26/2007	287196	1	Town of Dover / TN, USA	United States	1.00	
06/29/2007	287212	2	Wauchula / FL, USA	United States	1.00	
07/11/2007	287237	2	Southbridge / MA, USA	United States	1.00	
07/31/2007	287304	1	Harris County MUD #24, Spring	United States	1.00	
08/09/2007	287331	2	St. Cloud, FL; US	United States	1.00	
08/21/2007	287355	2	Grand Mission MUD #1, Richmond	United States	1.00	
08/22/2007	287359	4	Iron Bridge / FL, USA	United States	2.00	
11/05/2007	287592	1	UCONN / CT, USA	United States	1.00	
11/09/2007	287613	2	Magna - Barton Wellfield WTP /	United States	2.00	
01/16/2008	287796	4	Sharon / PA, US	United States	1.00	
03/12/2008	287981	1	Grants / NM, US	United States	1.00	
03/18/2008	288001	2	Penisula WRP / TX, US	United States	1.00	
04/15/2008	288069	2	Oconomowoc II / WI, US	United States	1.00	

04/16/2008	288075	1	Tillamook / OR - US	United States	1.00	
04/17/2008	288086	2	Hillsborough County NWWRF / FL	United States	1.00	
04/17/2008	288086	2	Hillsborough County NWWRF / FL	United States	1.00	
05/05/2008	288125	2	Laguna County / CA, US	United States	1.00	
05/14/2008	288153	4	Clearwater - North East Plant	United States	1.00	
05/14/2008	288154	2	Clearwater - East APCR / FL,	United States	1.00	
05/20/2008	288178	2	Maunabo - WAP / P.R., US	United States	1.00	
05/20/2008	288180	1	Diamond / IL, US	United States	1.00	
05/28/2008	288214	1	Munising, MI; US	United States	1.00	
06/10/2008	288253	2	WalCoMet / WI, US	United States	2.00	
07/10/2008	288334	2	Moapa Valley / NV, US	United States	1.00	
07/23/2008	288377	2	Lahaina / HI, US	United States	1.00	
07/23/2008	288377	2	Lahaina / HI, US	United States	1.00	
07/28/2008	288396	2	Nevada / MO, US	United States	1.00	
07/29/2008	288403	1	Elk Valley WWTP, Ozark/ MO, US	United States	1.00	
07/31/2008	288417	2	Chico / CA, US	United States	2.00	
08/07/2008	288442	2	Ahoskie / NC, US	United States	1.00	
08/21/2008	288463	2	Bacliff / TX, US	United States	1.00	
08/29/2008	288498	1	Perry Willard / UT, US	United States	1.00	
08/29/2008	288499	1	Harris County MUD #400, TX	United States	1.00	
09/22/2008	288564	1	Eureka / IL, US	United States	1.00	
09/24/2008	288567	1	Cornelia / GA, US	United States	1.00	
10/31/2008	288681	2	Bayfield / CO, US	United States	1.00	
11/20/2008	288732	1	Kewaskum / WI, US	United States	1.00	
11/26/2008	288742	2	West Wendover / NV, US	United States	1.00	
12/12/2008	288785	2	Auburndale / FL, US	United States	1.00	
12/16/2008	288795	2	Boone / IA, US	United States	1.00	
01/08/2009	288817	2	Stayton / OR, US	United States	1.00	
02/02/2009	288894	1	Driggs / ID, US	United States	1.00	
02/19/2009	288945	4	Halls Mill / AL, US	United States	1.00	
02/19/2009	288945	4	Halls Mill / AL, US	United States	1.00	
03/16/2009	289008	2	Lititz / PA, US	United States	1.00	
03/18/2009	289021	4	Struthers / OH, US	United States	1.00	
03/24/2009	289043	4	Otter Creek-Richmond / KY, US	United States	1.00	
03/24/2009	289043	4	Otter Creek-Richmond / KY, US	United States	1.00	
03/30/2009	289061	2	Cactus / TX, US	United States	1.00	
04/15/2009	289095	2	Pinetop-Lakeside / AZ, US	United States	1.00	
04/22/2009	289122	2	Spares Ucon / CT, US	United States	1.00	
04/23/2009	289123	2	Post Falls / ID, US	United States	1.00	
04/23/2009	289124	2	Payson / UT, US	United States	2.00	
04/30/2009	289143	2	Hagerstown / MD, US	United States	1.00	
04/30/2009	289143	2	Hagerstown / MD, US	United States	1.00	
05/07/2009	289168	1	Minooka / IL, US	United States	1.00	
05/25/2009	289209	4	Yerington / NV, US	United States	1.00	
05/28/2009	289224	2	Panther Creek WWTP / TX, US	United States	1.00	
05/28/2009	289227	2	Central Davis / UT, US	United States	1.00	
06/08/2009	289256	2	Groton II / CA, US	United States	1.00	
06/26/2009	289317	4	Kingman / AZ, US	United States	2.00	
07/16/2009	289380	2	Seacoast Utilities / FL, US	United States	2.00	
08/07/2009	289446	2	Butte-Silverbow / MT, US	United States	1.00	
08/20/2009	289474	2	Milton, FL;US	United States	1.00	
08/28/2009	289496	1	Warrensburg East Plant / MO,US	United States	1.00	
08/28/2009	289497	1	Warrensburg West Plant / MO,US	United States	1.00	
10/05/2009	289603	2	Upper Blue / CO, US	United States	2.00	
10/13/2009	289622	1	Grantsville / UT, US	United States	1.00	
10/21/2009	289655	2	Jordan Basin / UT, US	United States	2.00	
10/22/2009	289660	2	Douglas / AZ, US	United States	1.00	
10/23/2009	289662	2	Brigham City / UT, US	United States	2.00	
10/28/2009	289668	2	Renn Road / TX, US	United States	1.00	
11/17/2009	289732	2	Aberdeen / SD, US	United States	1.00	
11/24/2009	289756	2	Eagle / ID, US	United States	2.00	
12/11/2009	289810	2	Galveston County WCID #8 / TX,	United States	1.00	
12/11/2009	289815	2	Washington / IL, US	United States	1.00	
12/11/2009	289816	1	Dousmann / WI, US	United States	1.00	
01/25/2010	289892	1	Westchester / NY, US	United States	1.00	

02/10/2010	289935	2	Rattlesnake / OH, US	United States	1.00	
02/11/2010	289939	2	MC Henry / IL, US	United States	1.00	
02/16/2010	289941	2	Fort Bend MUD 151, US	United States	1.00	
03/08/2010	290007	2	Wahiawa / HI, US	United States	1.00	
03/08/2010	290007	2	Wahiawa / HI, US	United States	1.00	
03/11/2010	290025	4	Hills Canyon South / CA, US	United States	1.00	
03/15/2010	290040	4	Norwalk / CT, US	United States	3.00	
03/15/2010	290043	2	Richmond / TX, US	United States	1.00	
03/15/2010	290044	4	Timpanagos / UT, US	United States	1.00	
03/15/2010	290044	4	Timpanagos / UT, US	United States	1.00	
03/24/2010	290073	4	East Bay MUD / CA, US	United States	1.00	
04/01/2010	290103	2	Northcliffe / TX, US	United States	1.00	
04/07/2010	290114	2	Cary / NC, US	United States	1.00	
04/19/2010	290154	4	El Paso / TX, US	United States	1.00	
04/22/2010	290169	4	Linda / CA, US	United States	1.00	
04/29/2010	290189	2	Clinton / IA, US	United States	1.00	
04/29/2010	290189	2	Clinton / IA, US	United States	1.00	
04/29/2010	290191	2	Blue Springs / MO, US	United States	2.00	
05/11/2010	290226	6	Dos Rios - fix it / TX, US	United States	2.00	
06/24/2010	290350	2	Williamston / SC, US	United States	1.00	
06/28/2010	290358	2	Great Falls / MT, US	United States	1.00	
07/07/2010	290383	2	Greenville / TX, US	United States	1.00	
07/07/2010	290383	2	Greenville / TX, US	United States	1.00	
08/27/2010	290530	4	Beloit / WI, US	United States	1.00	
08/27/2010	290531	2	Orange County / WI, US	United States	1.00	
08/31/2010	290537	2	Waco-Bull Hide Creek / TX, US	United States	1.00	
09/08/2010	290559	2	Yuma / AZ, US	United States	1.00	
01/12/2011	290892	2	Missoula / MT, US	United States	2.00	
01/12/2011	290893	2	Deerfield / IL, US	United States	2.00	
01/17/2011	290909	2	Kihei / HI, US	United States	1.00	
03/15/2011	291070	2	Memorial Hills WWTP / TX, US	United States	1.00	
04/29/2011	291186	2	Mooresville / NC, US	United States	1.00	
04/29/2011	291188	2	Hubbard / OH, US	United States	1.00	
06/09/2011	291292	2	Monroe / WA, US	United States	1.00	
06/27/2011	291337	2	Aberdeen / MD, US	United States	1.00	
07/07/2011	291381	2	Rochester / NH, US	United States	1.00	
07/21/2011	291435	2	Mamaroneck / NY, US	United States	1.00	
07/27/2011	291451	2	Guadalupe / CA, US	United States	1.00	
08/17/2011	291509	2	Middle Big Creek, US	United States	1.00	
08/17/2011	291510	2	South Tahoe CA, US	United States	2.00	
09/05/2011	291488	2	Snoqualmie / WA, US	United States	1.00	
09/15/2011	291587	2	Kingman II / AZ, US	United States	1.00	
09/29/2011	291626	2	Beardstown / IL, US	United States	1.00	
10/07/2011	291626	2	Beardstown / IL, US	United States	1.00	
10/20/2011	291708	4	Miami Dade South / FL, US	United States	2.00	
10/20/2011	291708	4	Miami Dade South / FL, US	United States	2.00	
10/24/2011	291719	2	North Ft. Myers - Del Prado	United States	1.00	
11/21/2011	291792	2	Albermarle/NC_Long Creek WWTP,	United States	1.00	
11/21/2011	291792	2	Albermarle/NC_Long Creek WWTP,	United States	1.00	
11/21/2011	291793	2	Maui / HI, US	United States	1.00	
01/12/2012	291910	2	Stansbury Park / UT, US	United States	2.00	
01/12/2012	291916	2	Plattsburg / NY, US	United States	1.00	
01/12/2012	291916	2	Plattsburg / NY, US	United States	1.00	
01/17/2012	291929	2	Ft Lauderdale / FL, US	United States	4.00	
02/13/2012	291910	2	Stansbury Park / UT, US	United States	2.00	
02/14/2012	292003	2	Orange County / FL, US	United States	2.00	
02/16/2012	292010	4	San Leandro / CA, US	United States	1.00	
02/23/2012	292016	1	Driggs II / ID, US	United States	1.00	
02/23/2012	292017	1	Saukville WWTP, US	United States	1.00	
02/29/2012	292040	2	Snohomish / WA, US	United States	1.00	
03/12/2012	292062	2	Elgin Elm Creek / TX, US	United States	1.00	
05/30/2012	292272	6	ECUA Septage / FL, US	United States	2.00	
07/27/2012	292431	2	Moscow / ID, US	United States	1.00	
08/07/2012	292462	2	Marengo / IL, US	United States	1.00	
08/30/2012	292528	2	Vernal / UT, US	United States	1.00	

09/21/2012	292583	2	Grapevine WWTP / TX, US	United States	2.00	
09/24/2012	292584	2	Springfield / OH, US	United States	2.00	
10/29/2012	292683	4	Port Angeles / WA, US	United States	1.00	
10/30/2012	292684	2	Camp Pendleton / CA, US	United States	1.00	
10/30/2012	292684	2	Camp Pendleton / CA, US	United States	1.00	
11/14/2012	292733	2	Fredricksburg / TX, US	United States	1.00	
11/14/2012	293343	2	Fredricksburg / TX, US	United States	1.00	
11/16/2012	292734	4	Rowlett Creek WWTP/Plano / TX,	United States	1.00	
11/16/2012	292734	4	Rowlett Creek WWTP/Plano / TX,	United States	1.00	
11/26/2012	292760	4	Clarkston / WA, US	United States	1.00	
01/08/2013	292922	4	Union City / CA, US	United States	2.00	
01/21/2013	292962	4	Meridian / ID, US	United States	1.00	
01/24/2013	292968	2	Round Rock / TX, US	United States	2.00	
01/30/2013	292990	2	Box Elder / SD, US	United States	1.00	
03/13/2013	293119	2	Hartville OH, US	United States	1.00	
03/13/2013	293120	4	Marcy Gulch CO, US	United States	1.00	
04/25/2013	293208	4	Lewisville / TX, US	United States	1.00	
05/27/2013	293289	2	Smithfield LS-Logan City/UT,US	United States	1.00	
06/17/2013	293360	2	Diamond / IL, US	United States	1.00	
07/18/2013	293443	1	Lehigh Township (Walnut Creek)	United States	1.00	
08/13/2013	293517	2	Moscow, ID; US	United States	1.00	
08/13/2013	293519	4	Chambersburg, PA; US	United States	1.00	Yes
09/12/2013	293596	2	Davis / CA, US	United States	1.00	
09/12/2013	293596	2	Davis / CA, US	United States	1.00	
10/21/2013	293722	2	Palisade / CO, US	United States	1.00	
10/23/2013	293736	4	Superior / WI, US	United States	1.00	
10/23/2013	293736	4	Superior / WI, US	United States	1.00	
10/25/2013	293742	2	Pelican Rapids / MN, US	United States	1.00	
11/06/2013	293773	4	Hollywood / FL, US	United States	1.00	
11/06/2013	293773	4	Hollywood / FL, US	United States	1.00	
12/05/2013	293840	4	Stillwater / OK, US	United States	1.00	
12/16/2013	293869	4	Nashville / TN, US	United States	1.00	
12/16/2013	293869	4	Nashville / TN, US	United States	1.00	
12/16/2013	293869	4	Nashville / TN, US	United States	1.00	
01/13/2014	13000044	4	Kahului / HI, US	United States	1.00	
01/15/2014	13000057	2	Columbia, SC - Quail Lane PS, US	United States	1.00	
01/15/2014	13000057	2	Columbia, SC - Quail Lane PS, US	United States	1.00	
01/15/2014	13000059	2	Gogebic / MI, US	United States	1.00	
01/16/2014	13000063	2	Ele'Ele / HI, US	United States	1.00	
01/28/2014	13000106	2	Clavey Road, US	United States	1.00	
01/28/2014	13000106	2	Clavey Road, US	United States	1.00	
01/29/2014	13000108	2	Waukegan STP, US	United States	1.00	
01/29/2014	13000108	2	Waukegan STP, US	United States	1.00	
01/29/2014	13000108	2	Waukegan STP, US	United States	1.00	
01/29/2014	13000108	2	Waukegan STP, US	United States	1.00	
02/05/2014	13000144	2	Sunrise / FL - Sawgrass WWTP, US	United States	1.00	
02/05/2014	13000144	2	Sunrise / FL - Sawgrass WWTP, US	United States	1.00	
02/05/2014	13000144	2	Sunrise / FL - Sawgrass WWTP, US	United States	1.00	
03/12/2014	13000283	4	Clarksburg / WV, US	United States	1.00	
03/25/2014	13000334	2	Danbury / CT, US	United States	1.00	
05/14/2014	13000532	4	Lawrenceville / NJ - ELSA, US	United States	1.00	
06/16/2014	13000674	2	Fort Bend / TX - MUD #57, US	United States	1.00	
07/15/2014	13000830	2	Copperas Cove NE / TX, US	United States	1.00	
08/04/2014	13000926	4	Weiser / ID, US	United States	1.00	
09/30/2014	13001127	2	Hernando County / FL, US	United States	1.00	
09/30/2014	13001134	2	Boulder / MT, US	United States	1.00	
10/13/2014	13001183	4	Albermarle / NC, US	United States	1.00	
10/13/2014	13001185	2	Orlando, FI - Conserv I, US	United States	1.00	
10/13/2014	13001185	2	Orlando, FI - Conserv I, US	United States	1.00	
10/20/2014	13001213	2	Lehigh Acres / FL, US	United States	1.00	
11/10/2014	13001310	2	Seattle / WA - JBLM, US	United States	1.00	
11/10/2014	13001310	2	Seattle / WA - JBLM, US	United States	1.00	
11/19/2014	13001351	4	Middlesex / NJ, US	United States	1.00	Yes
11/27/2014	13001389	2	Watford / ND, US	United States	1.00	
01/19/2015	13001592	2	Sahuarita / AZ, US	United States	1.00	

01/26/2015	13001627	4	Braintree - Chelsea / MA, US	United States	1.00	
01/26/2015	13001631	2	Campbell WWTP / OH, US	United States	1.00	
02/09/2015	13001694	2	Orrville / OH, US	United States	1.00	
02/24/2015	13001760	2	Marysville / CA, US	United States	1.00	
04/02/2015	13001950	2	McAllen / TX, US	United States	1.00	
04/02/2015	13001950	2	McAllen / TX, US	United States	1.00	
04/08/2015	13001956	2	Henderson / TX - Northside, US	United States	1.00	
04/13/2015	13001966	4	TRA Ten Mile Creek / TX, US	United States	2.00	
04/21/2015	13001989	2	Stevensville / MT, US	United States	1.00	
05/06/2015	13002059	2	Lake Havasu / AZ, US	United States	1.00	
05/06/2015	13002062	2	Myrtle Point / OR, US	United States	1.00	
05/11/2015	13002071	2	UCONN - Storrs / CT, US	United States	1.00	
05/11/2015	13002071	2	UCONN - Storrs / CT, US	United States	1.00	
05/20/2015	13002105	2	Hutto South / TX, US	United States	1.00	
05/21/2015	13002109	2	Hillsborough Valrico / DE, US	United States	1.00	
05/21/2015	13002109	2	Hillsborough Valrico / DE, US	United States	1.00	
06/19/2015	13002226	2	Fenton / MO, US	United States	1.00	
06/26/2015	13002252	2	Trophy Club MUD / TX, US	United States	1.00	Yes
06/26/2015	13002254	2	Pahokee / FL, US	United States	2.00	
06/29/2015	13002266	2	Belton / MO, US	United States	1.00	
06/30/2015	13002284	2	Helena / MT, US	United States	1.00	
07/08/2015	13002314	4	Deer Park / TX, US	United States	1.00	
07/27/2015	13002388	4	Fargo / ND, US	United States	1.00	
07/27/2015	13002389	2	Pearland / TX, US	United States	1.00	
07/27/2015	13002392	2	Post Falls / ID, US	United States	1.00	
08/12/2015	13002470	2	Bolivar / MO, US	United States	1.00	
08/13/2015	13002475	2	Buckeye Lake / OH, US	United States	1.00	
08/25/2015	13002512	2	Marietta / SC, US	United States	1.00	
09/16/2015	13002595	2	Green Bay, WI; US	United States	2.00	
10/15/2015	13002714	4	TRA Central / TX, US	United States	2.00	
10/15/2015	13002714	4	TRA Central / TX, US	United States	1.00	
10/30/2015	13002776	2	Roswell / NM, US	United States	1.00	Yes
10/30/2015	13002785	2	Steward Creek / TX, US	United States	2.00	
11/18/2015	13002840	6	Salem / OR, US	United States	1.00	
12/07/2015	13002921	4	Miamisburg / OH, US	United States	1.00	
12/07/2015	13002921	2	Miamisburg / OH, US	United States	1.00	
12/08/2015	13002925	2	Niles / OH, US	United States	1.00	
12/09/2015	13002927	6	Liberty / SC, US	United States	1.00	
12/16/2015	13002956	2	Jacksonville / FL-Ponte Vedra, US	United States	1.00	
12/16/2015	13002960	2	Jacksonville/FL-Arlington East, US	United States	1.00	
12/16/2015	13002960	2	Jacksonville/FL-Arlington East, US	United States	1.00	
12/16/2015	13002960	2	Jacksonville/FL-Arlington East, US	United States	1.00	
01/19/2016	13003070	2	Wilton / ME, US	United States	1.00	
01/25/2016	13003092	2	Fulton / MO, US	United States	1.00	
02/29/2016	13003236	12	Belleville / IL, US	United States	1.00	Yes
02/29/2016	13003237	4	Greensborough / NC, US	United States	1.00	
02/29/2016	13003237	4	Greensborough / NC, US	United States	1.00	
03/11/2016	13003290	4	Mobile / AL, US	United States	1.00	
03/16/2016	13003306	4	Lake Lakota / WA, US	United States	1.00	
03/21/2016	13003327	2	Harris County / TX, US	United States	1.00	
03/31/2016	13003365	4	Orange County / FI, US	United States	1.00	
03/31/2016	13003365	4	Orange County / FI, US	United States	1.00	
03/31/2016	13003365	4	Orange County / FI, US	United States	1.00	
04/14/2016	13003406	2	Oshkosh / WI, US	United States	1.00	
05/12/2016	13003504	2	Santa Barbara / CA, US	United States	1.00	
05/20/2016	13003545	2	Lakeway / TX, US	United States	1.00	
05/25/2016	13003570	2	Genoa / MI, US	United States	1.00	
05/31/2016	13003589	4	Plum Island / SC, US	United States	2.00	Yes
06/14/2016	13003639	4	Altamonte Springs, FI; US	United States	1.00	
06/16/2016	13003652	4	Black Fords, FI; US	United States	1.00	
06/16/2016	13003652	4	Black Fords, FI; US	United States	1.00	
07/12/2016	13003760	2	Harris County / TX, US	United States	1.00	
07/20/2016	13003795	4	Pearland Reflection Bay / TX, US	United States	2.00	
09/23/2016	13004043	8+	Wilson Creek/TX, US	United States	1.00	
09/23/2016	13004043	8+	Wilson Creek/TX, US	United States	1.00	

09/23/2016	13004043	8+	Wilson Creek/TX, US	United States	1.00	
09/23/2016	13004043	8+	Wilson Creek/TX, US	United States	1.00	
10/10/2016	13004103	2	Portsmouth / MA, US	United States	1.00	
10/10/2016	13004103	2	Portsmouth / MA, US	United States	1.00	
10/14/2016	13004135	2	Oak Ridge/ TN, US	United States	1.00	
10/28/2016	13004182	2	Edson/AB, US	United States	2.00	
11/23/2016	13004270	2	Eaton/OH, US	United States	1.00	Yes
11/29/2016	13004298	2	The Dalles/OR, US	United States	2.00	Yes
12/14/2016	13004368	2	WAP Stock Machines, US	United States	5.00	
12/14/2016	13004368	4	WAP Stock Machines, US	United States	1.00	
12/21/2016	13004418	2	Oak Ridge 2nd Machine / TN, US	United States	1.00	
12/21/2016	13004427	2	Oak Harbor/ WA, US	United States	1.00	
01/23/2017	13004487	2	Brownsburg / IN, US	United States	1.00	
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01/25/2017	13004515	4	Morgantown Headworks / WV, US	United States	1.00	
02/22/2017	13004621	6	Okaloosa County / FL, US	United States	1.00	
02/23/2017	13004634	1	Dalhart / TX, US	United States	1.00	Yes
02/24/2017	13004645	4	Riverbend / TX, US	United States	1.00	
03/28/2017	13004765	2	East Hampton / CT, US	United States	1.00	
04/11/2017	13004853	4	Oneida / NY, US	United States	1.00	
04/11/2017	13004853	4	Oneida / NY, US	United States	1.00	
04/26/2017	13004917	4	Apopka / FL, US	United States	1.00	
04/27/2017	13004928	2	Marana / AZ, US	United States	1.00	
05/16/2017	13004979	2	Martinez / TX, US	United States	1.00	
06/27/2017	13005175	2	Pueblo West / CO, US	United States	1.00	
07/25/2017	13005329	2	Miami Dade Central / FL, US	United States	2.00	
07/27/2017	13005347	4	East Lansing / MI, US	United States	1.00	
07/27/2017	13005347	4	East Lansing / MI, US	United States	1.00	
08/31/2017	13005498	2	Ajax Terrace-Roxbury / NJ, US	United States	1.00	
11/29/2017	13005839	4	Belleville / IL, US	United States	1.00	No
11/29/2017	13005839	4	Belleville / IL, US	United States	1.00	No
12/20/2017	13005930	4	Winkler/ MB, US	United States	1.00	No
12/20/2017	13005932	2	Edmond / OK, US	United States	2.00	No
01/19/2018	13006010	2	Glendale / AZ, US	United States	3.00	No
01/31/2018	13006088	6	North Conway / NH, US	United States	1.00	No
02/21/2018	13006156	2	Pima County State Prison / AZ, US	United States	1.00	No
03/20/2018	13006252	2	Pasco County / FL, US	United States	1.00	No
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03/20/2018	13006252	4	Pasco County / FL, US	United States	1.00	No
03/20/2018	13006252	4	Pasco County / FL, US	United States	1.00	No
					550	

SCOPE OF SUPPLY

HUBER TECHNOLOGY
WASTE WATER Solutions

Project Name: Lexington, KY – East Hickman

Huber Proposal Number: 180002237

Equipment: RakeMax, WAP

Bid Date: 02/12/2018

Addenda: 4

Huber Contact:
Regional Sales Manager: Brian Baker
Email Address: Brian.Baker@hhusa.net
Phone Number: 704.840.3085

Represented By:
Representative Firm: Pelton Environmental Products
Representative Associate: Jim Pelton
Email Address: jimpelton@peltonenv.com
Phone Number: 773.428.4499

Huber Technology, Inc.
9735 NorthCross Center Court
Suite A
Huntersville, NC 28078

Phone: (704) 949-1010
Fax: (704) 949-1020

ITEM	QUANTITY	DESCRIPTION
1	2	***Section 11420 – Fine Screen*** **Multi-Rake Bar Screen RakeMax®** Size: 8320x975x6 mm <u>Design Information:</u> Peak Flow per Screen: 32.5 MGD Channel Depth: 22' Channel Width: 4' Screen Width: 3' – 10" Inclination: 85° Bar Spacing: 1/4" (6 mm) Discharge Height Above Channel Invert: 26' – 10" <u>Screens Include:</u> • 304L Stainless Steel Construction with Full Submersion Passivation for Superior Corrosion Resistance. • 304L Stainless Steel Teardrop Shape Bars • Type 316L SST Chain with Polyamide Rollers & SST Pins • Cast Iron Flanged Upper Bearings; Silicium Carbide Slide Lower Bearings • Removable Screen Covers in 304L SST • Support Structure in 304L SST • Pivoting Scraper Mechanism in 304L SST with Polyethylene Blades • Tensioned Rocker Arm in 304L SST with Proximity Sensor for Jam Protection • Class 1 Division 1 VFD Motor, 3-HP, 460 VAC, 3 Ph, 60 Hz, S.F. 1.0 <u>Spare Parts:</u> • One (1) Set of Rake Bars and Rake Plates / Screen • Five (5) Feet Chain Section / Screen • Two (2) Wiper for Scraper / Screen Include 1 year supply of all lubricants per specification.
2	2	***Section 11420 – Screenings Washing and Compacting*** **Screening Wash Press WAP** Size: 4 <u>Design Information:</u> Maximum Throughput: 140 ft^3/hr Volume Reduction of up to 70% Weight Reduction of up to 40% Wash Water Demand: 16 gpm at 60 psi

		Including: • 304L Stainless Steel Construction with Full Submersion Passivation for Superior Corrosion Resistance. • 304L Stainless Steel Auger with Increasing Flight Thickness & Nylon Brushes • Class 1 Division 1 Motor, 5-HP, 460 VAC, 3 Ph, 60 Hz, S.F. 1.15 • Perforated Drain in Compaction and Washing Zones in 304L SST • Support Legs in 304L SST • Drain Pan with 3.5" Connection in 304L SST • Discharge Pipe with 10" ANSI Flange in 304L SST w/ Endless Bagging System • Enclosed Feed Trough with Inspection Door in 304L SST • Two (2) Stainless Steel Ball Valves • Three (3) Washing Points with Two (2) 1" Solenoid Valves, Class 1 Division 1, 2-Way Brass Body, 120 VAC, 60 Hz Spare parts: • One (1) Set of Wear Bars / WAP • One (1) Cleaning Brush / WAP Include 1 year supply of all lubricants per specification.
3	1	**Dual RakeMAX /Dual WAP - Main Control Panel** — Two (2) ULC, HydroRanger 200, Differential Level Controller — Four (4) 3-Hole Local Control Station, NEMA 7 [HOA, FOR, and E-Stop] — Two (2) WAP - Hopper Photo Sensor — Two (2) Float Switch, Mecuryless w/ 100' Cable — Four (4) E-Stop Pull Cord, NEMA 7 w/ 50' Cable — Spares per Specification 17311.1.09.B / Specification 11420.2.06.C.3 Including: • 1 - Enclosure, NEMA 12 Painted Steel w/ Flange Disconnect Handle • 1 - Main Disconnect, Circuit Breaker Type with Door Handle • 2 - VFD, AB PowerFlex 755 with Branch Circuit Protection [Screen 3HP - 480VAC Max] • 2 - Motor Starter, NEMA, Reversing with OL and Branch Circuit Protection [Screen 5HP - 480VAC Max] • 2 - Current Monitor [Press (x2)] • 1 - Lot, Surge Protection • 1 - Control Power Transformer, 480-120 with CB Branch Circuit Protection • 1 - UPS, 120VAC • 1 - Panel Fan • 1 - PLC, Allen-Bradley CompactLogix, with required I/O • 1 - OIU, Allen-Bradley PanelView Plus 1000, 10" Color Touch Screen • 1 - Lot, Pilot Lights, PTT, LED Type, [As Required] • 1 - Lot, Selector Switches, [As Required] • 1 - Lot, Push Buttons, [As Required]

		• 1 - Lot, Control Relays, [As Required] • 1 - Lot, Terminal Blocks, [As Required] • 1 - Lot, Intrinsically Safe Circuits [As Required] • 1 - UL Label
4	**1**	**Manufacturer's services** Including: • Three (3) trips, five (5) days total onsite to inspect the final installation, supervise initial start-up and field test operation and to train operating personnel in the proper operation and maintenance of the system. • Shipping to Site • 1 Year Warranty

Technical Clarifications:

1. All electrical interconnections, wirings, junction boxes and terminations between the equipment and electrical components are to be provided by installing contractor.
2. All piping to and from the equipment is to be supplied by the installing contractor.
3. Any Item not specifically listed above is not considered part of this scope of supply. Please contact our representatives listed above for further clarification.
4. Programming software and spare parts for the controls systems are not included in this scope of supply unless stated otherwise. These items are available for an additional cost adder upon request.
5. HUBER will ship all equipment to site inside of 20', 40' or 40'OT ocean containers as deemed appropriate by our factory. Huber will not ship any equipment on flatbed truck. Flatbed truck shipping means that the equipment would need to be transferred at port from factory packaged containers to the flatbed. This process it out of HUBER's control and it is our experience that equipment always gets damaged during this process.
6. Huber has provided equipment which is designed to meet the performance requirements of the specification, however, it will differ in construction. The differences include but are not limited to the following:
    - Rakemax frame shall be 5/32" thick
    - Rakemax Chain Average Ultimate Strength shall be 25,000lbsf
    - Rakemax bearings shall be a slide bearing in a Stainless casing, with white cast iron shafts and silicon carbide bushings.
    - WAP Drain Connection shall be 3.5"
    - Huber understand to supply *One Rake Bar Section and One Rake* per screen in place of specified "One set of Rake Bars and Rake Plates"

LIST OF SPECIAL TOOLS REQUIRED

City of Lexington, KY
East Hickman Wet Weather Storage Facility and Pump Stations
in accordance with Specification Section 11420
Mechanical Screens & Screenings Compactors

Huber Technology, Inc. confirms that no special tools are required for maintenance or repair of this equipment.

HUBER TECHNOLOGY
WASTE WATER Solutions

LIST OF MATERIALS REQUIRED FOR SERVICE

City of Lexington, KY
East Hickman Wet Weather Storage Facility and Pump Stations
in accordance with Specification Section 11420
Mechanical Screens & Screenings Compactors

Huber Technology, Inc. confirms that other then factory spare parts and the machine itself, there are no other materials needed to perform service work on this equipment.

GENERAL LONG TERM STORAGE REQUIREMENTS

City of Lexington, KY
East Hickman Wet Weather Storage Facility and Pump Stations
in accordance with Specification Section 11420
Mechanical Screens & Screenings Compactors

When selecting the storage place take care that:

- The components are not damaged due to vehicle traffic or careless working adjacent to the equipment.
- The components must not get dirty/contaminated due to splashes of concrete, mortar or spark fountains from angle grinders etc.
- The control panel and electrical components are protected from rain (temperature down to - 13°F is permissible).
- In the event the equipment is stored for more than 6 months, the gearbox lubricant must be drained and refilled.

TAB 2

Product Catalog Information

Customer:
Huber Technology

Job Name:
Lexington, KY - East Hickman

Dual Rakemax / Dual WAP Control Panel

Arranged By:
EleMech, Inc.
2275 White Oak Circle
Aurora, IL, 60502

Project Engineer:
Dobre Gjorgiev

Date:
04/13/18

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Catalog Cuts - E

Submittal Comments

B

ELEMECH INC. 630-499-7080 · www.elemechinc.com	Rev: 0	Section: B	
	Date: 4/13/2018		
Section Name: Submittal Comments	By: TCC	Job Number: HBR7281	Page # 1/1

ELEMECH INC.
ELECTRICAL AND MECHANICAL ENGINEERING SERVICES

Submittal Comments

Project Name: **Lexington, KY – East Hickman**
Project Number: **HBR7281**
Customer Project: **73002974**
Panel Type: **Dual RakeMax/Dual WAP Control Panel**

April 11, 2018

The following comments are based on the Lexington, KY – East Hickman Dual Rakemax/Dual WAP control panel revision 0 submittal:

1. The Dual RakeMax/Dual WAP control panel can be remotely monitored over the Ethernet connection. The list of available monitoring signals provided can be found on sheet 12 of the control drawings. The listed set points on sheet 12 will also be available for remote monitoring. Advise if any additional signals are required.

2. Dry contacts for remote monitoring have been provided on drawing sheet 11 per spec section 11420.2.05.C. Please advise if additional dry contacts need to be included.

3. The control panel will include provisions to monitor a system enable dry contact. When this signal is received and maintained the corresponding Screen/Press system will be enabled for Auto operation. If the System Enable signal is removed, the Auto operation of the Screen/Press system will be disabled. Advise if this operation is incorrect.

4. Qty. (2) Siemens HydroRanger200 Ultrasonic Level Controllers (ULC) have been provided for Screen level indication and operation. Please note that the HydroRanger200 controllers will be mounted in a NEMA4X, fiberglass enclosure with a window, and can be installed adjacent to the main control panel in a non-hazardous environment. This will allow the operator to adjust the ULC parameters and monitor the Screens level without opening the main control panel door.

5. Qty. (4) ST-H Ultrasonic Level Sensors with 100 foot (30m) cable has been provided and will be suitable for installation in a hazardous environment.

6. Quantity (2) Siemens MFA-4P zero motion controllers (ZSC) have been provided. The (ZSC) will be mounted in a NEMA4X fiberglass enclosure. Each controller will provide zero motion indication for each Press. Each controller will be provided with a Siemens XPP-5 Zero Motion Sensor suitable for use in a hazardous area. The sensors will be provided with a 10 meter cable.

7. Quantity (2) Flygt ENM float switches with 100' of cable have been provided for high level indication and operation of each Screen. These float switches will be suitable for installation in a classified/hazardous area.

2275 White Oak Circle
Aurora, IL 60502

Phone: 630-499-7080
Fax: 630-499-7760

8. Square D, Altivar 320, variable frequency drives (P/N: Square D: ATV320U22N4C) have been provided for the Screens. Please advise if a different model drive is required.

9. Qty.(4) E-Stop pull-cords have been provided. Qty.(2) for the Screens and Qty.(2) for the presses. Please advise of any changes.

10. A 1 pole, 120VAC Surge Suppressor (Bussman: BSPM1120S2G) has been provided.

11. Please note that the Local Control Stations for the Screen and Press have been provided per specification 11420.2.05.2 and 11420.2.05.3.

12. Qty.(2), NEMA 7, 3-Hole Screen local control stations have been provided and will include the following pilot devices:

    - Screen Hand-Off-Remote Selector
    - Screen Forward-Off-Reverse Selector
    - E-Stop Pushbutton

13. Qty.(2), NEMA 7, 5-Hole Press local control stations have been provided and will include the following pilot devices:

    - Press Hand-Off-Remote Selector
    - Press Forward-Off-Reverse Selector
    - Press Zone Wash Hand-Off-Remote
    - Pan Wash Hand-Off-Remote
    - E-Stop Pushbutton

14. Spare parts have been provided per specification 11420.2.06.C.3 and 17311.1.09.B.

15. Contract drawing E-00-706 outlines motor disconnects for the Screen/Press system. It appears that the motor disconnects include an aux contact. Please advise if these contacts need to be wired to the Huber main control panel and the purpose of the signals.

16. Drive motor accumulated run time will be displayed on the OIU. Additional through the door hour meters have not been provided.

17. Provide static IP addresses for the main control panel PLC and Operator Interface. Ethernet addresses are required.

18. When any Emergency Stop pushbuttons are pressed or Emergency Stop pull cords are activated, all of the screens and presses will stop operation immediately. The motors will remain stopped until the E-Stop is re-enabled and the system reset pushbutton is pressed.

19. An Allen Bradley, CompactLogix (L30ER) PLC and a PanelView Plus 1000 operator interface have been provided and will be programmed with the following software:
    - PLC: Studio 5000 (Latest Version)
        - Ladder Diagram Programming Type only
    - OIU: FTView ME (Latest Version)
        - Developed utilizing EleMech's standard Global Object library.

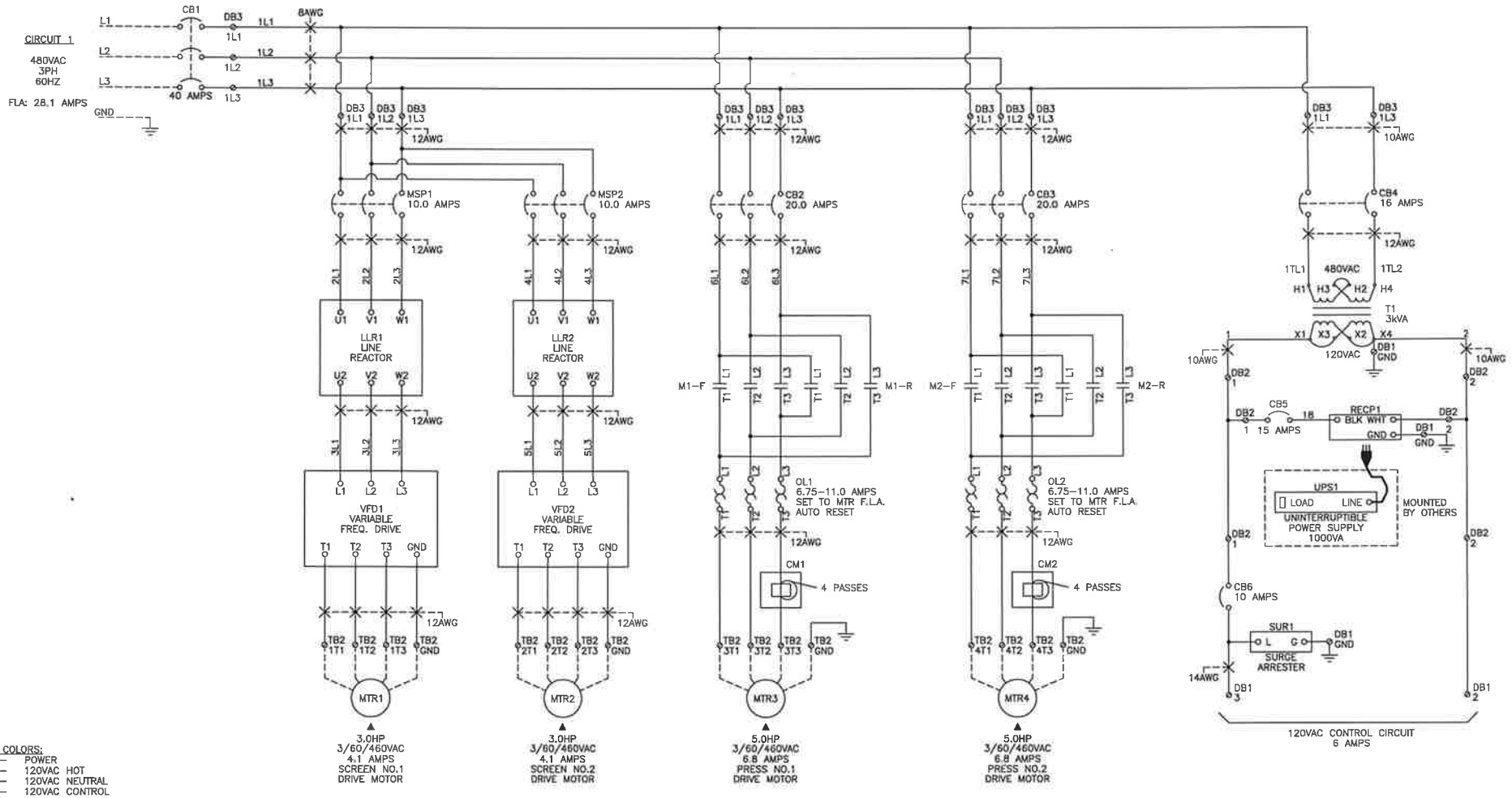
2275 White Oak Circle
Aurora, IL 60502

Phone: 630-499-7080
Fax: 630-499-7760

Electrical Drawings

C

ELEMECH INC. 630-499-7080 · www.elemechinc.com	Rev: 0	Section: C	
Section Name: Electrical Drawings	Date: 4/13/2018	Job Number: HBR7281	Page # 1/1
	By: TCC		



WIRE COLORS:
BLK – POWER
BLK – 120VAC HOT
WHT – 120VAC NEUTRAL
RED – 120VAC CONTROL
YEL – REMOTE
GRN – GROUND
BLU – DC POSITIVE/CONTROL
WHT/BLU – DC NEUTRAL

NOTES:
1. ▲ DEVICES LOCATED OUTSIDE CONTROL PANEL.
2. ⌀ TERMINAL BLOCK (TB) OR DISTRIBUTION BLOCK (DB) LOCATED IN CONTROL PANEL.
3. FIELD WIRING.
4. CONTROL PANEL WIRING SHALL BE MTW TYPE, TINNED COPPER, 600V, 105°C, UL1015/CSA.
5. NAMEPLATES SHALL BE ENGRAVED WHITE WITH BLACK LETTERS.
6. ELEMECH RESERVES THE RIGHT TO CHANGE, AS NECESSARY, THE SPACING, ORIENTATION, AND PHYSICAL LOCATION OF DEVICES IN ORDER TO OPTIMIZE THE DESIGN.
7. LOCAL MOTOR DISCONNECT SWITCHES SHALL BE PROVIDED BY OTHERS IF REQUIRED BY LOCAL REGULATIONS.
8. JUNCTION BOXES ARE NOT SHOWN AND SHALL BE PROVIDED BY OTHERS AS NECESSARY.

DATE	REVISION	NO.	BY	CK	APP

DESIGNED DC
DETAILED
CHECKED CCC
APPROVED
DATE 04/11/18

HUBER TECHNOLOGY
9735 NorthCross Center Court, Suite A
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Tel. 704-949-1010
info@hhusa.net

DUAL RAKEMAX / DUAL WAP CONTROL PANEL

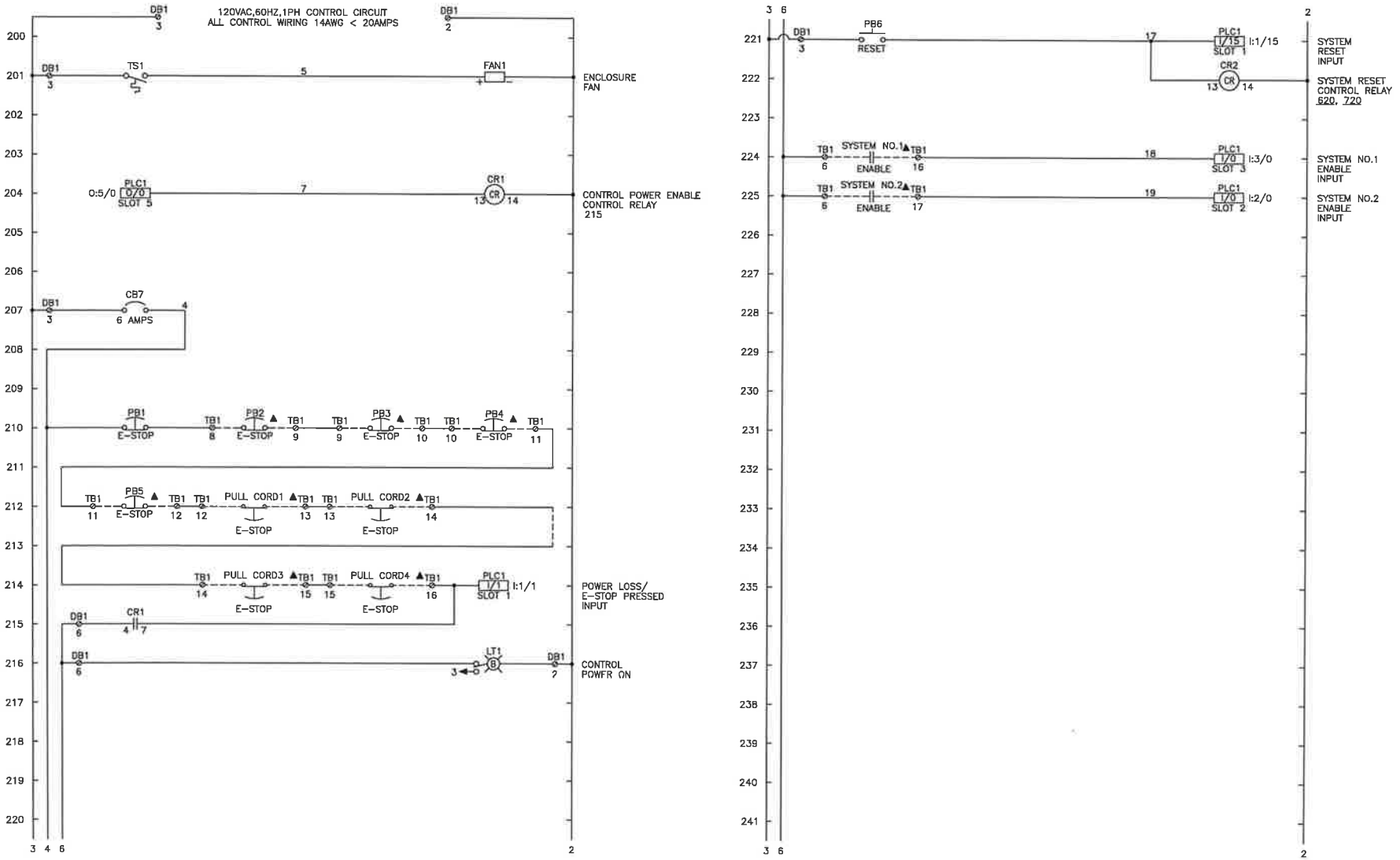
LEXINGTON, KY
EAST HICKMAN

SCALE: NONE

PROJECT NUMBER: 73002974

DRAWING NO: HBR7281A1

SHEET 1 OF 17



DATE	REVISION	NO.	BY	CK	APP

DESIGNED: DG
DETAILED:
CHECKED: CCC
APPROVED:
DATE: 04/11/18

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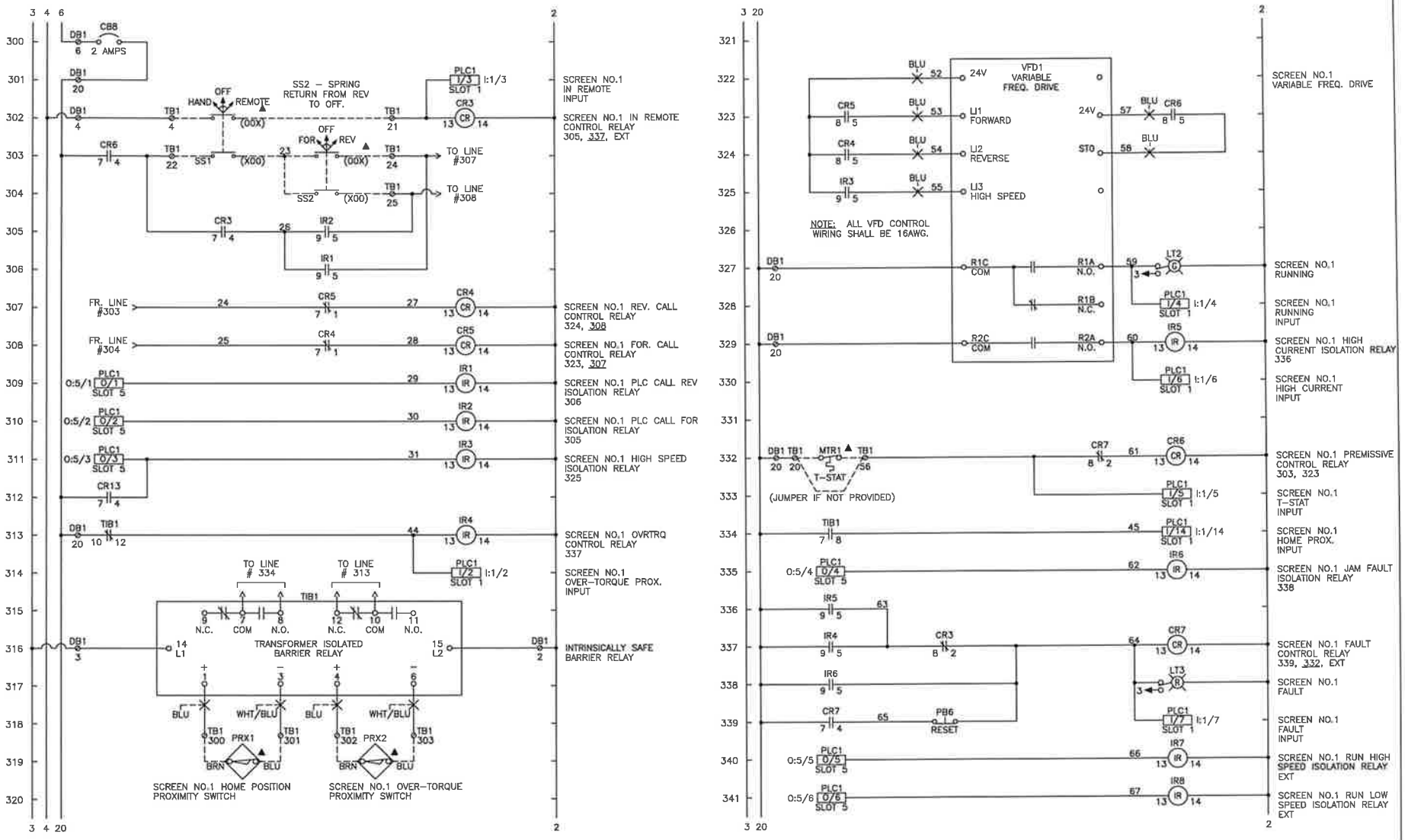
LEXINGTON, KY
EAST HICKMAN

SCALE: NONE

PROJECT NUMBER: 73002974

DRAWING NO: HBR7281A2

SHEET 2 OF 17



DATE	REVISION	NO.	BY	CK	APP	DATE
					DESIGNED	DC
					DETAILED	
					CHECKED	CCC
					APPROVED	
					DATE	04/11/18

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DUAL RAKEMAX / DUAL WAP CONTROL PANEL

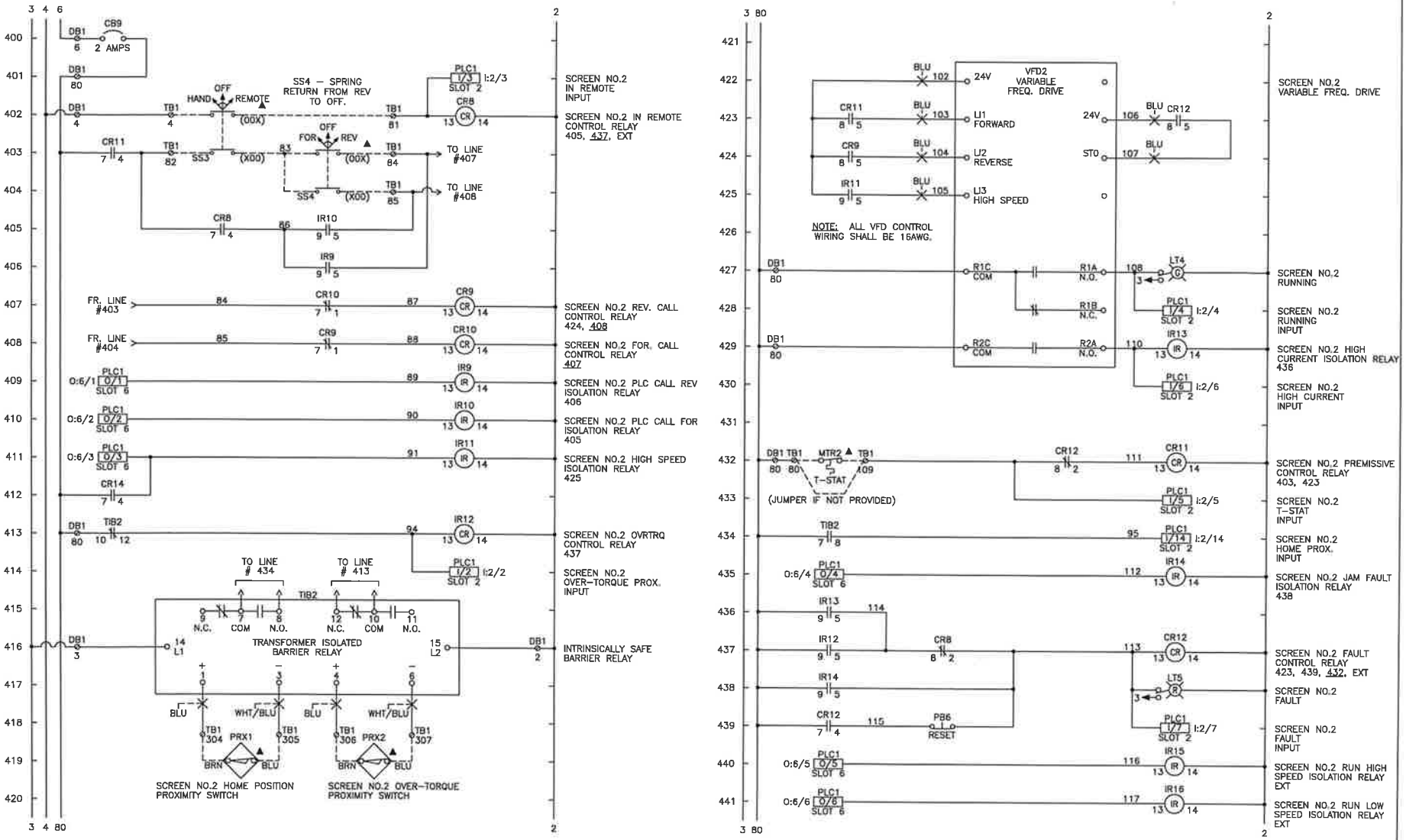
LEXINGTON, KY
EAST HICKMAN

SCALE: NONE

PROJECT NUMBER: 73002974

DRAWING NO: HBR7281A3

SHEET 3 OF 17



DATE	REVISION	NO.	BY	CK	APP	DATE
					DESIGNED	CC
					DETAILED	
					CHECKED	CCC
					APPROVED	
					DATE	04/11/18

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DUAL RAKEMAX / DUAL WAP CONTROL PANEL

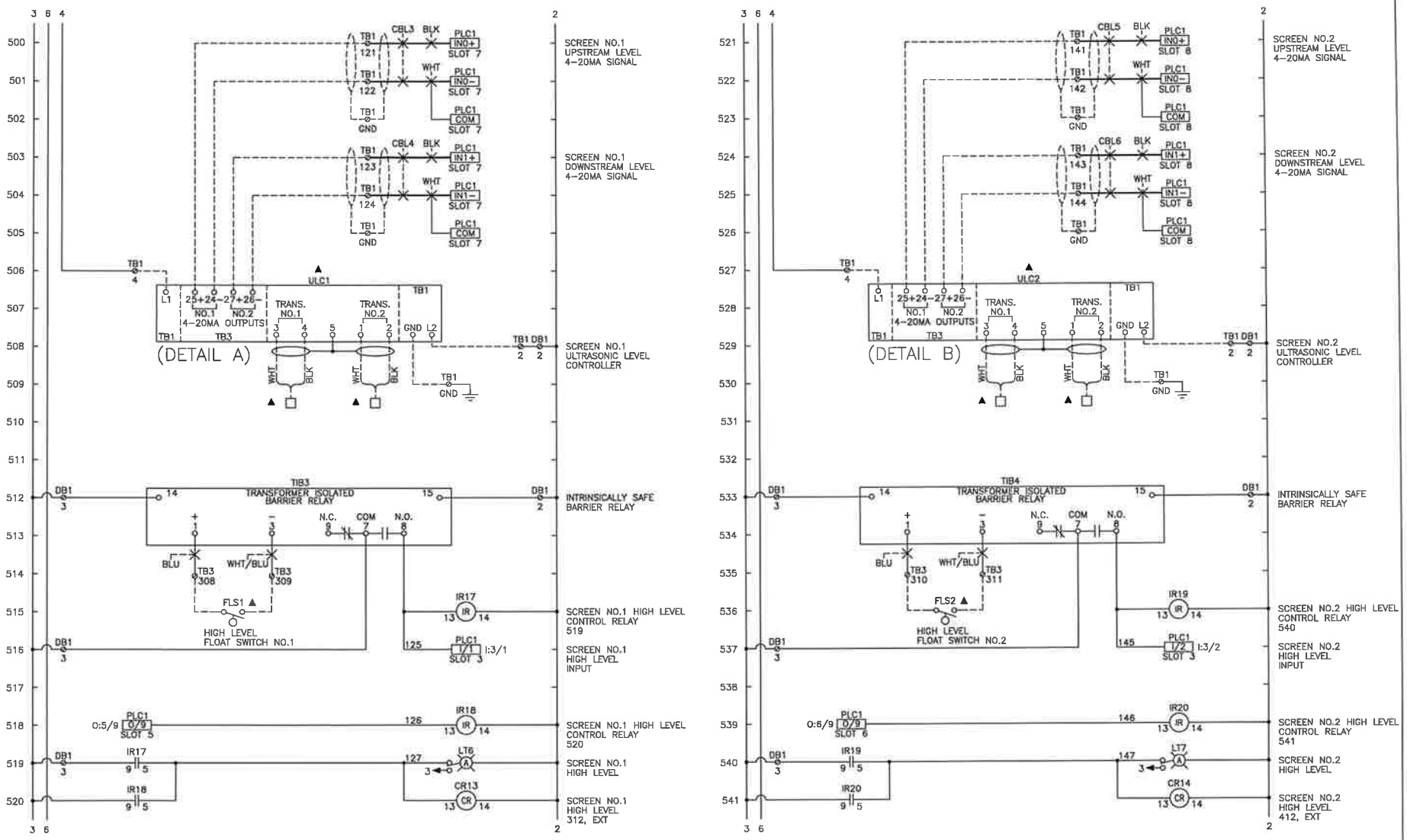
LEXINGTON, KY
EAST HICKMAN

SCALE: NONE

PROJECT NUMBER: 73002974

DRAWING NO: HBR7281A4

SHEET 4 OF 17



DATE	REVISION	NO.	BY	CK	APP

DESIGNED DG
DETAILED
CHECKED CCC
APPROVED
DATE 04/11/18

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DUAL RAKEMAX / DUAL WAP CONTROL PANEL

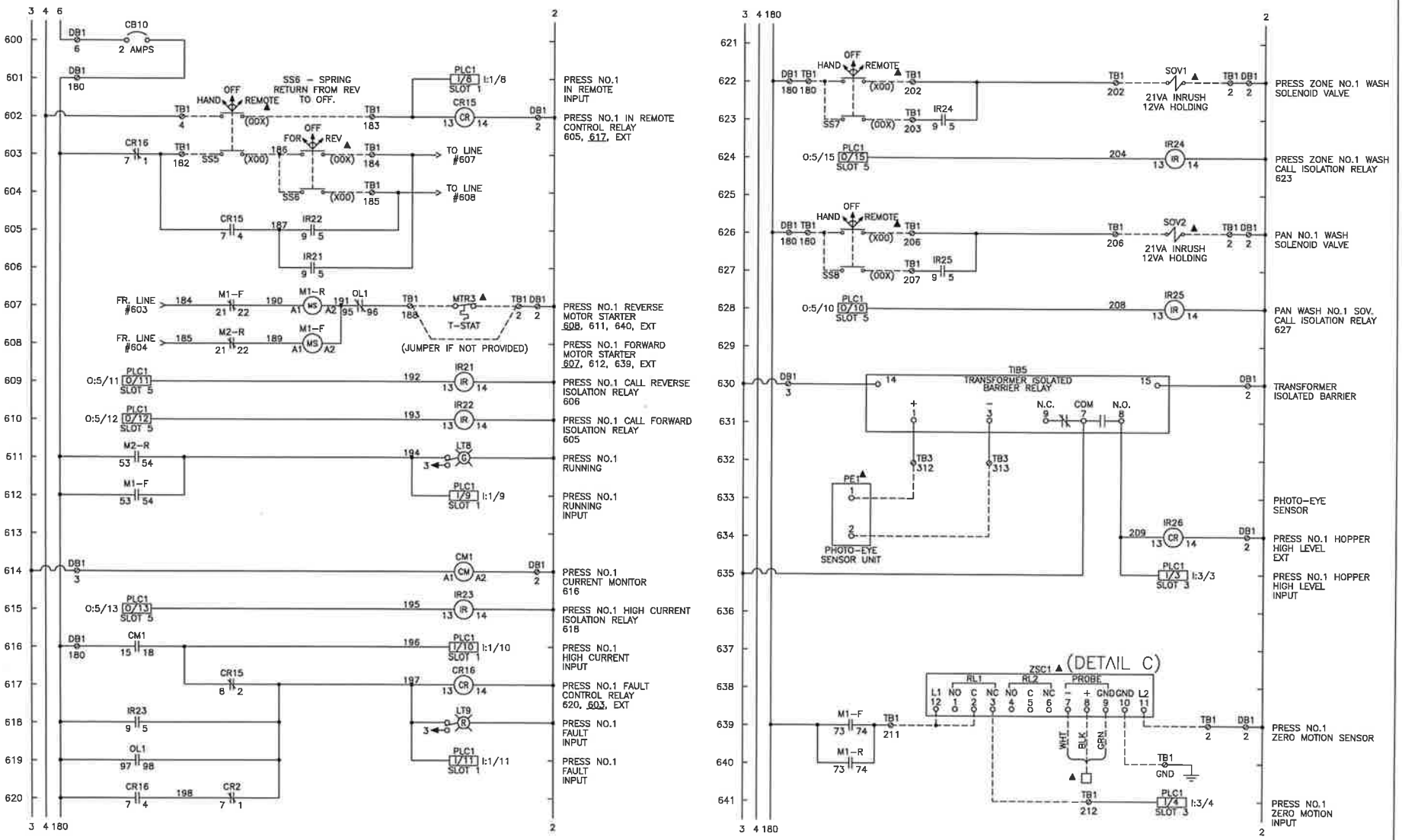
LEXINGTON, KY
EAST HICKMAN

SCALE: NONE

PROJECT NUMBER: 73002974

DRAWING NO: HBR7281A5

SHEET 5 OF 17



DATE	REVISION	NO.	BY	CK	APP	DATE
					DESIGNED	OG
					DETAILED	
					CHECKED	CCC
					APPROVED	
					DATE	04/11/18

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DUAL RAKEMAX / DUAL WAP CONTROL PANEL

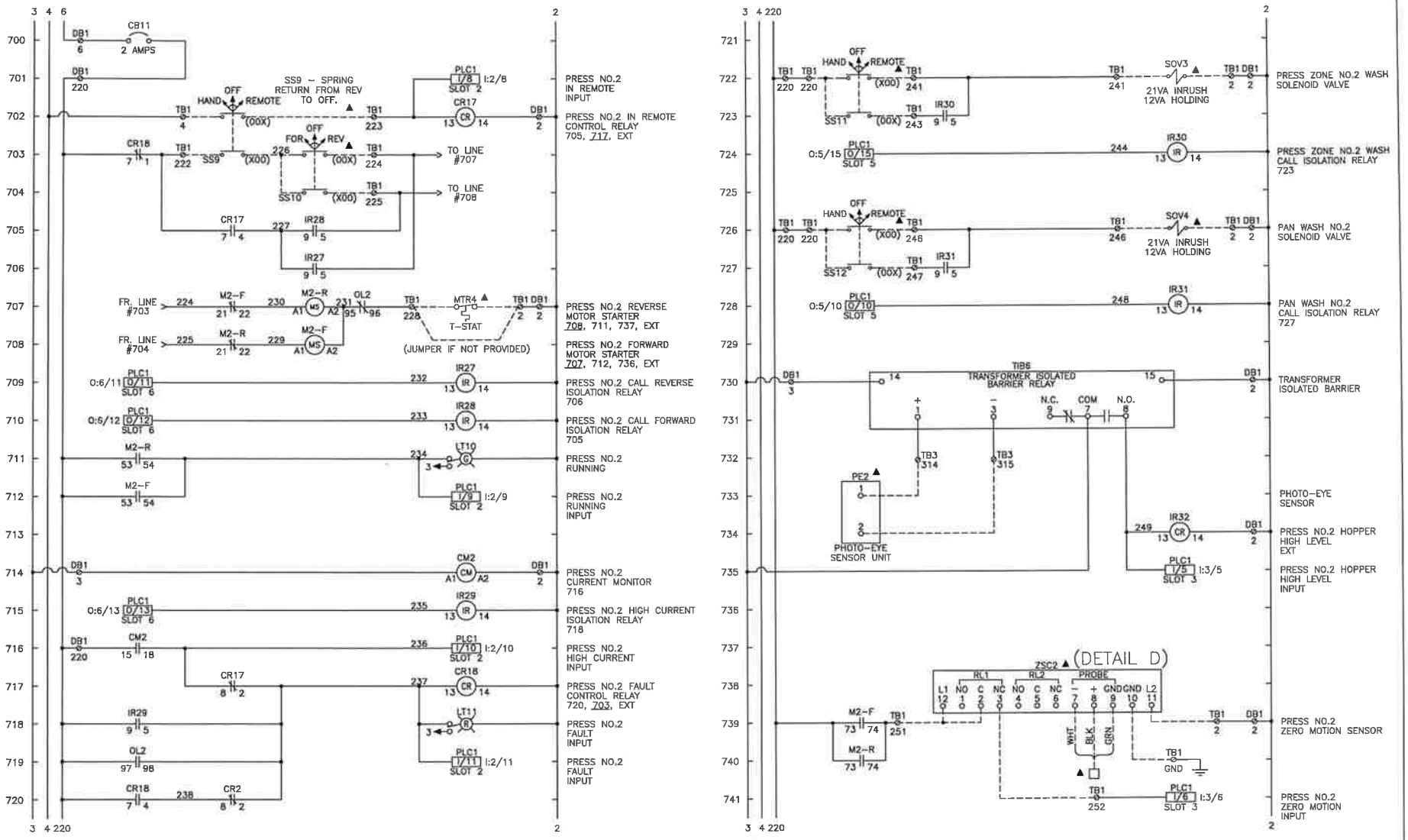
LEXINGTON, KY
EAST HICKMAN

SCALE: NONE

PROJECT NUMBER: 73002974

DRAWING NO: HBR7281A6

SHEET 6 OF 17



DATE	REVISION	NO.	BY	CK	APP.	DATE
					DESIGNED	DG
					DETAILED	
					CHECKED	CDC
					APPROVED	
					DATE	04/11/18

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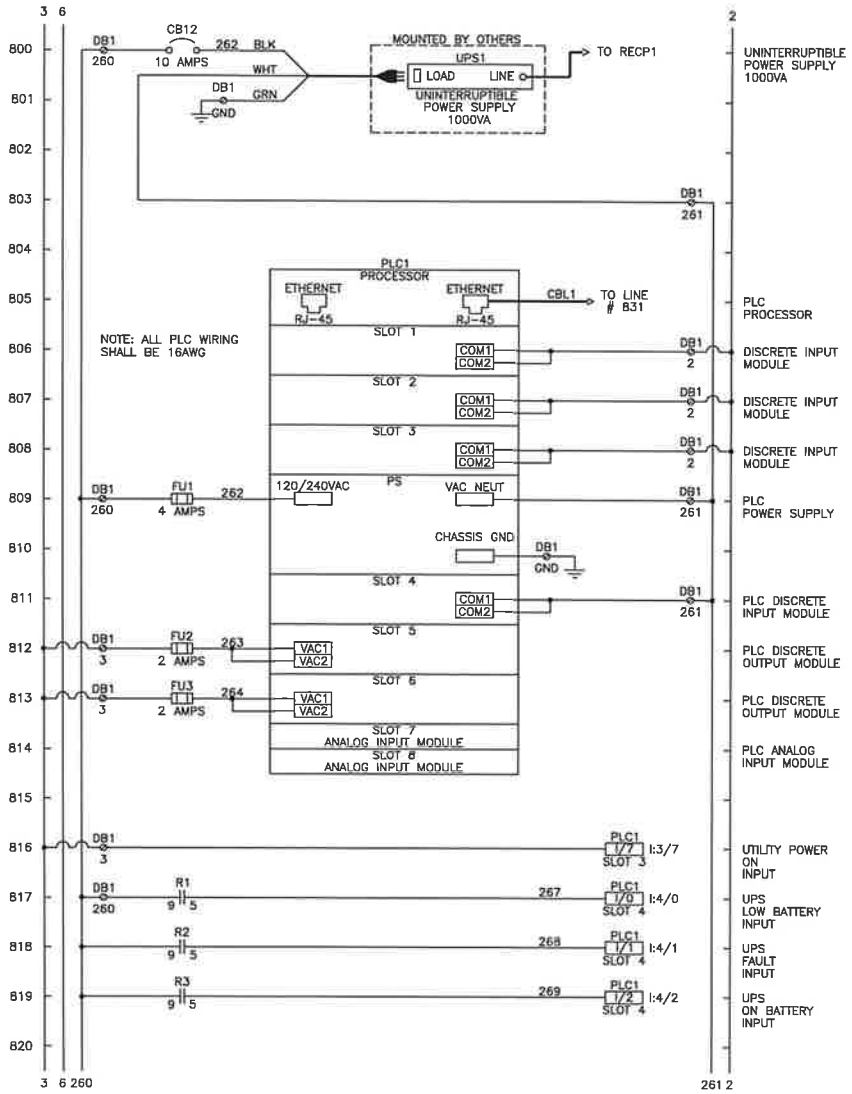
LEXINGTON, KY
EAST HICKMAN

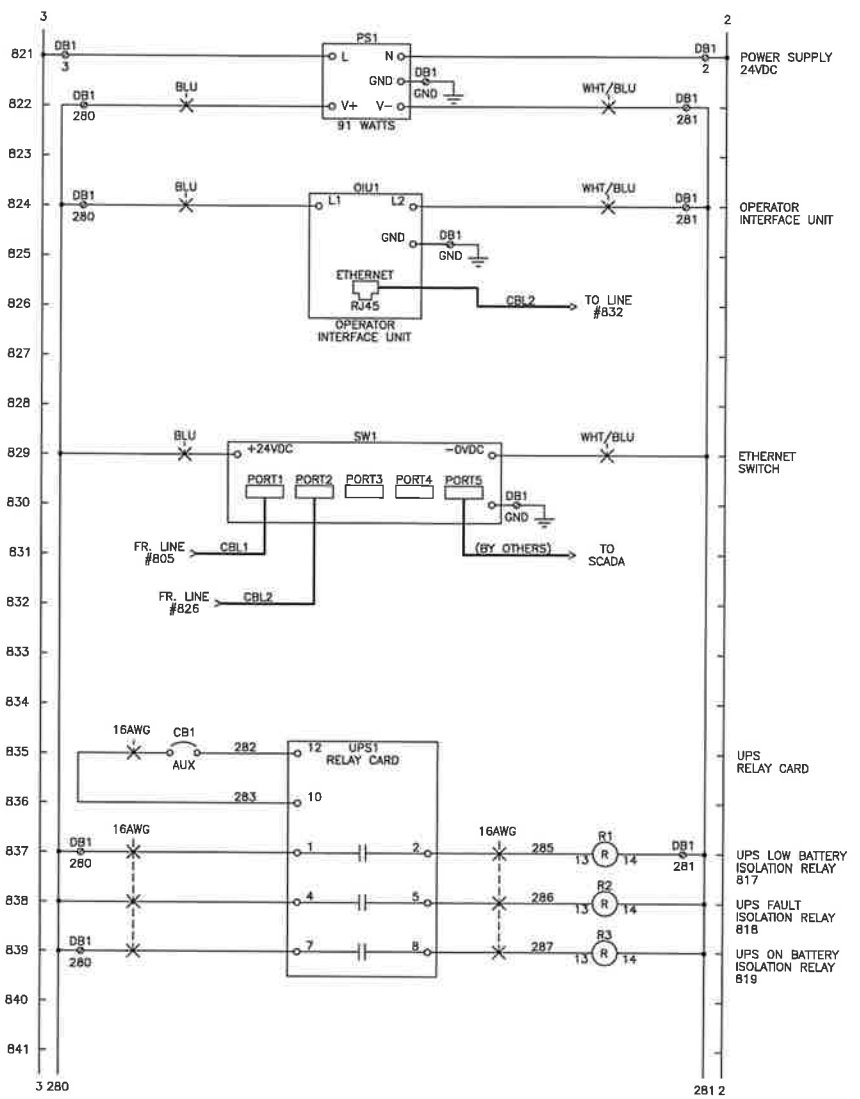
SCALE: NONE

PROJECT NUMBER: 73002974

DRAWING NO: HBR7281A7

SHEET 7 OF 17





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DATE	04/11/18

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9735 NorthCross Center Court, Suite A
Huntersville, NC 28078
Tel. 704-949-1010
Info@hhuse.net

DUAL RAKEMAX / DUAL WAP CONTROL PANEL

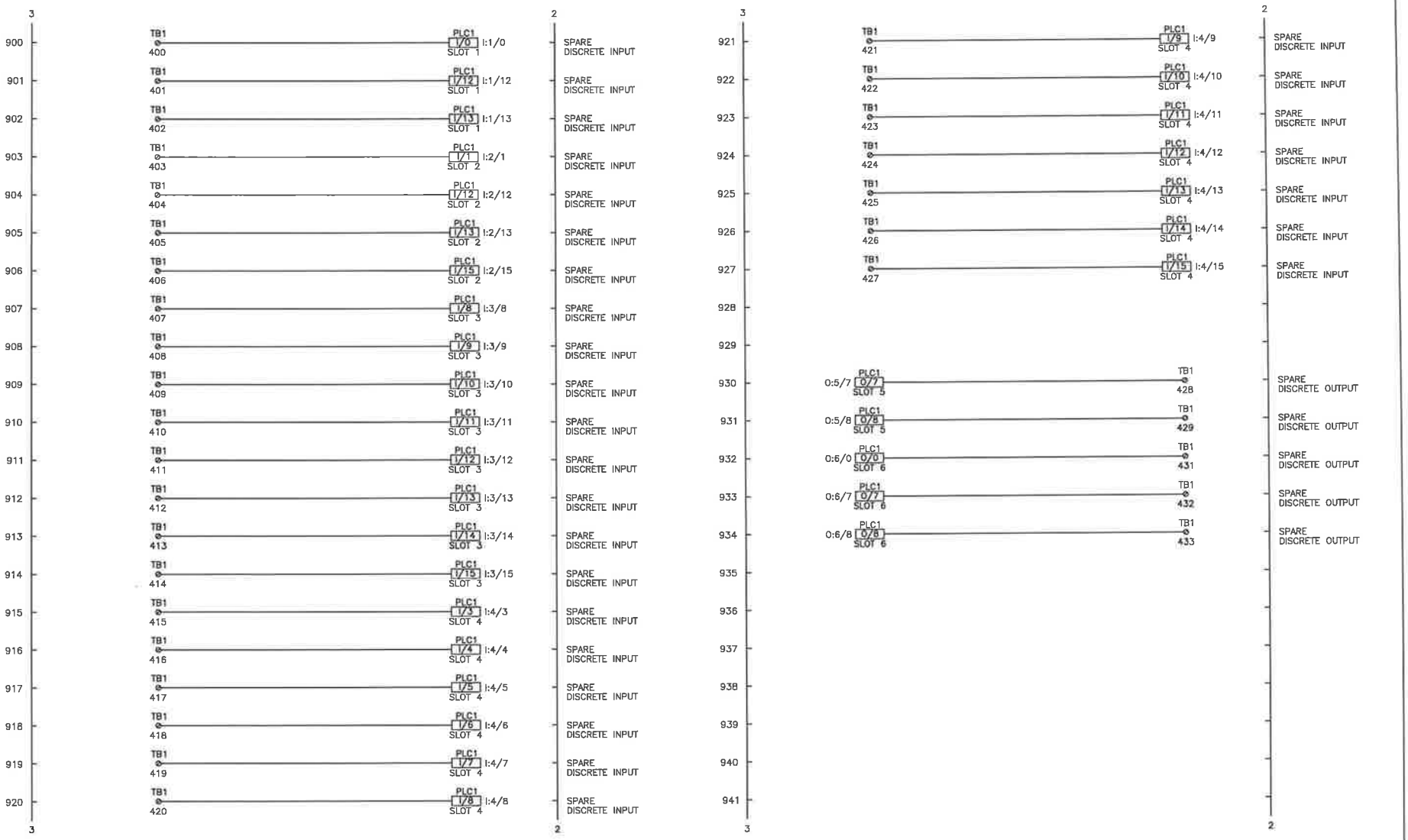
LEXINGTON, KY
EAST HICKMAN

SCALE: NONE

PROJECT NUMBER: 73002974

DRAWING NO: HBR7281A8

SHEET 8 OF 17



DATE	REVISION	NO.	BY	CK.	APP.

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DUAL RAKEMAX / DUAL WAP CONTROL PANEL

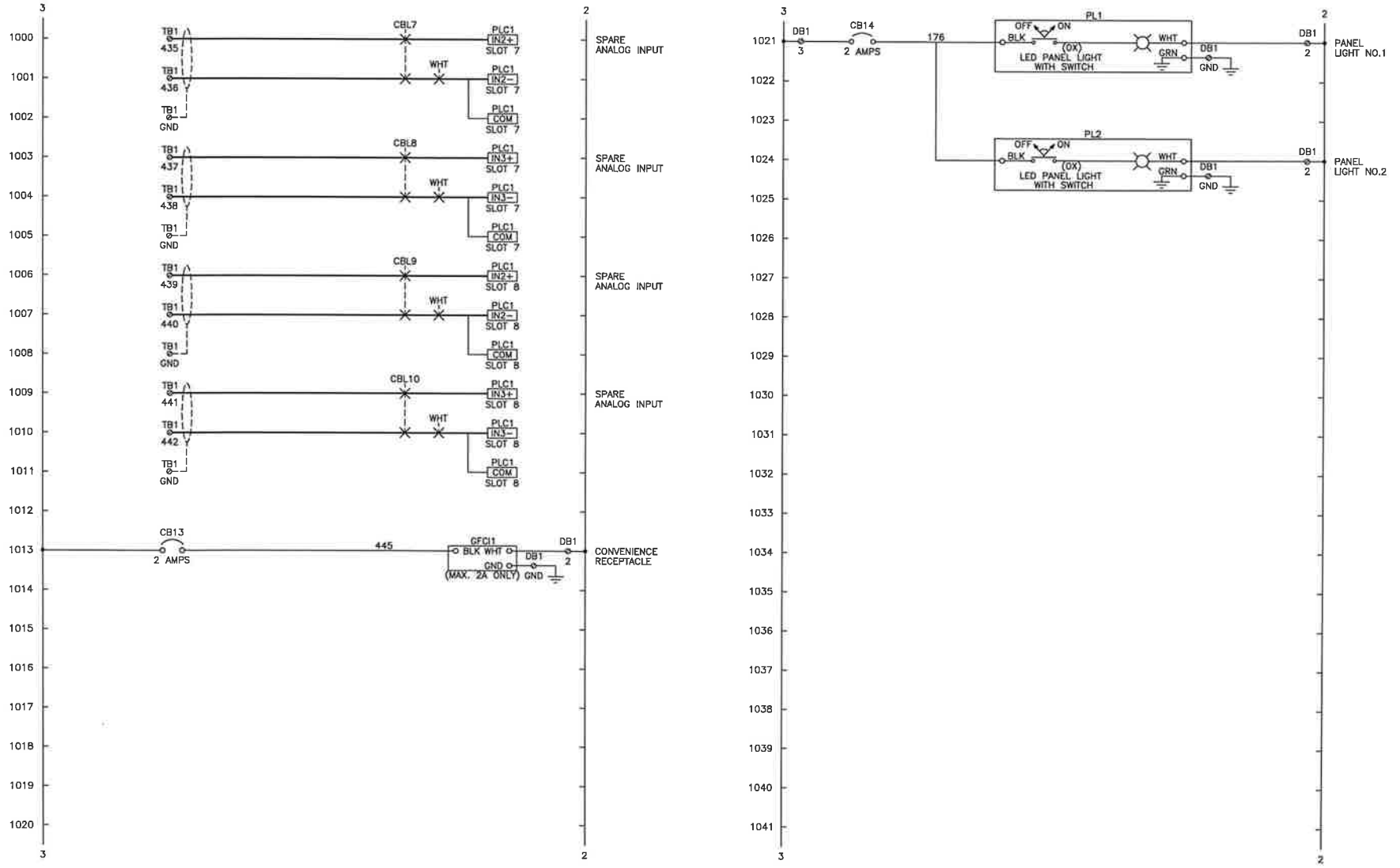
LEXINGTON, KY
EAST HICKMAN

SCALE: NONE

PROJECT NUMBER: 73002974

DRAWING NO: HBR7281A9

SHEET 9 OF 17



DATE	REVISION	NO.	BY	CK	APP	DATE
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					CHECKED	CCC
					APPROVED	
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DUAL RAKEMAX / DUAL WAP
CONTROL PANEL

LEXINGTON, KY
EAST HICKMAN

SCALE: NONE

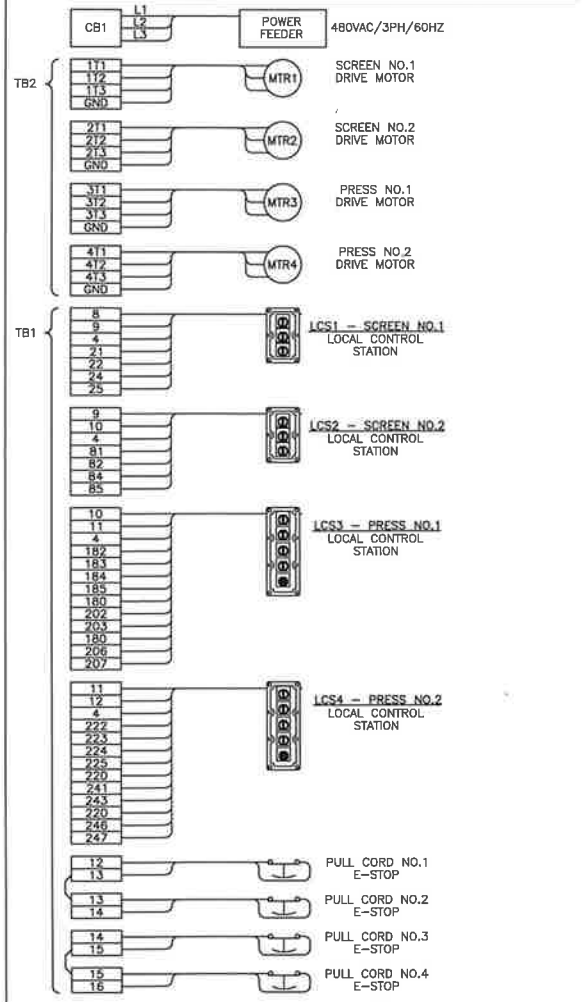
PROJECT NUMBER: 73002974

DRAWING NO: HBR7281A10

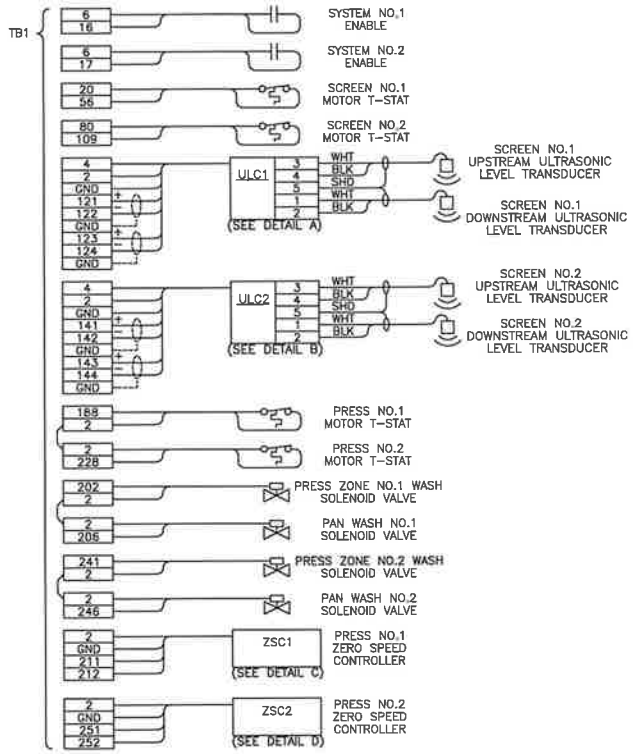
SHEET 10 OF 17

FIELD WIRING DIAGRAM

WARNING:
DAMAGE RESULTING FROM INSTALLATION OF TOP ENTRY CONDUIT WILL VOID WARRANTY.
- USE PROPER FITTINGS, MYERS TYPE 4 OR EQUAL
- PROTECT INTERIOR DEVICES FROM INSTALLATION DEBRIS
- CONDUIT MUST BE SEALED WATERTIGHT TO PREVENT WATER ENTRY



FIELD WIRING DIAGRAM



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DUAL RAKEMAX / DUAL WAP CONTROL PANEL

LEXINGTON, KY
EAST HICKMAN

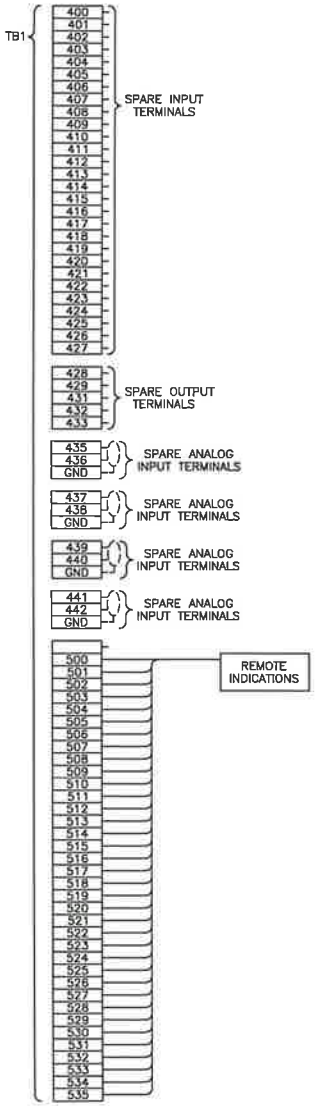
SCALE: NONE

PROJECT NUMBER: 73002974

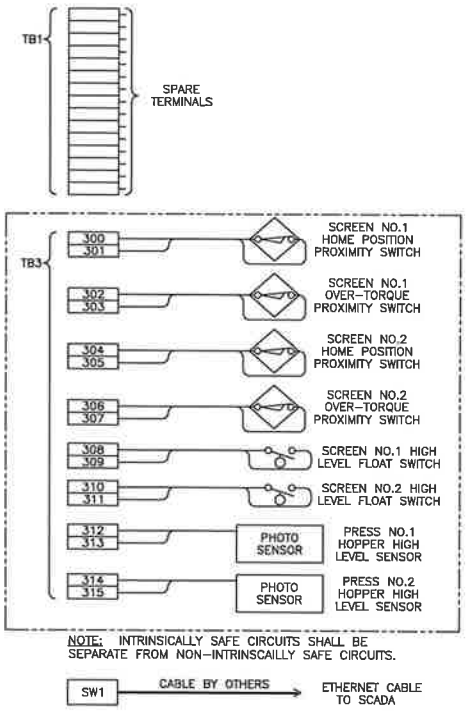
DRAWING NO: HBR7281A11

SHEET 11 OF 17

FIELD WIRING DIAGRAM

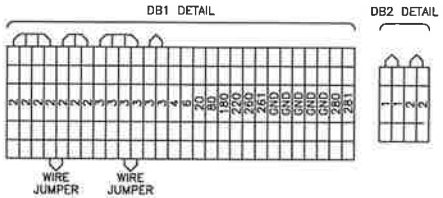


FIELD WIRING DIAGRAM



NOTE: INTRINSICALLY SAFE CIRCUITS SHALL BE SEPARATE FROM NON-INTRINSCAILLY SAFE CIRCUITS.

SW1 — CABLE BY OTHERS → ETHERNET CABLE TO SCADA



DATE	REVISION	NO.	BY	CK	APP	DATE
					DESIGNED	DG
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DUAL RAKEMAX / DUAL WAP CONTROL PANEL

LEXINGTON, KY
EAST HICKMAN

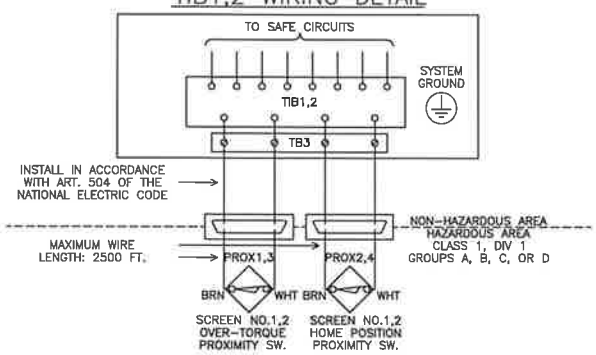
SCALE: NONE

PROJECT NUMBER: 73002974

DRAWING NO: HBR7281A12

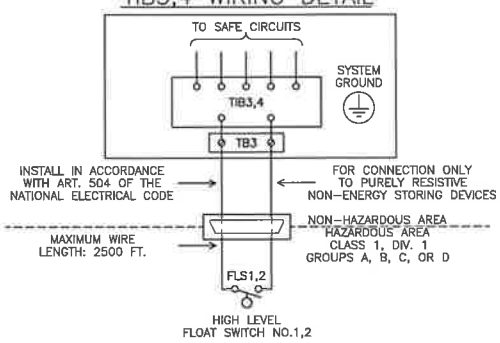
SHEET 12 OF 17

TIB1,2 WIRING DETAIL



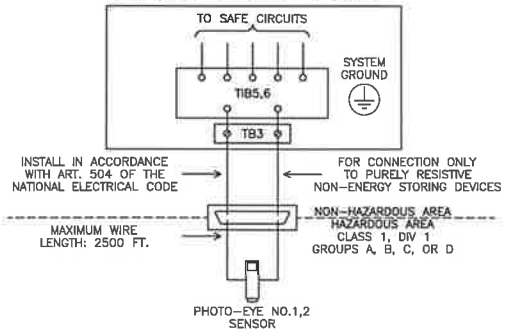
NOTES:
1. ENSURE CONTROL PANEL IS CONNECTED TO GROUND.
2. CAUTION: MAINTAIN SEPARATION BETWEEN INTRINSICALLY SAFE WIRING AND OTHER WIRING.

TIB3,4 WIRING DETAIL



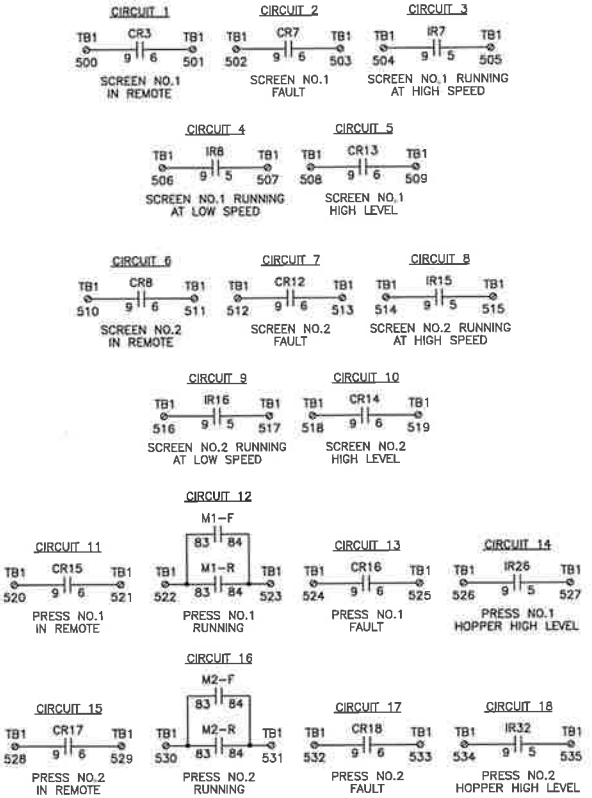
NOTES:
1. ENSURE CONTROL PANEL IS CONNECTED TO GROUND.
2. CAUTION: MAINTAIN SEPARATION BETWEEN INTRINSICALLY SAFE WIRING AND OTHER WIRING.

TIB5,6 WIRING DETAIL



NOTES:
1. ENSURE CONTROL PANEL IS CONNECTED TO GROUND.
2. CAUTION: MAINTAIN SEPARATION BETWEEN INTRINSICALLY SAFE WIRING AND OTHER WIRING.

DRY OUTPUT CONTACTS



DATE	REVISION	NO.	BY	CK	APP	DESIGNED	DC
						DETAILED	
						CHECKED	CCC
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DUAL RAKEMAX / DUAL WAP CONTROL PANEL

LEXINGTON, KY
EAST HICKMAN

SCALE: NONE

PROJECT NUMBER: 73002974

DRAWING NO: HBR7281A13

SHEET 13 OF 17

DEVICE SETTINGS

L30ER CPU	DISCRETE IN	ISO. DISCRETE IN	DISCRETE OUT	ANALOG IN
RUN ☐ ☐ I/O	0 1 2 3	0 1 2 3	0 1 2 3	☐ POWER
FORCE ☐ ☐ RS232	4 5 6 7	4 5 6 7	4 5 6 7	
BATT ☐ ☐ OK	8 9 10 11	8 9 10 11	8 9 10 11	
RUN REM PROG	12 13 14 15	12 13 14 15	12 13 14 15	
KEY	QTY: 3 SLOT 1-3	QTY: 1 SLOT 4	QTY: 2 SLOT 5,6	QTY: 2 SLOT 7,8

PLC INPUTS – SLOT 1

I/0	SPARE PRE-WIRED
I/1	CONTROL POWER ON
I/2	SCREEN NO.1 OVRTRQ
I/3	SCREEN NO.1 IN AUTO
I/4	SCREEN NO.1 RUNNING
I/5	SCREEN NO.1 T'STAT
I/6	SCREEN NO.1 HIGH CURRENT
I/7	SCREEN NO.1 FAULT
I/8	PRESS NO.1 IN AUTO
I/9	PRESS NO.1 RUNNING
I/10	PRESS NO.1 HIGH CURRENT
I/11	PRESS NO.1 FAULT
I/12	SPARE PRE-WIRED
I/13	SPARE PRE-WIRED
I/14	SCREEN NO.1 HOME POS.
I/15	SYSTEM RESET

PLC INPUTS – SLOT 2

I/0	SYSTEM NO.2 ENABLE
I/1	SPARE PRE-WIRED
I/2	SCREEN NO.2 OVRTRQ
I/3	SCREEN NO.2 IN AUTO
I/4	SCREEN NO.2 RUNNING
I/5	SCREEN NO.2 T'STAT
I/6	SCREEN NO.2 HIGH CURRENT
I/7	SCREEN NO.2 FAULT
I/8	PRESS NO.2 IN AUTO
I/9	PRESS NO.2 RUNNING
I/10	PRESS NO.2 HIGH CURRENT
I/11	PRESS NO.2 FAULT
I/12	SPARE PRE-WIRED
I/13	SPARE PRE-WIRED
I/14	SCREEN NO.2 HOME POS.
I/15	SPARE PRE-WIRED

PLC INPUTS – SLOT 3

I/0	SYSTEM NO.1 ENABLE
I/1	SCREEN NO.1 HIGH LEVEL
I/2	SCREEN NO.2 HIGH LEVEL
I/3	PRESS NO.1 HIGH LEVEL
I/4	PRESS NO.1 ZERO MOTION
I/5	PRESS NO.2 HIGH LEVEL
I/6	PRESS NO.2 ZERO MOTION
I/7	UTILITY POWER OK
I/8	SPARE PRE-WIRED
I/9	SPARE PRE-WIRED
I/10	SPARE PRE-WIRED
I/11	SPARE PRE-WIRED
I/12	SPARE PRE-WIRED
I/13	SPARE PRE-WIRED
I/14	SPARE PRE-WIRED
I/15	SPARE PRE-WIRED

PLC ANALOG INPUTS – SLOT 7

IN0	UPSTREAM LEVEL NO.1
IN1	DOWNSTREAM LEVEL NO.1
IN2	SPARE PRE-WIRED
IN3	SPARE PRE-WIRED

PLC INPUTS – SLOT 4

I/0	UPS LOW BATTERY
I/1	UPS FAULT
I/2	UPS ON BATTERY
I/3	SPARE PRE-WIRED
I/4	SPARE PRE-WIRED
I/5	SPARE PRE-WIRED
I/6	SPARE PRE-WIRED
I/7	SPARE PRE-WIRED
I/8	SPARE PRE-WIRED
I/9	SPARE PRE-WIRED
I/10	SPARE PRE-WIRED
I/11	SPARE PRE-WIRED
I/12	SPARE PRE-WIRED
I/13	SPARE PRE-WIRED
I/14	SPARE PRE-WIRED
I/15	SPARE PRE-WIRED

PLC OUTPUTS – SLOT 5

O/0	CONTROL POWER ENABLE
O/1	SCREEN NO.1 CALL REV.
O/2	SCREEN NO.1 CALL FOR.
O/3	SCREEN NO.1 HIGH SPEED
O/4	SCREEN NO.1 JAM FAULT
O/5	SCREEN NO.1 HIGH SPEED
O/6	SCREEN NO.1 LOW SPEED
O/7	SPARE PRE-WIRED
O/8	SPARE PRE-WIRED
O/9	SCREEN NO.1 HIGH LEVEL
O/10	PAN WASH NO.1 CALL
O/11	PRESS NO.1 CALL REVERSE
O/12	PRESS NO.1 CALL FORWARD
O/13	PRESS NO.1 HIGH CURRENT FAULT
O/14	PRESS NO.1 COMMON FAULT
O/15	PRESS ZONE WASH NO.1 CALL

PLC OUTPUTS – SLOT 6

O/0	SPARE PRE-WIRED
O/1	SCREEN NO.2 CALL REV.
O/2	SCREEN NO.2 CALL FOR.
O/3	SCREEN NO.2 HIGH SPEED
O/4	SCREEN NO.2 JAM FAULT
O/5	SCREEN NO.2 HIGH SPEED
O/6	SCREEN NO.2 LOW SPEED
O/7	SPARE PRE-WIRED
O/8	SPARE PRE-WIRED
O/9	SCREEN NO.2 HIGH LEVEL
O/10	PAN WASH NO.2 CALL
O/11	PRESS NO.2 CALL REVERSE
O/12	PRESS NO.2 CALL FORWARD
O/13	PRESS NO.2 HIGH CURRENT FAULT
O/14	PRESS NO.2 COMMON FAULT
O/15	PRESS ZONE WASH NO.2 CALL

PLC ANALOG INPUTS – SLOT 8

IN0	UPSTREAM LEVEL NO.2
IN1	DOWNSTREAM LEVEL NO.2
IN2	SPARE PRE-WIRED
IN3	SPARE PRE-WIRED

DEVICE SETTINGS

PLC1 – SCADA INFORMATION

REGISTER NUMBER	DESCRIPTION	DATA TYPE	SIGNAL FUNCTION	NORMAL STATE	ACTIVE STATE
S_INT[0]	PLC SLOT 1 INPUTS	BIT	READ	0	1
S_INT[1]	PLC SLOT 2 INPUTS	BIT	READ	0	1
S_INT[2]	PLC SLOT 3 INPUTS	BIT	READ	0	1
S_INT[3]	PLC SLOT 4 INPUTS	BIT	READ	0	1
S_INT[4]	PLC SLOT 5 OUTPUTS	BIT	READ	0	1
S_INT[5]	PLC SLOT 6 OUTPUTS	BIT	READ	0	1
S_REAL[1]	UPSTREAM NO.1 LEVEL (IN.)	REAL	READ	–	–
S_REAL[2]	DOWNSTREAM NO.1 LEVEL (IN.)	REAL	READ	–	–
S_REAL[3]	DIFFERENTIAL NO.1 LEVEL (IN.)	REAL	READ	–	–
S_REAL[4]	UPSTREAM NO.2 LEVEL (IN.)	REAL	READ	–	–
S_REAL[5]	DOWNSTREAM NO.2 LEVEL (IN.)	REAL	READ	–	–
S_REAL[6]	DIFFERENTIAL NO.2 LEVEL (IN.)	REAL	READ	–	–
S_INT[0].120	SYSTEM NO.1 ENABLE	BIT	WRITE	0	1
S_INT[0].121	SYSTEM NO.2 ENABLE	BIT	WRITE	0	1

NOTES:
1. THE ABOVE IS A LISTING OF BITS BEING MESSAGED FROM THE MAIN PANEL TO THE SCADA SYSTEM.

PLC1 – COMMUNICATIONS SETUP

PARAMETER	VALUE
DRIVER	DF1 FULL DUPLEX
BAUD RATE	9600
PARITY	NONE
STOP BITS	1
ERROR DETECTION	CRC

PARAMETER	VALUE
PANEL IP ADDRESS	10.0.0.1
SUBNET MASK	255.255.255.0
GATEWAY ADDRESS	0.0.0.0

OIU1 – COMMUNICATIONS SETUP

PARAMETER	VALUE
DRIVER	DF1 FULL DUPLEX
BAUD RATE	9600
PARITY/STOP BITS	NONE/1
ERROR DETECTION	CRC
HANDSHAKING	OFF

PARAMETER	VALUE
PANEL IP ADDRESS	10.0.0.2
SUBNET MASK	255.255.255.0
GATEWAY ADDRESS	0.0.0.0

DEVICE SETTINGS

PLC1 – SETPOINTS

REGISTER NUMBER	DESCRIPTION	FACTORY SETTING	RANGE
SP[0].INT	SCREEN 1 – REPEAT CYCLE OFF TIME	60 MIN.	1–180 MIN.
SP[1].INT	SCREEN 1 – ON DELAY TIME	5 SEC.	1–60 SEC.
SP[2].INT	SCREEN 1 – OFF DELAY TIME	10 SEC.	1–60 SEC.
SP[3].INT	SCREEN 1 – FAULT DWELL TIME	5 SEC.	1–10 SEC.
SP[4].INT	SCREEN 1 – REVERSE RUN TIME	25 SEC.	1–180 SEC.
SP[5].INT	SCREEN 1 – FAULT CYCLE COUNTER	1 CYCLE	1–5 CYCLES
SP[6].INT	SCREEN 1 – ZERO MOTION ON–DELAY	15 SEC.	1–999 SEC.
SP[7].INT	SCREEN 1 – RAKE POSITION DELAY	15 SEC.	1–999 SEC.
SP[8].INT	SCREEN 2 – REPEAT CYCLE OFF TIME	60 MIN.	1–180 MIN.
SP[9].INT	SCREEN 2 – ON DELAY TIME	5 SEC.	1–60 SEC.
SP[10].INT	SCREEN 2 – OFF DELAY TIME	10 SEC.	1–60 SEC.
SP[11].INT	SCREEN 2 – FAULT DWELL TIME	5 SEC.	1–10 SEC.
SP[12].INT	SCREEN 2 – REVERSE RUN TIME	25 SEC.	1–180 SEC.
SP[13].INT	SCREEN 2 – FAULT CYCLE COUNTER	1 CYCLE	1–5 CYCLES
SP[14].INT	SCREEN 2 – ZERO MOTION ON–DELAY	15 SEC.	1–999 SEC.
SP[15].INT	SCREEN 2 – RAKE POSITION DELAY	15 SEC.	1–999 SEC.
SP[16].INT	PRESS 1 – SCREEN ACCUMULATION RUN TIME	30 SEC.	1–999 SEC.
SP[17].INT	PRESS 1 – WASH CYCLE DURATION	80 SEC.	1–600 SEC.
SP[18].INT	PRESS 1 – NORMAL WASH RUN TIME	5 SEC.	1–60 SEC.
SP[19].INT	PRESS 1 – FORWARD DWELL TIME	5 SEC.	1–60 SEC.
SP[20].INT	PRESS 1 – INTERRUPT ON–DELAY TIME	30 SEC.	30–600 SEC.
SP[21].INT	PRESS 1 – INTERRUPT OFF–DELAY TIME	30 SEC.	5–120 SEC.
SP[22].INT	PRESS 1 – FAULT DWELL TIME	2 SEC.	1–10 SEC.
SP[23].INT	PRESS 1 – REVERSE RUN TIME	2 SEC.	1–10 SEC.
SP[24].INT	PRESS 1 – FAULT CYCLE COUNTER	1	1–5
SP[25].INT	PRESS 1 – ZERO MOTION ON–DELAY	15 SEC.	1–999 SEC.
SP[26].INT	PRESS ZONE 1 WASH – ON TIME	5 SEC.	1–60 SEC.
SP[27].INT	PRESS ZONE 1 WASH – OFF TIME	2 SEC.	1–60 SEC.
SP[28].INT	PAN WASH 1 – RUN TIME	2 SEC.	1–60 SEC.
SP[29].INT	PRESS 2 – SCREEN ACCUMULATION RUN TIME	30 SEC.	1–999 SEC.
SP[30].INT	PRESS 2 – WASH CYCLE DURATION	80 SEC.	1–600 SEC.
SP[31].INT	PRESS 2 – NORMAL WASH RUN TIME	5 SEC.	1–60 SEC.
SP[32].INT	PRESS 2 – FORWARD DWELL TIME	5 SEC.	1–60 SEC.
SP[33].INT	PRESS 2 – INTERRUPT ON–DELAY TIME	30 SEC.	30–600 SEC.
SP[34].INT	PRESS 2 – INTERRUPT OFF–DELAY TIME	30 SEC.	5–120 SEC.
SP[35].INT	PRESS 2 – FAULT DWELL TIME	2 SEC.	1–10 SEC.
SP[36].INT	PRESS 2 – REVERSE RUN TIME	2 SEC.	1–10 SEC.
SP[37].INT	PRESS 2 – FAULT CYCLE COUNTER		1–5
SP[38].INT	PRESS ZONE 2 WASH – ON TIME	5 SEC.	1–60 SEC.
SP[39].INT	PRESS ZONE 2 WASH – OFF TIME	2 SEC.	1–60 SEC.
SP[40].INT	PAN WASH 2 – RUN TIME	2 SEC.	1–60 SEC.
SP[41].INT	PRESS 1 – ZERO MOTION ON–DELAY	15 SEC.	1–999 SEC.
SP[50].REAL	SCREEN 1 START DIFFERENTIAL LEVEL	***	1–999 INCH.
SP[51].REAL	SCREEN 1 HIGH UPSTREAM LEVEL	***	1–999 INCH.
SP[52].REAL	SCREEN 1 HIGH DIFFERENTIAL LEVEL	***	1–999 INCH.
SP[53].REAL	4mA – SCREEN 1 UPSTREAM LEVEL	***	0–999 INCH.
SP[54].REAL	20mA – SCREEN 1 UPSTREAM LEVEL	***	0–999 INCH.
SP[55].REAL	4mA – SCREEN 1 DOWNSTREAM LEVEL	***	0–999 INCH.
SP[56].REAL	20mA – SCREEN DOWNSTREAM 1 LEVEL	***	0–999 INCH.
SP[57].REAL	SCREEN 2 START DIFFERENTIAL LEVEL	***	1–999 INCH.
SP[58].REAL	SCREEN 2 HIGH UPSTREAM LEVEL	***	1–999 INCH.
SP[59].REAL	SCREEN 2 HIGH DIFFERENTIAL LEVEL	***	1–999 INCH.
SP[60].REAL	4mA – SCREEN 2 UPSTREAM LEVEL	***	0–999 INCH.
SP[61].REAL	20mA – SCREEN 2 UPSTREAM LEVEL	***	0–999 INCH.
SP[62].REAL	4mA – SCREEN 2 DOWNSTREAM LEVEL	***	0–999 INCH.
SP[63].REAL	20mA – SCREEN 2 DOWNSTREAM LEVEL	***	0–999 INCH.

NOTES:
1. THE ABOVE IS A PARTIAL LISTING OF SETPOINTS. ONLY THE SETPOINTS THAT ARE SHOWN ABOVE SHALL BE ALTERED IN THE FIELD.

DATE	REVISION	NO.	BY	CK	APP	DATE

DESIGNED DC
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DATE 04/11/18

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DUAL RAKEMAX / DUAL WAP CONTROL PANEL

LEXINGTON, KY
EAST HICKMAN

SCALE: NONE

PROJECT NUMBER: 73002974

DRAWING NO: HBR7281A14

SHEET 14 OF 17

DEVICE SETTINGS

VFD1 – ALTIVAR 320

PARAMTER GROUP	CODE	DESCRIPTION	DEFAULT	FACTORY SETTING
CONFIGURE (ConF) ↓ FULL SETTINGS (FULL) ↓ SETTINGS (SEt)	Inr	RAMP INCREMENT	0.1	
	ACC	ACCELERATION	3 SEC.	5 SEC.
	dEC	DECELERATION	3 SEC.	5 SEC.
	LSP	LOW SPEED	0 HZ	20 HZ
	HSP	HIGH SPEED	bFr	60 HZ
	ItH	MOTOR THERMAL CURRENT	**	*
	uFr	IR COMPENSATION	100%	
	SLP	SLIP COMPENSATION	100%	
	SFr	SWITCHING FREQUENCY	4.0 kHZ	
	SP2	PRESET SPEED 2	10 HZ	60HZ
	Ctd	CURRENT THRESHOLD	**	*
CONFIGURE (ConF) ↓ FULL SETTINGS (FULL) ↓ MTR CONTROL (drC) ↓ ASYNC MOTOR (ASY)	bFr	STD. MOTOR FREQUENCY	50 HZ	60 HZ
	tFr	MAX FREQUENCY	60 HZ	60 HZ
	nPr	RATED MOTOR POWER		NAMEPLATE
	CoS	MOTOR 1 COSINUS PHI		NAMEPLATE
	unS	RATED MOTOR VOLTAGE		NAMEPLATE
	nCr	RATED MOTOR CURRENT		NAMEPLATE
	FrS	RATED MOTOR FREQUENCY	50 HZ	NAMEPLATE
	nSP	RATED MOTOR SPEED		NAMEPLATE
	Ctt	MOTOR CONTROL TYPE	Std	
	nrd	NOISE REDUCTION	no	
	SFC	K SPEED LOOP FILTER	65	
CONFIGURE (ConF) ↓ FULL SETTINGS (FULL) ↓ I/O CONFIG (I-O)	tCC	2/3 WIRE CONTROL	2C	
	tCt	2 WIRE TYPE	trn	LEL
	Frd	FORWARD ASSIGN	LI1	
	rrS	REVERSE ASSIGN	LI2	nO
	AI3-CrL3	AI3 MIN VALUE	0 mA	4 mA
	AI3-CrH3	AI3 MAX VALUE	20 mA	
	Ao1t	AO1 TYPE	0A	
	Ao1	ANALOG OUTPUT ASSIGNMENT	no	oFr
	R1	R1 ASSIGNMENT	FLt	run
	R2	R2 ASSIGNMENT	no	Ctg
CONFIGURE (ConF) ↓ FULL SETTINGS (FULL) ↓ COMMAND (CtL)	Fr1	REF 1 CHANNEL	AI1	
	ChCF	PROFILE	Sin	SEP
	rFC	REF 2 SWITCHING	Fr1	LI4
	Fr2	REF 2 CHANNEL	no	
CONFIGURE (ConF) ↓ FULL SETTINGS (FULL) ↓ APP FUNC (FUn)	Stt	TYPE OF STOP	rMP	nSt
	PSS-PS2	2 PRESET SPEEDS	no	

NOTES:
1. THE ABOVE IS A PARTIAL LISTING OF SET-POINTS. REFER TO THE INSTRUCTION MANUAL FOR A COMPLETE PARAMETER LISTING.
2. VERIFY MOTOR NAMEPLATE DATA. ENTER PARAMETERS AS PRINTED ON MOTOR NAMEPLATE.
3. ** INDICATES A DEFAULT SETTING SPECIFIC TO THE VFD SIZE. THE DEFAULT SETTING IS THE NOMINAL DRIVE OUTPUT CURRENT.
4. * INDICATES A PARAMETER THAT MUST BE SET BY THE START-UP TECHNICIAN.

DEVICE SETTINGS

ULC1.2 – HYDRORANGER 200 HMI

FUNCTION NUMBER	FUNCTION DESCRIPTION	DEFAULT	FACTORY SETTING	FIELD SETTING
2.1.1	UNIT	M	IN	
2.1.3	SENSOR MODE	LEVEL	DUAL POINT DIFF	
2.1.5	TRANSDUCER	NO	STH	
2.1.6	MATERIAL	LIQUID	LIQUID	
2.2.2	SPAN 1	26.2	*	
	SPAN 2	26.2	*	
2.2.4	EMPTY 1	26.2	*	
	EMPTY 2	26.2	*	
2.2.6	BLANKING 1	11.8	*	
	BLANKING 2	11.8	*	
2.3.4	RESPONSE RATE 1	MEDIUM	MEDIUM	
	RESPONSE RATE 2	MEDIUM	MEDIUM	
2.4.2	LOE TIMER 1	10.0 MIN	10.0 MIN	
	LOE TIMER 2	10.0 MIN	10.0 MIN	
2.4.4	FAIL SAFE MODE 1	HOLD	HI	
	FAIL SAFE MODE 2	HOLD	LO	
2.5.2	MA OUTPUT RANGE 1	4 TO 20 MA	4 TO 20 MA	
	MA OUTPUT RANGE 2	4 TO 20 MA	4 TO 20 MA	
2.5.3	CURRENT OUTPUT FUNCTION 1	DISTANCE	LEVEL	
	CURRENT OUTPUT FUNCTION 2	DISTANCE	LEVEL	
2.5.4	MA OUTPUT ALLOCATION 1	POINT 1	POINT 1	
	MA OUTPUT ALLOCATION 2	POINT 1	POINT 2	
2.5.5	4MA SETPOINT 1	0	*	
	4MA SETPOINT 2	0	*	
2.5.6	20MA SETPOINT 1	0	*	
	20MA SETPOINT 2	0	*	
2.5.10	FAIL SAFE MODE 1	OFF	HI	
	FAIL SAFE MODE 2	OFF	LO	

NOTES:
1. FACTORY SETTING '*' NOTES PARAMETERS SET IN THE FIELD.
2. THE ABOVE IS A PARTIAL LISTING OF SETPOINTS. REFER TO THE INSTRUCTION MANUAL FOR A COMPLETE PARAMETER LISTING.
3. ALLOW AT LEAST ONE MINUTE FOR CONTROLLER LEVEL READING TO STABILIZE AFTER RETURNING TO THE RUN MODE.
4. ENSURE THE CORRECT PROFILE IS SELECTED WHEN ALTERING SETPOINTS WITH MULTIPLE FIELDS.

DEVICE SETTINGS

CM1.2 – CURRENT MONITOR

DIP SETTINGS	
1	ON
2	OFF
3	ON
4	OFF
5	OFF
6	ON

HYSTERESIS	MIN
LEVEL	MIN
DELAY	MIN

NOTES:
1. THE CURRENT MONITOR DIAL SHALL BE SET TO MINIMUM FROM FACTORY.
2. FIELD CONFIGURATION SHALL BE PERFORMED BY THE STARTUP TECHNICIAN PER THE APPROPRIATE TECHNICAL DOCUMENTS.

TIB1.2 – TRANSFORMER ISOLATED BARRIER

DIP SWITCH	SET AT
S1	I
S2	I
S3	I

TIB3-6 – TRANSFORMER ISOLATED BARRIER

DIP SWITCH	SET AT
S1	II
S2	I
S3	I

NO.	BY	CK	APP	DATE	REVISION
					DESIGNED DC
					DETAILED
					CHECKED CCC
					APPROVED
				04/11/16	DATE

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DUAL RAKEMAX / DUAL WAP CONTROL PANEL

LEXINGTON, KY
EAST HICKMAN

SCALE: NONE

PROJECT NUMBER: 73002974

DRAWING NO: HBR7281A15

SHEET 15 OF 17

SEQUENCE OF OPERATION

CONTROL POWER ON-DELAY:
EACH TIME THE CONTROL PANEL POWER SUPPLY IS CYCLED, THE PLC WILL ALLOW ALL SOLID STATE DEVICES TO BECOME FULLY ENERGIZED BEFORE ENABLING THE CONTROL POWER CIRCUIT.

SCREEN MODES OF OPERATION:
HAND/LCS: WHEN THE SCREEN SELECTOR, LOCATED ON THE LCS IS IN THE HAND POSITION, THE SCREEN WILL CYCLE ON AND OFF WITH THE SCREEN FOR-OFF-REV SELECTOR.
FOR/LCS: WHEN THE SCREEN SELECTOR, LOCATED ON THE LCS IS IN THE HAND POSITION AND THE FORWARD DIRECTION IS SELECTED, THE SCREEN WILL RUN CONTINUOUSLY IN THE FORWARD DIRECTION.
REV/LCS: WHEN THE SCREEN SELECTOR, LOCATED ON THE LCS IS IN THE HAND POSITION AND THE REVERSE DIRECTION SELECTED, THE SCREEN WILL RUN IN THE REVERSE DIRECTION. THIS SWITCH WILL SPRING RETURN FROM REV TO OFF.
REMOTE/LCS: WHEN THE SCREEN SELECTOR, LOCATED ON THE LCS IS IN THE REMOTE POSITION, THE SCREEN WILL OPERATE PER THE ON-OFF-AUTO SELECTOR LOCATED ON THE OIU.
ON/OIU: WHEN THE SCREEN SELECTOR, LOCATED ON THE OIU IS IN THE ON POSITION, THE SCREEN WILL OPERATE PER THE OIU FORWARD-OFF-REVERSE SELECTOR.
AUTO/OIU: WHEN THE SCREEN SELECTOR, LOCATED ON THE OIU IS IN THE AUTO POSITION, THE SCREEN WILL BEGIN TO RUN DUE TO ANY ONE OF THE FOLLOWING CONDITIONS:
- LEVEL HAS RISEN AND REMAINED ABOVE THE START DIFFERENTIAL LEVEL OR THE START UPSTREAM LEVEL SETPOINT FOR THE TIME SET IN THE PLC
- LEVEL HAS RISEN AND REMAINED ABOVE THE HIGH LEVEL FLOAT FOR THE TIME SET IN THE PLC.
- SCREEN OFF TIME HAS REACHED MAXIMUM TIME SET IN PLC
- SYSTEM RESET PUSHBUTTON PRESSED AND HELD FOR TIME SET IN PLC

ONCE A CYCLE IS STARTED THE SCREEN WILL RUN CONTINUOUSLY IN THE FORWARD DIRECTION UNTIL THE LEVEL DROPS BELOW THE START LEVEL SETPOINT, PER THE TIME SETTING SET IN THE SCREEN OFF DELAY TIMER.

SCREEN HIGH SPEED:
THE SCREEN WILL OPERATE AT HIGH SPEED ONCE THE LEVEL OF MATERIAL REACHES THE HIGH UPSTREAM, HIGH DIFFERENTIAL LEVEL SETPOINT OR THE HIGH LEVEL FLOAT. THE SCREEN WILL CONTINUE TO OPERATE AT HIGH SPEED UNTIL THE LEVEL DROPS BELOW THE START LEVEL SETPOINT.

NOTES:
1. HIGH SPEED OPERATION WILL ONLY TAKE PLACE WHEN OPERATING IN AUTO AND IN THE FORWARD DIRECTION.
2. EACH SCREEN/PRESS SYSTEM WILL BE AVAILABLE TO OPERATE IN AUTO MODE, WHEN THE SYSTEM ENABLE SIGNAL IS RECEIVED.

SCREEN RAKE PARKING:
WHEN THE SCREEN OFF DELAY TIMER IS COMPLETED THE SCREEN WILL CONTINUE TO RUN IN THE FORWARD DIRECTION TO TRIGGER THE SCREEN HOME POSITION PROXIMITY SWITCH. ONCE THE SWITCH IS TRIGGERED, THE SCREEN WILL CONTINUE RUNNING PER THE TIME SETTING IN THE SCREEN RAKE POSITION DELAY TIMER.

PRESS MODES OF OPERATION:
HAND/LCS: WHEN THE PRESS SELECTOR, LOCATED ON THE LCS, IS IN THE HAND POSITION, THE PRESS WILL CYCLE ON AND OFF WITH THE PRESS FOR-OFF-REV SELECTOR.
FOR/LCS: WHEN THE PRESS SELECTOR, LOCATED ON THE LCS, IS IN THE HAND POSITION, AND THE FORWARD DIRECTION IS SELECTED, THE PRESS WILL RUN CONTINUOUSLY IN THE FORWARD DIRECTION.
REV: WHEN THE PRESS SELECTOR, LOCATED ON THE LCS, IS IN THE HAND POSITION AND THE REVERSE DIRECTION SELECTED, THE PRESS WILL RUN CONTINUOUSLY IN THE REVERSE DIRECTION. THIS SWITCH WILL SPRING RETURN FROM REV TO OFF.
REMOTE/LCS: WHEN THE PRESS SELECTOR, LOCATED ON THE LCS IS IN THE REMOTE POSITION, THE PRESS WILL OPERATE PER THE ON-OFF-AUTO SELECTOR LOCATED ON THE OIU.
ON/OIU: WHEN THE SCREEN SELECTOR, LOCATED ON THE OIU IS IN THE ON POSITION, THE SCREEN WILL OPERATE PER THE FORWARD-OFF-REVERSE SELECTOR LOCATED ON THE OIU.
AUTO/OIU: WHEN THE PRESS SELECTOR, LOCATED ON THE OIU IS IN THE AUTO POSITION, THE PRESS WILL RUN BASED ON ONE OF THE FOLLOWING CONDITIONS:

NORMAL MODE: THE PRESS WILL BEGIN A NORMAL WASH CYCLE BASED ON ONE OF THE FOLLOWING CONDITIONS:
- THE SCREEN ACCUMULATED RUNTIME HAS REACHED THE SCREEN RUN ACCUMULATION TIMER
- SYSTEM RESET PUSHBUTTON PRESSED AND HELD FOR 3 SECONDS

DURING A NORMAL WASHING CYCLE, THE PRESS WILL RUN FORWARD FOR THE TIME SET IN THE PRESS NORMAL WASH RUN TIMER. THE PRESS WILL THEN STOP AND DWELL FOR THE TIME SET IN THE PRESS DWELL TIMER. THESE FORWARD-DWELL CYCLES WILL CONTINUE UNTIL THE WASH CYCLE DURATION TIMER SET IN THE PLC HAS EXPIRED.

INTERRUPT MODE: THE PRESS WILL IMMEDIATELY BEGIN A INTERRUPT WASH CYCLE WHEN THE CONTINUOUS RUN TIME OF THE SCREEN EXCEEDS THE INTERRUPT WASH CYCLE ON-DELAY TIMER. DURING THE INTERRUPT WASHING CYCLE THE PRESS WILL CYCLE FORWARD CONTINUOUSLY WITHOUT DWELLING. THE INTERRUPT CYCLE WILL CONTINUE UNTIL THE FEEDING EQUIPMENT STOPS AND REMAINS OFF FOR THE TIME SET IN THE INTERRUPT OFF-DELAY TIMER. AFTER EACH INTERRUPT CYCLE, A NORMAL WASH CYCLE WILL BE COMPLETED BEFORE THE PRESS SHUTS OFF.

SEQUENCE OF OPERATION

PRESS ZONE WASH MODES OF OPERATION:
HAND/LCS: WHEN THE PRESS ZONE WASH SELECTOR LOCATED ON THE LCS IS IN THE HAND POSITION, PRESS ZONE WASH SOLENOID WILL OPEN CONTINUOUSLY.
REMOTE/LCS: WHEN THE PRESS ZONE WASH SELECTOR LOCATED ON THE LCS IN IN THE REMOTE POSITION, THE PRESS ZONE WASH SOLENOID VALVE WILL OPERATE PER THE ON-OFF-AUTO SELECTOR LOCATED ON THE OIU.
ON/OIU: WHEN THE PRESS ZONE WASH SELECTOR, LOCATED ON THE OIU IS IN THE ON POSITION, THE PRESS ZONE WASH SOLENOID VALVE WILL OPEN CONTINUOUSLY.
AUTO/OIU: WHEN THE PRESS ZONE WASH SELECTOR LOCATED ON THE OIU IS IN THE AUTO POSITION, THE PRESS ZONE WASH SOLENOID WILL CYCLE ON AND OFF, ON TIME FIRST, PER REPEAT CYCLE TIMES SET IN THE PLC. THE PRESS ZONE WASH WILL ONLY BE ACTIVE DURING THE NORMAL WASH CYCLE.

NOTE: DURING THE INTERRUPT WASH CYCLE, THE PRESS ZONE WASH SOLENOID VALVE WILL REMAIN CLOSED.

PAN WASH MODES OF OPERATION:
HAND/LCS: WHEN THE PAN WASH SELECTOR LOCATED ON THE LCS IS IN THE HAND POSITION, PAN WASH SOLENOID WILL OPEN CONTINUOUSLY.
REMOTE/LCS: WHEN THE PAN WASH SELECTOR LOCATED ON THE LCS IN IN THE REMOTE POSITION, THE PAN WASH SOLENOID VALVE WILL OPERATE PER THE ON-OFF-AUTO SELECTOR LOCATED ON THE OIU.
ON/OIU: WHEN THE PAN WASH SELECTOR, LOCATED ON THE OIU IS IN THE ON POSITION, THE PAN WASH SOLENOID VALVE WILL OPEN CONTINUOUSLY.
AUTO/OIU: WHEN THE PAN WASH SELECTOR LOCATED ON THE OIU IS IN THE AUTO POSITION, THE PAN WASH WILL BEGIN TO RUN ONCE THE WASH CYCLE IS COMPLETE. THE PAN WASH WILL REMAIN ON FOR THE TIME SET IN THE PAN WASH RUN TIME.

NOTE: DURING THE INTERRUPT WASH CYCLE, THE PAN WASH SOLENOID VALVE WILL REMAIN CLOSED.

OIU - INFORMATION:
1. THE OIU WILL DISPLAY THE ELAPSED MOTOR RUN TIME.
2. ALL ADJUSTABLE SETPOINTS CAN BE ACCESSED AND ADJUSTED THROUGH THE OIU.
3. THE PRESENT FAULT WILL BE DISPLAYED ON THE OIU.
4. THE HISTORY OF PAST FAULTS CAN BE ACCESSED THROUGH THE OIU.
5. THE SCREEN PRESENT LEVEL WILL BE DISPLAYED ON THE OIU.
6. ON-OFF-AUTO SELECTORS FOR THE SCREENS, PRESSES AND SOLENOIDS WILL BE DISPLAYED ON THE OIU.

EMERGENCY STOP:
WHEN ANY OF THE E-STOP PUSHBUTTONS ARE PRESSED THE SCREENS, PRESSES AND ALL SOLENOID VALVES WILL STOP IMMEDIATELY. THE CONTROL POWER ON LIGHT WILL DE-ENERGIZE. TO RESET, INSURE ALL E-STOPS ARE ENABLED, AND PRESS THE SYSTEM RESET PUSHBUTTON.

NOTE: IF THE POWER TO THE PANEL IS INTERRUPTED, THE EQUIPMENT MAY CYCLE IMMEDIATELY ONCE THE POWER IS RESTORED. PRESSING THE SYSTEM RESET PUSHBUTTON AFTER A POWER OUTAGE WILL NOT BE REQUIRED.

SEQUENCE OF OPERATION

FAULTS:
SCREEN MOTOR THERMOSTAT - WHEN THE SCREEN MOTOR THERMOSTAT IS TRIPPED THE SCREEN WILL STOP IMMEDIATELY AND THE SCREEN FAULT LIGHT WILL BE ENERGIZED.

SCREEN OVERLOAD SHUTDOWN - IF HIGH CURRENT IS MEASURED WHILE THE SCREEN IS OPERATING IN THE FORWARD DIRECTION, THEN THE SCREEN WILL TRY TO CLEAR THE FAULT AS DETAILED BELOW IN THE JAM LOGIC SEQUENCE. IF THE JAM LOGIC SEQUENCE IS UNSUCCESSFUL THEN THE SCREEN WILL SHUTDOWN IMMEDIATELY AND THE SCREEN FAULT PILOT LIGHT WILL BE ENERGIZED.

SCREEN ZERO MOTION - IF THE SCREEN IS RUNNING AND THE SCREEN HOME POSITION PROXIMITY SWITCH IS NOT TRIGGERED BEFORE THE ZERO SPEED ON-DELAY TIMER EXPIRES, THEN THE SCREEN WILL SHUTDOWN IMMEDIATELY AND THE SCREEN FAULT LIGH WILL BE ENERGIZED.

SCREEN HIGH TORQUE - IF HIGH TORQUE IS MEASURED WHILE THE SCREEN IS OPERATING IN THE FORWARD DIRECTION, THEN THE SCREEN WILL TRY TO CLEAR THE FAULT AS DETAILED BELOW IN THE JAM LOGIC SEQUENCE. IF THE JAM LOGIC SEQUENCE IS UNSUCCESSFUL THEN THE SCREEN WILL SHUTDOWN IMMEDIATELY AND THE SCREEN FAULT PILOT LIGHT WILL BE ENERGIZED.

JAM LOGIC:
WHEN A FAULT CONDITION OCCURS THAT REQUIRES THE JAM LOGIC SEQUENCE, THE SCREEN WILL STOP AND DWELL, RUN IN REVERSE, STOP AND DWELL, THEN CONTINUE ITS CYCLE. IF THE FAULT CONDITION PERSISTS, THE SCREEN WILL CONTINUE TO TRY AND CLEAR THE FAULT. IF THE NUMBER OF ATTEMPTS TO CLEAR THE FAULT EXCEEDS THE NUMBER ALLOWED WITHIN 5 MINUTES, THEN THE SCREEN WILL SHUTDOWN IMMEDIATELY AND THE SCREEN FAULT PILOT LIGHT WILL BE ENERGIZED.

NOTE: IF THE FAULT CONDITION OCCURS WHILE THE SCREEN IS OPERATING IN THE REVERSE DIRECTION OR WHILE IN HAND, THE SCREEN WILL SHUTDOWN IMMEDIATELY AND THE SCREEN FAULT PILOT LIGHT WILL BE ENERGIZED.

SCREEN CALL FOR NOT RUNNING - IF THE SCREEN IS READY AND THE PLC HAS CALLED THE SCREEN TO RUN, BUT DOES NOT RECEIVE RUNNING CONFIRMATION WITHIN 3 SECONDS, THE SCREEN WILL STOP IMMEDIATELY AND THE SCREEN FAULT LIGHT WILL BE ENERGIZED.

PRESS MOTOR OVERLOAD - WHEN THE PRESS MOTOR OVERLOAD IS TRIPPED THE PRESS WILL STOP IMMEDIATELY AND THE PRESS FAULT LIGHT WILL BE ENERGIZED.

PRESS HIGH CURRENT - WHEN THE PRESS CURRENT MONITOR DETECTS HIGH CURRENT WHILE THE PRESS IS IN HAND MODE, THE PRESS WILL STOP IMMEDIATELY AND THE PRESS FAULT LIGHT WILL BE ENERGIZED.

PRESS OVERLOAD SHUTDOWN - IF HIGH CURRENT IS MEASURED WHILE THE PRESS IS OPERATING IN THE FORWARD DIRECTION, THEN THE PRESS WILL TRY TO CLEAR THE FAULT. TO CLEAR THE FAULT THE PRESS WILL STOP AND DWELL, RUN IN REVERSE, STOP AND DWELL, THEN CONTINUE ITS CYCLE. IF THE HIGH CURRENT PERSISTS, THE PRESS WILL CONTINUE TO TRY AND CLEAR THE FAULT. IF THE NUMBER OF ATTEMPTS TO CLEAR THE FAULT EXCEEDS THE NUMBER ALLOWED WITHIN 5 MINUTES, THEN THE PRESS WILL SHUTDOWN IMMEDIATELY AND THE PRESS FAULT PILOT LIGHT WILL BE ENERGIZED. NOTE: IF HIGH CURRENT IS MEASURED WHILE THE PRESS IS OPERATING IN THE REVERSE DIRECTION OR WHILE IN HAND, THE PRESS WILL SHUTDOWN IMMEDIATELY AND THE PRESS FAULT PILOT LIGHT WILL BE ENERGIZED.

PRESS ZERO MOTION - WHEN THE PRESS ZERO MOTION SENSOR SENSES ZERO MOTION, THE PRESS WILL STOP IMMEDIATELY AND THE PRESS FAULT LIGHT WILL BE ENERGIZED.

ALL OF THE ABOVE FAULTS CAN BE RESET BY PRESSING THE SYSTEM RESET PUSHBUTTON.

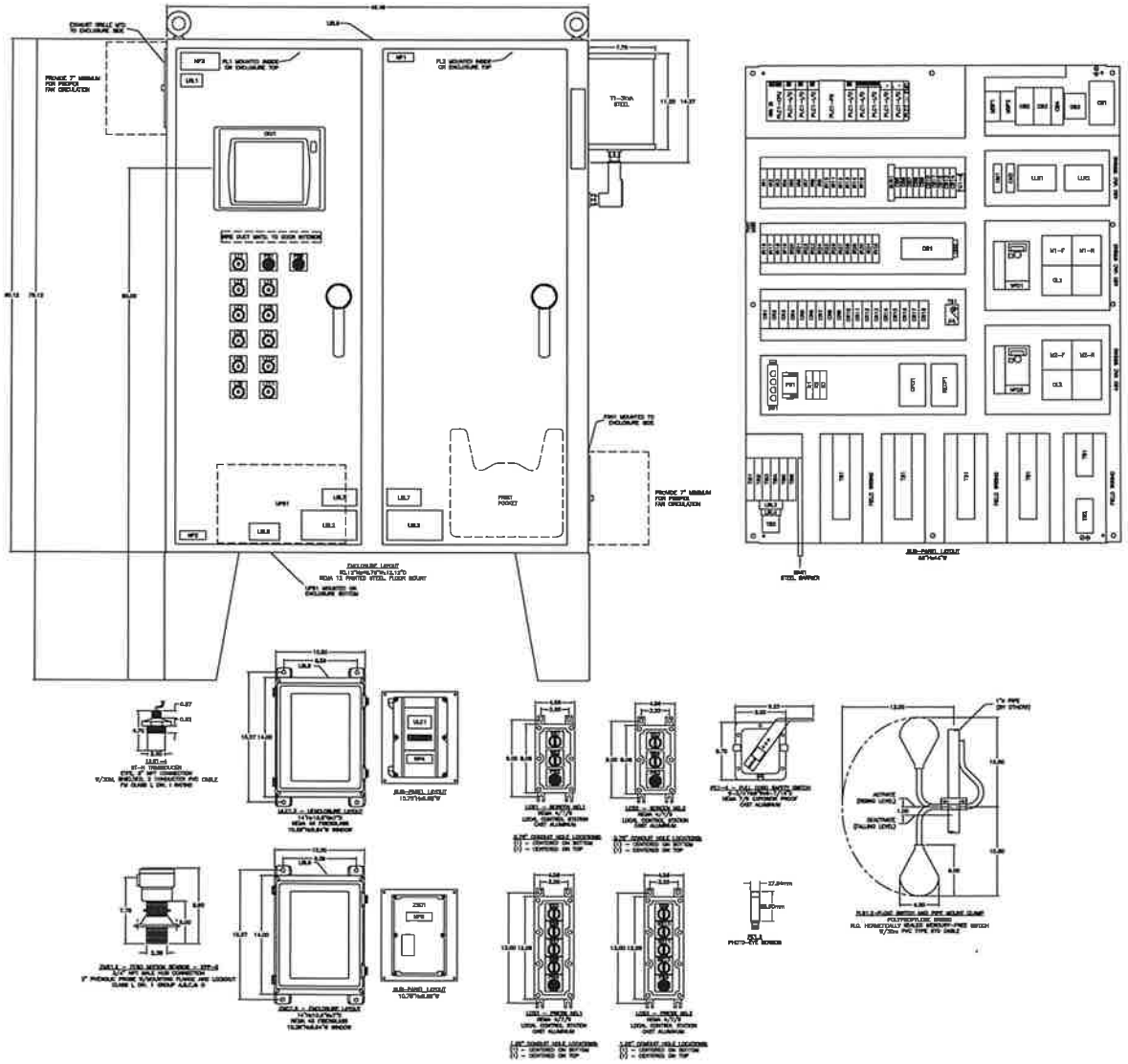
PRESS MOTOR T-STAT - WHEN THE PRESS MOTOR T-STAT IS TRIPPED THE PRESS WILL STOP IMMEDIATELY. THE PRESS WILL RESUME OPERATION ONCE THE PRESS MOTOR HAS RETURNED TO SAFE OPERATING TEMPERATURE. PRESSING THE RESET PUSHBUTTON WILL NOT BE REQUIRED.

HIGH LEVEL LIGHT:
IF THE SCREEN LEVEL RAISES ABOVE THE SCREEN HIGH LEVEL SETPOINT SET IN THE PROGRAMMABLE LOGIC CONTROLLER OR THE SCREEN HIGH LEVEL FLOAT, THE SCRFFN HIGH LEVEL LIGHT WILL BE ENERGIZED. THE LIGHT WILL REMAIN ENERGIZED UNTIL THE LEVEL DROPS BELOW THE HIGH LEVEL FLOAT OR THE SCREEN HIGH LEVEL SETPOINT.

DATE	REVISION	NO.	BY	CK	APP	DESIGNED	DG
						DETAILED	
						CHECKED	CCC
						APPROVED	
						DATE	04/11/18

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DUAL RAKEMAX / DUAL WAP CONTROL PANEL
LEXINGTON, KY
EAST HICKMAN
SCALE: NONE
PROJECT NUMBER: 73002974
DRAWING NO: HBR7281A16
SHEET 16 OF 17



PILOT DEVICE LEGEND PLATES:

LT1	–	CONTROL POWER ON	
LT2	–	SCREEN 1 RUNNING	
LT3	–	SCREEN 1 FAULT	
LT4	–	SCREEN 2 RUNNING	
LT5	–	SCREEN 2 FAULT	
LT6	–	SCREEN 1 HIGH LEVEL	
LT7	–	SCREEN 2 HIGH LEVEL	
LT8	–	PRESS 1 RUNNING	
LT9	–	PRESS 1 FAULT	
LT10	–	PRESS 2 RUNNING	
LT11	–	PRESS 2 FAULT	
PB1	–	EMERGENCY STOP	
PB2	–	EMERGENCY STOP	
PB3	–	EMERGENCY STOP	
PB4	–	EMERGENCY STOP	
PB5	–	EMERGENCY STOP	
PB6	–	SYSTEM RESET	
SS1	–	SCREEN NO.1	HAND–OFF–REMOTE
SS2	–	SCREEN NO.1	FOR–OFF–REV
SS3	–	SCREEN NO.2	HAND–OFF–REMOTE
SS4	–	SCREEN NO.2	FOR–OFF–REV
SS5	–	PRESS NO.1	HAND–OFF–REMOTE
SS6	–	PRESS NO.1	FOR–OFF–REV
SS7	–	PRESS ZONE NO.1	HAND–OFF–REMOTE
SS8	–	PAN WASH NO.2	HAND–OFF–REMOTE
SS9	–	PRESS NO.2	HAND–OFF–REMOTE
SS10	–	PRESS NO.2	FOR–OFF–REV
SS11	–	PRESS ZONE NO.2	HAND–OFF–REMOTE
SS12	–	PAN WASH NO.2	HAND–OFF–REMOTE

NAMEPLATES:

NP1	–	480VAC–3PH–60HZ
NP2	–	INTRINSICALLY SAFE CIRCUITS
NP3	–	CONTROL PANEL PROVIDES INTRINSICALLY SAFE CIRCUIT EXTENSIONS FOR USE IN CLASS I, GROUPS A, B, C, D; CLASS II, GROUPS E, F, G; CLASS III HAZARDOUS LOCATIONS WHEN CONNECTED PER P&F INSTALLATION DRAWING NO. 116–0145D
NP4	–	ULTRASONIC LEVEL CONTROLLER
NP5	–	ZERO MOTION CONTROLLER

LABEL DESCRIPTION:

LBL1	–	WARNING:	MULTIPLE SUPPLY SOURCES OPEN ALL DISCONNECTS BEFORE SERVICING EQUIPMENT OR OTHER UNIT WIRING
LBL2	–	DANGER	HIGH VOLTAGE ENTRY BY QUALIFIED PERSON ONLY
LBL3	–	WARNING	SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY
LBL4	–	INTRINSICALLY SAFE FIELD WIRING TERMINALS	
LBL5	–	ELEMECH	ELECTRICAL CONTROL SYSTEMS
LBL6	–	WARNING	DAMAGE RESULTING FROM INSTALLATION OF TOP ENTRY CONDUIT WILL VOID WARRANTY. – USE PROPER FITTINGS, MYERS TYPE 4 OR EQUAL – PROTECT INTERIOR DEVICES FROM INSTALLATION DEBRIS – CONDUIT MUST BE SEALED WATERTIGHT TO PREVENT WATER ENTRY
LBL7	–	DANGER	ARC FLASH AND SHOCK HAZARD FOLLOW ALL REQUIREMENTS NFPA 70E FOR SAFE WORK PRACTICES AND FOR PERSONAL PROTECTIVE EQUIPMENT.

DATE	REVISION	NO.	BY	CK	APP	DATE
					DESIGNED	DG
					DETAILED	
					CHECKED	CDC
					APPROVED	
					DATE	04/11/18

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DUAL RAKEMAX / DUAL WAP CONTROL PANEL

LEXINGTON, KY
EAST HICKMAN

SCALE: NONE

PROJECT NUMBER: 73002974

DRAWING NO: HBR7281A17

SHEET 17 OF 17

Bill of Materials

D

ELEMECH INC. 630-499-7080 · www.elemechinc.com	Rev: 0	Section: D	
Section Name: Bill of Materials	Date: 4/13/2018	Job Number: HBR7281	Page # 1/1
	By: TCC		

Item No	Component	Description	Manufacturer Part Number	QTY	Device
Dual Rakemax / Dual WAP Control Panel (Quantity: 1)					
1	00-000-000	Wire, Hardware, Wire labels, etc.	EleMech: Miscellaneous	3	
2	10-069-000	Wireway Duct Cover, 1.5"W, 6 Ft. Section, w/Panduit F Series	Panduit: C1.5WH6	9	
3	10-069-001	Wireway Duct Cover, 1"W, 6 Ft. Section, w/Panduit F Series	Panduit: C1WH6	6	
4	10-069-002	Wireway Duct Cover, 2"W, 6 Ft. Section, w/Panduit F Series	Panduit: C2WH6	6	
5	10-069-003	Wireway Duct Cover, 3"W, 6 Ft. Section, w/Panduit F Series	Panduit: C3WH6	6	
6	10-069-005	Wireway Duct, 1.5"Wx3"H, 6 Foot Section	Panduit: F1.5X3WH6	9	
7	10-069-007	Wireway Duct, 1"Wx3"H, 6 Foot Section	Panduit: F1X3WH6	6	
8	10-069-008	Wireway Duct, 2"Wx3"H, 6 Foot Section	Panduit: F2X3WH6	6	
9	10-069-009	Wireway Duct, 3"Wx3"H, 6 Foot Section	Panduit: F3X3WH6	6	
10	25-000-A001	Legendplate Assembly, Yellow E-Stop, Standard Encl.	EleMech: 25-000-A001 Assembly	1	
11	25-000-A002	Legendplate Assembly, White, Black Text, Standard Encl.	EleMech: 25-000-A002 Assembly	12	
12	25-000-A019	Nameplate Assembly, White: Power Supply - 3/60/480VAC	EleMech: 25-000-A019 Assembly	1	
13	42-063-007	Terminal Block, Din Rail, 35MM Wide, 15 High, 2 Meters Long	Iboco: Omega 3 AF	2	
14	52-000-003	Label, Underwriters Laboratories 698A, w/Decal Set	EleMech: 698A	1	
15	18-000-002	Steel Barrier, 14Ga., 0.5"Wx10.0"x6.0"D, Standard	EleMech: 18-000-002	1	BAR1
16	03-018-073	Circuit Breaker, 3 Pole, 480VAC, 40A, 65K AIC, E125	Cutler-Hammer: EGH3040FFG	1	CB1
17	03-018-101	Circuit Breaker Disc., Flange, E125-Frame, NEMA 4X, 3' Cable	Cutler-Hammer: EHMFS03X	1	CB1
18	03-018-108	Circuit Breaker Aux. Contact, E125-Frame, 1NO/NC, 6A	Cutler-Hammer: AUX1A1BPK	1	CB1
19	03-001-172	Circuit Breaker, 3 Pole, 480VAC, 20A, 10kA, UL489, Type K	ABB: SU203M-K20	2	CB2,3
20	03-001-154	Circuit Breaker, 2 Pole, 480VAC, 16A, 10kA, UL489, Type K	ABB: SU202M-K16	1	CB4
21	03-001-131	Circuit Breaker, 1 Pole, 240VAC, 15A, 10kA, UL489, Type C	ABB: SU201M-C15	1	CB5
22	03-001-130	Circuit Breaker, 1 Pole, 240VAC, 10A, 10kA, UL489, Type C	ABB: SU201M-C10	2	CB6,12
23	03-001-128	Circuit Breaker, 1 Pole, 240VAC, 6A, 10kA, UL489, Type C	ABB: SU201M-C6	1	CB7
24	03-001-124	Circuit Breaker, 1 Pole, 240VAC, 2A, 10kA, UL489, Type C	ABB: SU201M-C2	6	CB8-11,13-
25	57-009-014	Cable, Comm., Ethernet, Cat. 6, 600V,4 PAIR, 23AWG, 3.3 FT	Belden: E605001-010S1	1	CBL1
26	57-009-011	Cable, Comm., Ethernet, Cat. 6, 600V,4 PAIR, 23AWG, 6.6 FT	Belden: E605002-010S1	1	CBL2
27	04-094-000	Current Monitor, Selectable, SPDT, 120/24V ,2-100A, w/Delay	Gavazzi: DIB01CM24100A	2	CM1-2
28	06-058-011	Control Relay, 3PDT,120VAC, 11Pin Spade, Indicator, Operator	Square D: RXM3AB2F7	18	CR1-18
29	06-058-012	Control Relay, Bus Jumper, 2-Pole, w/Telemec. RXM Relay	Square D: RXZ S2	17	CR1-18

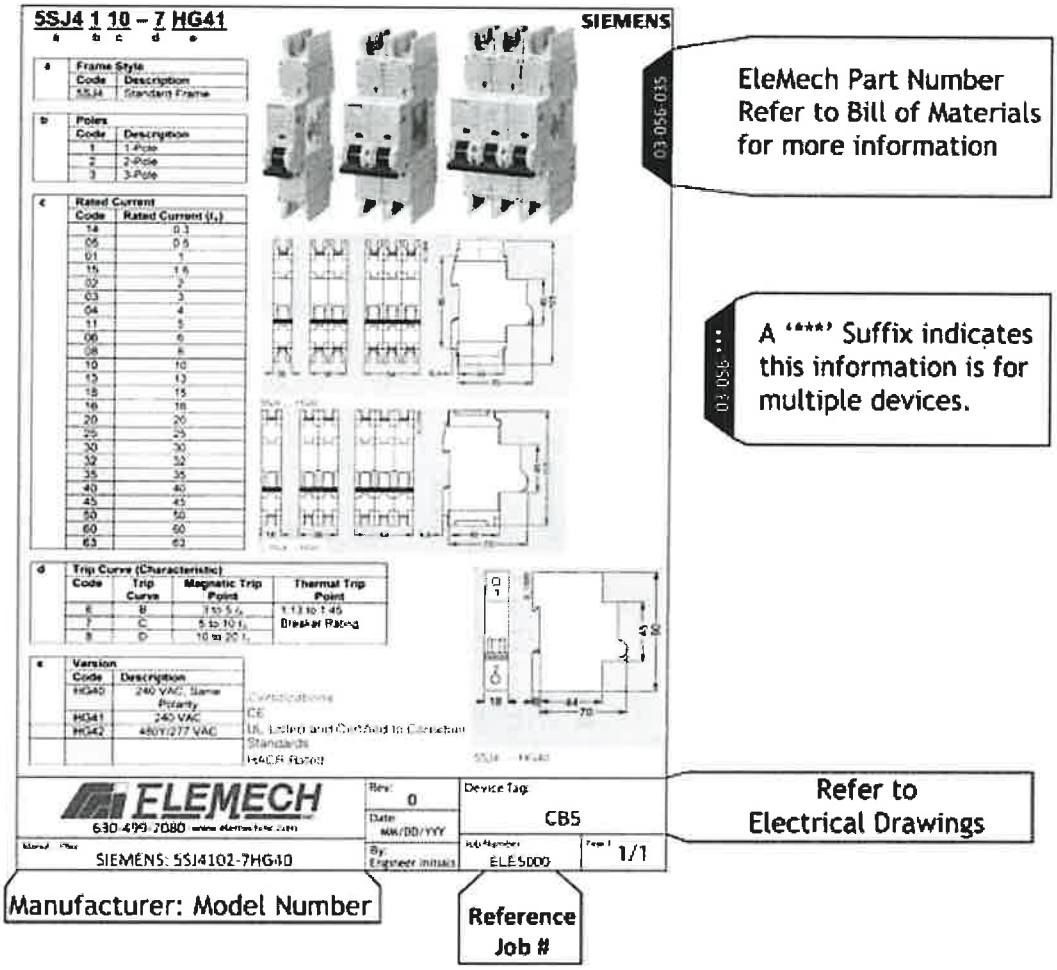
Item No	Component	Description	Manufacturer Part Number	QTY	Device
30	38-058-003	Socket, 11 Pin Spade, Din, Screw Term., 3Tier, 250V w/3-Pole	Square D: RXZE2S111M	18	CR1-18
31	07-063-000	Distribution Block, End Cover, 4 Pole, 300V,10A, w/WK4E\U\VB	Wieland: 07.311.4053.1	2	DB1
32	07-063-001	Distribution Block, Jumper, 4 Pole, 300V,10A, w/WK4E\U\VB	Wieland: Z7.210.3427	3	DB1
33	07-063-002	Distribution Block, Single Pole, 10A, 300V, WK4E\U\VB	Wieland: 57.404.6955.1	23	DB1
34	07-030-A004	Distribution Block Assembly, 3PH, 85A, 4-14AWG, 1 In, 4 Out	Mersen: MPDB62161 Assembly	1	DB3
35	11-035-337	Sub-Panel, Painted Steel, w/60"Hx48"W C. Hinge Encl	Hoffman: A-60P48	1	EN1
36	11-035-803	Enclosure, Nema 12, Painted Steel, 60"Hx49"Wx12"D, Flange D.	Hoffman: A-60X4912LPFTC	1	EN1
37	11-035-840	Enclosure Filter Fan, Series HF, 159CFM w/Filter, 115VAC,10"	Hoffman: HF1016414	1	FAN1
38	11-035-885	Enclosure Exhaust Grill , Series HG, 10"	Hoffman: HG10000404	1	FAN1
39	13-030-178	Fuse, Glass, Time Delay, 250VAC, 8 Amp, 6x30mm	Ferraz-Shawmut: GDL-8	1	FU1
40	42-063-027	Terminal Block, Fused, Single Pole, 15A, 120V, 6.3mm Fuses	Wieland: 57.904.6755.0	3	FU1-3
41	13-030-048	Fuse, Glass, Time Delay, 250VAC, 2 Amp, 6x30mm	Ferraz-Shawmut: GDL-2	2	FU2,3
42	14-071-A003	Receptacle Assembly, 6mA GFCI Trip, 15 Amps, 125VAC	Leviton: GFNT1-I Assembly	1	GFCI
43	15-011-000	Ground Lug, 14AWG - 4AWG	Blackburn: L70	2	GND
44	06-058-024	Control Relay, SPDT,120VAC, 5Pin Spade, Operator, 15A	Square D: RPM12F7	32	IR1-32
45	06-058-027	Control Relay Retension Clip, w/Telemec. RPM 1-Pole Relay	Square D: RPZR235	32	IR1-32
46	38-058-009	Socket, 5 Pin Spade, Din Mount, Screw Term., w/ RPM 1-Pole	Square D: RPZF1	32	IR1-32
47	52-137-002	Label, Multiple Supply Sources, Warning, 2.5"Wx1.5"H, Yellow	Nameplate Tech: 52-137-002	1	LBL1
48	52-137-001	Label, High Voltage, Danger, 6.5"Wx3.5"H, White/Black/Red	Nameplate Tech: 52-137-001	2	LBL2
49	19-045-022	Line/Load Reactor, 3/5% Imp., 3PH, 8 Amps, See Notes	MTE: RL-00803	2	LLR1,2
50	32-005-A004	Pilot light, PTT, NEMA 4X, Universal, LED, Blue	Allen-Bradley: 800H-QRTH2B	1	LT1
51	32-005-A001	Pilot light, PTT, NEMA 4X, Universal, LED, Green	Allen-Bradley: 800H-QRTH2G	4	LT2,4,8,10
52	32-005-A002	Pilot light, PTT, NEMA 4X, Universal, LED, Red	Allen-Bradley: 800H-QRTH2R	4	LT3,5,9,11
53	32-005-A003	Pilot light, PTT, NEMA 4X, Universal, LED, Amber	Allen-Bradley: 800H-QRTH2A	2	LT6,7
54	22-018-003	Motor Starter, Reversing, NEMA 1, 120VAC Coil, w/OL	Cutler-Hammer: AN56DN0AB	2	M1,2
55	22-018-007	Aux. Contact, Top mounted, 3NO/1NC, w/C-H Freedom	Cutler-Hammer: C320KGT14	4	M1-2
56	23-058-010	Motor Starter Protector, 3PH, 600V, 6.3-10 Amp Range, 508E	Square D: GV2P14	2	MSP1,2
57	23-058-011	Motor Starter Protector, Line Insulator, 508E	Square D: GV2GH7	2	MSP1,2
58	25-000-A010	Nameplate Assembly, White, Black Text, 1"Hx3"W	EleMech: 25-000-A010 Assembly	4	NP1,2,4,5
59	25-000-A013	Nameplate Assembly, Yel., Intrinsically Safe, P&F, KFA5, UL	EleMech: 25-000-A013 Assembly	1	NP3

Item No	Component	Description	Manufacturer Part Number	QTY	Device
60	26-005-071	OIU, PVP1000, 24VDC, Touch, Ethernet, 512MB, Series 7	Allen Bradley: 2711P-T10C22D9P	1	OIU1
61	HBR-134-P014	Program, OIU, Panelview Plus 1000, Standard	EleMech: HBR-134-P014	1	OIU1
62	28-018-009	Overload Relay Heater Pack, 3PH, 6.75-11.0A, w/Freedom, C20	Cutler-Hammer: H2010B-3	2	OL1,2
63	29-005-117	Pushbutton, E-Stop, NEMA 4X, Oper+1NC, Twist Rel. Red Head	Allen-Bradley: 800H-TFRXT6D2	1	PB1
64	02-005-002	Contact Block, 2NC, w/A-B 800 Series	Allen-Bradley: 800T-XA4	1	PB6
65	29-005-002	Pushbutton, NEMA 4X, Oper+1NO, Flush Head, Black	Allen-Bradley: 800H-AR2D1	1	PB6
66	54-092-001	Panel Light, Fluor.,8 W, 115VAC, w/lamp, 12.25"L, off-on swi	Duray: DUC108-ES-N-L	2	PL1,2
67	33-005-023	Compact I/O, End Cap	Allen-Bradley: 1769-ECR	1	PLC1
68	33-005-025	Compact I/O, Discrete Input Module, 16 Point, 120VAC	Allen-Bradley: 1769-IA16	4	PLC1
69	33-005-031	Compact I/O, Analog Input, 4 Chnl.	Allen-Bradley: 1769-IF4	2	PLC1
70	33-005-046	Compact Logix, Power Supply, 120VAC-100VA, 2A-5V, PA2	Allen-Bradley: 1769-PA2	1	PLC1
71	33-005-129	Compact I/O, Discrete Output Module, 16 Point Relay,120VAC	Allen-Bradley: 1769-OW16	2	PLC1
72	33-005-200	CompactLogix, CPU 1MB Mem, SD, 2-Ether, USB, 1 Bank/8 Mods	Allen-Bradley: 1769-L30ER	1	PLC1
73	HBR-134-P015	Program, PLC, CompactLogix, Standard	EleMech: HBR-134-P015	1	PLC1
74	37-323-011	Power Supply, 91W, 85-264VAC IN, 24VDC OUT, NEC Class 2	Delta: DRS-24V100W1NZ	1	PS1
75	06-058-034	Control Relay, DPDT,24VDC, 8Pin Spade, Operator, 15A	Square D: RPM22BD	3	R1-3
76	38-058-008	Socket, 8 Pin Spade, Din Mount, Screw Term., w/ RPM 2-Pole	Square D: RPZF2	3	R1-3
77	14-037-A000	Receptacle Assembly, Single, 15 Amps, 125VAC	Hubbell: 5261-I Assembly	1	RECP1
78	13-000-A000	Spare Parts Box Assembly, Din Rail Mount	EleMech: 13-000-A000 Assembly	1	SP1
79	40-012-004	Surge Suppressor, 1 Pole, 120VAC, 200kA SCCR, DIN, Trip Ind.	Bussman: BSPM1120S2GR	1	SUR1
80	33-098-002	Ethernet Switch, 5TX, 9-32VDC, RJ45, 5 Port, 10/100	Phoenix: 2891152	1	SW1
81	41-018-A051	Transformer Assembly, 480/240-120VAC, 3KVA, NEMA 3R, Steel	Cutler-Hammer: S20N11S03N Assembly	1	T1
82	42-063-000	Terminal Block, Labels, Custom Printed, w/WK4/U	Wieland: 04.242.6353-CUSTOM	422	TB,DB
83	42-063-004	Terminal Block, Ground, 30A, 600V, 6MM Wide, w/WK4/U	Wieland: 57.504.9055.0	19	TB,DB
84	42-063-009	Terminal Block, End Clamp, w/WKN10/U	Wieland: Z5.522.8553	13	TB,DB
85	42-063-008	Terminal Block, Labels, Blank, w/WK4/U-(600 tags per box)	Wieland: Z4.242.6353	22	TB1
86	42-063-010	Terminal Block, Jumper, w/WK4/U	Wieland: Z7.281.0027.0	3	TB1
87	42-063-001	Terminal Block, End Plate, Gray, w/WK4/U	Wieland: 07.311.0155.0	3	TB1-3
88	42-063-003	Terminal Block, Single Pole, 30A, 600V, 6MM Wide, WK4/U	Wieland: 57.504.0055.0	186	TB1-3
89	18-049-001	Transformer Isolated Barrier, Dual Channel, 120VAC	P&F: KFA5-SR2/EX2.W	2	TIB1,2

Item No	Component	Description	Manufacturer Part Number	QTY	Device
90	18-049-000	Transformer Isolated Barrier, Single Channel, 120VAC	P&F: KFA5-SR2/EX1.W	4	TIB3-6
91	46-034-001	Thermostat, for fan control, N.O.contact, 6 amp,30-140 F.	Stego: 01141.9-00	1	TS1
92	48-000-010	Mounting Shelf, UPS, 19" x 7" x 2.5",1500VA, 12" w/Swing Out	EleMech: 48-000-010	1	UPS1
93	48-210-010	UPS, GXT3, 120VAC, 1000VA, 900 Watts, Mini Tower	Liebert: GXT3-1000MT120	1	UPS1
94	48-210-011	UPS, GXT Comm. Card, Intellislot Relay, 24VAC/DC	Liebert: IS-RELAY	1	UPS1
95	51-000-040	Cord, Extension, 9'-10", 15A, 14 Ga., 3 Wire, Male Plug Only	McMaster-Carr: 70355K84	1	UPS1
96	50-058-126	Variable Freq. Drive, Open 3HP 480VAC 3PH Altv 320, w/Pot	Square D: ATV320U22N4C	2	VFD1,2
LCS, 3 Hole, Nema 4/7/9, E-Stop, H-O-A, F-O-R (Quantity: 2)					
97	25-000-A004	Legendplate Assembly, White, Black Text, LCS Encl.	EleMech: 25-000-A004 Assembly	2	
98	25-000-A006	Legendplate Assembly, Yellow E-Stop, Exp. Proof Encl.	EleMech: 25-000-A006 Assembly	1	
99	53-053-003	Conduit, Lockwasher, 3/4", Use w/3/4" Nipple	Steel City: LN102	3	
100	11-004-006	Local Control Station, NEMA 4/7/9, 3 Hole, 3/4"NPT Holes	Akron Electric: CXI-373-X3-N4-N5-2RP2	1	LCS
101	29-005-009	Pushbutton E-Stop, NEMA 7/9, Oper+1NCLB, Push-Pull Red Head	Allen-Bradley: 800H-FPX6D4	1	PB
102	39-005-005	Selector Switch, NEMA 7/9, 3 Pos. Maintained, 1NO-1NC	Allen-Bradley: 800H-JP2KB7AXXX	1	SS
103	39-005-007	Selector Switch, Nema 7/9, 3 Pos. Spring Fr. Right, 1NO-1NC	Allen-Bradley: 800H-JP5KB7AXXX	1	SS
LCS, 5 Hole, Nema 4/7/9, E-Stop, (3) H-O-A, (1) F-O-R (Quantity: 2)					
104	25-000-A003	Legendplate Assembly, Black, White Text, LCS Encl.	EleMech: 25-000-A003 Assembly	4	
105	25-000-A005	Legendplate Assembly, Yellow E-Stop, LCS Encl.	EleMech: 25-000-A005 Assembly	1	
106	11-004-000	Local Control Station, NEMA 4/7/9, 5 Hole, (2)1-1/4 NPT	Akron Electric: CXI-3113-X5-N4-N5-2RP4	1	LCS1
107	29-005-009	Pushbutton E-Stop, NEMA 7/9, Oper+1NCLB, Push-Pull Red Head	Allen-Bradley: 800H-FPX6D4	1	PB
108	39-005-005	Selector Switch, NEMA 7/9, 3 Pos. Maintained, 1NO-1NC	Allen-Bradley: 800H-JP2KB7AXXX	3	SS
109	39-005-007	Selector Switch, Nema 7/9, 3 Pos. Spring Fr. Right, 1NO-1NC	Allen-Bradley: 800H-JP5KB7AXXX	1	SS
Zero Motion Assembly, Milltronics MFA-4P, Nema 4X FRP (Quantity: 2)					
110	11-035-126	Sub-Panel, Painted Steel, w/12"Hx10"W Junction Box	Hoffman: A-12P10	1	EN
111	11-035-176	Enclosure Mounting Feet, Fiberglass, J box	Hoffman: A-50MFKR	1	EN
112	11-035-273	Enclosure, Nema 4X, Fiberglass, 13.53"Hx10"Wx7"D, w/Window	Hoffman: A-14107JFGQRPWR	1	EN
113	25-000-A010	Nameplate Assembly, White, Black Text, 1"Hx3"W	EleMech: 25-000-A010 Assembly	1	NP
114	65-043-001	Zero Motion Sensor, 120VAC, 2-SPDT Relays, 4X, Probe Req'd	Milltronics: MFA-4P (7MH71441AA2)	1	ZSC
ULC, Hydroranger200 HMI, NEMA 4X FRP, Enclosure w/Win (Quantity: 2)					
115	11-035-126	Sub-Panel, Painted Steel, w/12"Hx10"W Junction Box	Hoffman: A-12P10	1	EN

Item No	Component	Description	Manufacturer Part Number	QTY	Device
116	11-035-176	Enclosure Mounting Feet, Fiberglass, J box	Hoffman: A-50MFKR	1	EN
117	11-035-273	Enclosure, Nema 4X, Fiberglass, 13.53"Hx10"Wx7"D, w/Window	Hoffman: A-14107JFGQRPWR	1	EN
118	25-000-A023	Nameplate Assembly, White: Ultrasonic Level Controller	EleMech: 25-000-A023 Assembly	1	NP
119	49-043-117	ULC, Hydro 200 HMI, 120VAC, 6-Relay, 4-20mA	Siemens: 7ML5034-4AA01	1	ULC
Safety Switch, Left/Right, NEMA 7/9, w/fitting, cable, plug (Quantity: 4)					
120	92-295-000	Safety Switch, Left/Right, NEMA7/9, 3/4"NPT, Flag Arm	Control Components Company: RS-1X	1	PC1
121	92-295-001	Safety Cable, Vinyl Coated, 3/16" O.D., Orange, per ft.	Control Components Company: RS-25	60	PC1
122	92-295-002	Safety Cable, End Fitting	Control Components Company: RS-28	2	PC1
123	92-295-003	Safety Switch, Conduit Plug, 3/4"	Control Components Company: RS-29	1	PC1
Spare Parts / Ship Loose (Total Quantity Provided)					
124	12-216-003	Float Switch, ENM Series, SPDT, Mercury-Free, 98' Cable	Flygt: ENM-10 (582-88-84)	2	FLS
125	67-324-007	Sensor, Photo-Prox, 5-15.5VDC, Exp Proof, M16-Terminals	SICK: 1041910 (WT24-2X200)	2	PHOTO
126	49-043-009	ULS, STH, 2"NPT, 30M Cable, FM Class 1 Div. 1	Siemens: 7ML1100-0CA20	4	ULS
127	33-005-200	CompactLogix, CPU 1MB Mem, SD, 2-Ether, USB, 1 Bank/8 Mods	Allen-Bradley: 1769-L30ER	1	SPARE
128	33-005-025	Compact I/O, Discrete Input Module, 16 Point, 120VAC	Allen-Bradley: 1769-IA16	2	SPARE
129	33-005-031	Compact I/O, Analog Input, 4 Chnl.	Allen-Bradley: 1769-IF4	2	SPARE
130	33-005-129	Compact I/O, Discrete Output Module, 16 Point Relay,120VAC	Allen-Bradley: 1769-OW16	2	SPARE
131	33-005-046	Compact Logix, Power Supply, 120VAC-100VA, 2A-5V, PA2	Allen-Bradley: 1769-PA2	1	SPARE
132	13-030-178	Fuse, Glass, Time Delay, 250VAC, 8 Amp, 6x30mm	Ferraz-Shawmut: GDL-8	2	SPARE
133	13-030-048	Fuse, Glass, Time Delay, 250VAC, 2 Amp, 6x30mm	Ferraz-Shawmut: GDL-2	4	SPARE
134	06-058-011	Control Relay, 3PDT,120VAC, 11Pin Spade, Indicator, Operator	Square D: RXM3AB2F7	2	SPARE
135	06-058-024	Control Relay, SPDT,120VAC, 5Pin Spade, Operator, 15A	Square D: RPM12F7	2	SPARE
136	06-058-034	Control Relay, DPDT,24VDC, 8Pin Spade, Operator, 15A	Square D: RPM22BD	2	SPARE
137	32-005-047	Bulb, Pilot Light, 6VAC/DC, Transformer Type, w/A-B 800H	Allen-Bradley: 800T-N65	2	SPARE
138	32-005-047	Bulb, Pilot Light, 6VAC/DC, Transformer Type, w/A-B 800H	Allen-Bradley: 800T-N65	2	SPARE
139	65-043-002	Zero Motion Sensor, Probe, Class 1, Div 1, 10M CBL w/ MFA-4P	Milltronics: XPP-5 (7MH71460HA)	2	ZMS

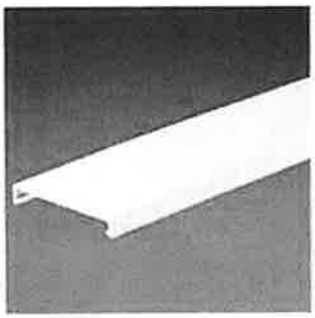
Catalog Cuts



ELEMECH INC. 630-499-7080 · www.elemechinc.com	Rev: 0	Device Tag:	
	Date: 4/13/2018		
Manuf.: . PNo: Catalog Cuts	By: TCC	Job Number: HBR7281	Page # 1/1

C1.5WH6

PANDUIT



10-069-000

- **Base and covers sold separately**
- **Non-slip cover design incorporates integral high friction lining to inhibit cover movement**
- **Cover flush with base provides greater wire capacity and improves aesthetics**
- **Easy cover removal makes changes to wiring quick and easy**
- **Available in various colors**

Part Number	C1.5WH6
RoHS Compliancy Status	Compliant
Part Description	Covers duct to protect wires, improve aesthetics and provides greater wire capacity. Base and covers sold separately.
Product Type	Type C Cover for Flush Cover Wiring Duct
Material	Lead-Free PVC
Color	White
Length (ft)	6
Length (m)	1.82
CE Compliant	Yes
Pricing Description	Duct Cover, PVC, 1.5"W X 6', White

C1WH6

PANDUIT

- **Base and covers sold separately**
- **Non-slip cover design incorporates integral high friction lining to inhibit cover movement**
- **Cover flush with base provides greater wire capacity and improves aesthetics**
- **Easy cover removal makes changes to wiring quick and easy**
- **Available in various colors**



10-069-001

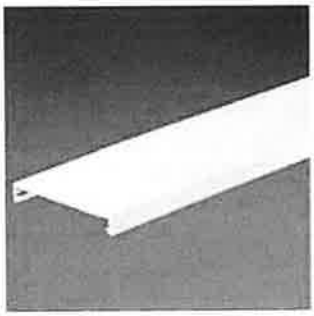
Part Number	C1WH6
RoHS Compliancy Status	Compliant
Part Description	Covers duct to protect wires, improve aesthetics and provides greater wire capacity. Base and covers sold separately.
Product Type	Type C Cover for Flush Cover Wiring Duct
Material	Lead-Free PVC
Color	White
Length (ft.)	6
Length (m)	1.82
CE Compliant	Yes
Pricing Description	Duct Cover, PVC, 1"W X 6', White

Panduit Wiring Duct Approvals and Compliances

C2WH6

PANDUIT

10-069-002



- **Base and covers sold separately**
- Non-slip cover design incorporates integral high friction lining to inhibit cover movement
- Cover flush with base provides greater wire capacity and improves aesthetics
- Easy cover removal makes changes to wiring quick and easy
- Available in various colors

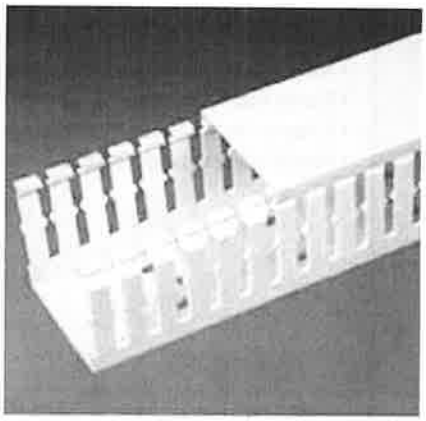
Part Number	C2WH6
RoHS Compliancy Status	Compliant
Part Description	Covers duct to protect wires, improve aesthetics and provides greater wire capacity.
Material	Lead-free PVC
Color	White
Length (ft.)	6
Length (m)	1.82
Pricing Description	Duct Cover, PVC, 2"W X 6', White
Min. Order UOM	FT
Min. Order Qty.	6
BOM Qty. (# of Pkgs.)	

Panduit Wiring Duct Approvals and Compliances

F1.5X3WH6

PANDUIT

10-069-005



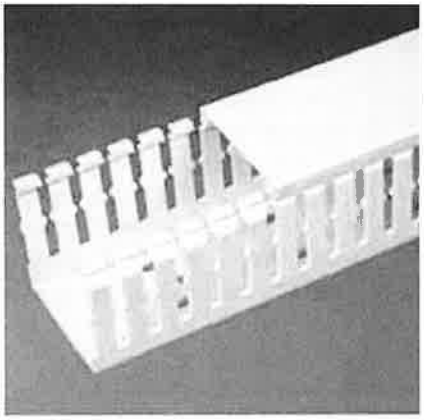
Specifications

- Made of lead-free PVC
- UL Recognized continuous use temperature: 122°F (50°C)
- UL94 Flammability Rating of V-0
- Conforms with NFPA 79-2002 section 14.3.1 requirement for flame retardant material
- Available in Light Gray and White
- Provided with mounting holes

• Part Number	F1.5X3WH6
• RoHS Compliancy Status	Compliant
• Part Description	Narrow finger, slotted wiring duct.
• Material	Lead–Free PVC
• Color	White
• CSA Certified	Yes
• Length (ft.)	6
• CE Compliant	Yes
• CE Marking	Yes
• Duct Size W x H (In.)	1.75 x 3.12
• Duct Size W x H (mm)	44.5 x 79.2
• Mounting Method	Standard Mounting Holes
• Pricing Description	Slotted Duct,PVC,1.5"X3"X6',White

F1X3WH6

PANDUIT



10-069-007

Specifications

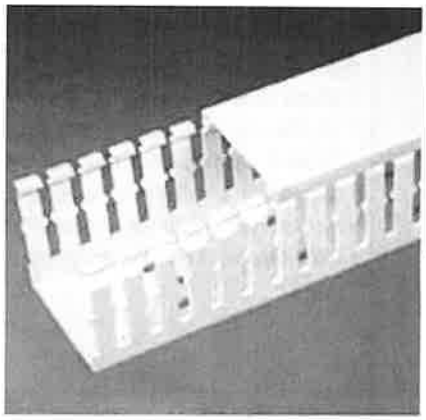
- Made of lead-free PVC
- UL Recognized continuous use temperature: 122°F (50°C)
- UL94 Flammability Rating of V-0
- Conforms with NFPA 79-2002 section 14.3.1 requirement for flame retardant material
- Available in Light Gray and White
- Provided with mounting holes

Part Number	F1X3WH6
RoHS Compliancy Status	Compliant
Part Description	Narrow finger, slotted wiring duct
Material	Lead–Free PVC
Color	White
CSA Certified	Yes
Length (ft.)	6
CE Compliant	Yes
CE Marking	Yes
Duct Size W x H (in.)	1.26 x 3.12
Duct Size W x H (mm)	32.0 x 79.2
Mounting Method	Standard Mounting Holes
Pricing Description	Slotted Duct,PVC,1"X3"X6',White

Panduit Wiring Duct Approvals and Compliances

F2X3WH6

PANDUIT



10-069-008

Specifications
- Made of lead-free PVC
- UL Recognized continuous use temperature: 122°F (50°C)
- UL94 Flammability Rating of V-0
- Conforms with NFPA 79-2002 section 14.3.1 requirement for flame retardant material
- Available in Light Gray and White
- Provided with mounting holes

Part Number	F2X3WH6
RoHS Compliancy Status	Compliant
Part Description	Narrow finger, slotted wiring duct
Material	Lead-Free PVC
Color	White
CSA Certified	Yes
Length (ft.)	6
CE Marking	Yes
Duct Size W x H (In.)	2.25 x 3.12
Duct Size W x H (mm)	57.2 x 79.2
Mounting Method	Standard Mounting Holes
Pricing Description	Slotted Duct,PVC,2"X3"X6',White
Slot Width (In.)	0.20
Slot Width (mm)	5.0

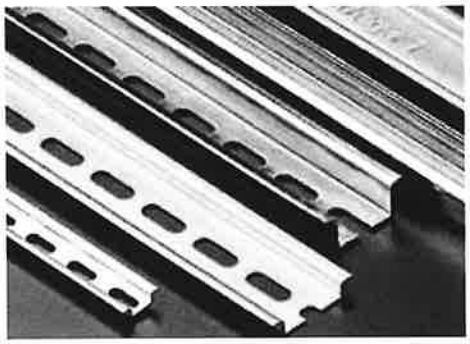
DIN RAILS

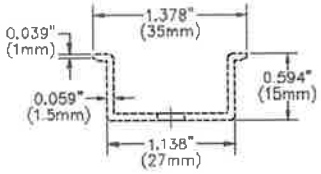
IBOCO
Integrated Panel Management

42-063-007

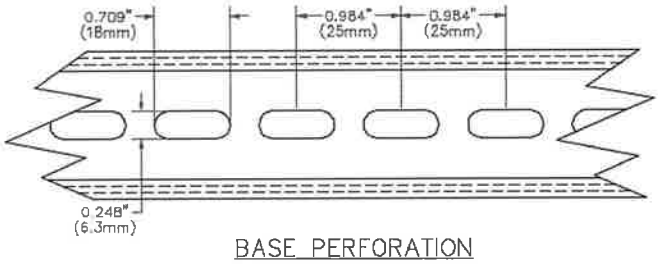
Catalog Number	Lengths per Pack
G1	12
G1F	12
G1F1	24
OMEGA 2F	20
OMEGA 2F1	40*
OMEGA 3	20
OMEGA 3F	20
OMEGA 3F1	40*
OMEGA 3FD	20
OMEGA 3A	10
OMEGA 3AF	10
OMEGA 3AF1	20*
OMEGA 3AFD	10
OMEGA 3B	10
OMEGA 3B1	10*
OMEGA 75	2

Treated with galvanic zinc plating and passivation
(gal Zn 8c according to Din 50960)
Minimum thickness 6 microns
Standard length:
2 meters (6'6¾")

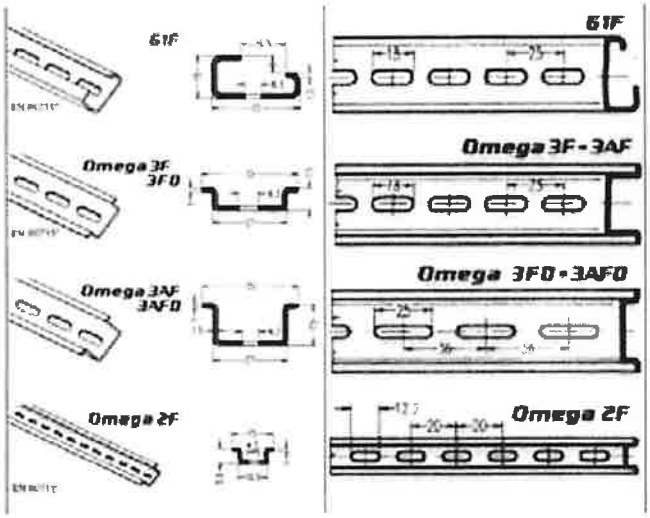




FRONT SECTION



BASE PERFORATION



ELEMECH INC. 630-499-7080 · www.elemechinc.com	Rev: 0	Device Tag:	
	Date: 4/13/2018		
Manuf.: . PNo: IBOCO: OMEGA 3 AF	By: TCC	Job Number: HBR7281	Page # 1/1

Series G – EG-Frame (15–125 Amperes)

E G H 3 015 FF G

Frame
E

Standard/Application
G = IEC/CE/UL/CSA

Performance				
	600Y/347	480	415	240
B	—	18	18	25
E	18	25	25	35
S	22	35	40	85
H	25	65	70	100
C	35	100	100	200
K	Molded case switch [3]			

Number of Poles
1 = One
2 = Two
3 = Three
4 = Four—neutral 0% protected
7 = Four—neutral 100% protected

Amperes
016 [1]
015
020
025
030
032 [1]
035
040
045
050
060
063 [1]
070
080
090
100
110
125
160 [1]

Terminations/Hardware	
Terminals	Mounting Hardware
M = Metric end caps	Metric
E = Imperial end caps	Imperial
G = Line/load standard	Metric
B = Bolt-on	—

Trip Unit
FF = Fixed fixed
AF = Adjustable thermal fixed magnetic
KS = Molded case switch

EG-Frame



EG-Frame – 70/65

Maximum Continuous Amps at 40°C [1]	Single-Pole Fixed Thermal, Fixed Magnetic Catalog Number	Two-Pole Fixed Thermal, Fixed Magnetic Catalog Number	Three-Pole Fixed Thermal, Fixed Magnetic Catalog Number	Three-Pole Adjustable [2] Thermal, Fixed Magnetic Catalog Number	Four-Pole [3] Fixed Thermal, Fixed Magnetic Catalog Number	Four-Pole [3] Adjustable [2] Thermal, Fixed Magnetic Catalog Number
15	EGH1015FFG	EGH2015FFG	EGH3015FFG	—	EGH4015FFG	—
16	EGH1016FFG	EGH2016FFG	EGH3016FFG	—	EGH4016FFG	—
20	EGH1020FFG	EGH2020FFG	EGH3020FFG	EGH3020AFG	EGH4020FFG	EGH4020AFG
25	EGH1025FFG	EGH2025FFG	EGH3025FFG	EGH3025AFG	EGH4025FFG	EGH4025AFG
30	EGH1030FFG	EGH2030FFG	EGH3030FFG	—	EGH4030FFG	—
32	EGH1032FFG	EGH2032FFG	EGH3032FFG	EGH3032AFG	EGH4032FFG	EGH4032AFG
35	EGH1035FFG	EGH2035FFG	EGH3035FFG	—	EGH4035FFG	—
40	EGH1040FFG	EGH2040FFG	EGH3040FFG	EGH3040AFG	EGH4040FFG	EGH4040AFG
45	EGH1045FFG	EGH2045FFG	EGH3045FFG	—	EGH4045FFG	EGH4050AFG
50	EGH1050FFG	EGH2050FFG	EGH3050FFG	EGH3050AFG	EGH4050FFG	—
60	EGH1060FFG	EGH2060FFG	EGH3060FFG	—	EGH4060FFG	—
63	EGH1063FFG	EGH2063FFG	EGH3063FFG	EGH3063AFG	EGH4063FFG	EGH4063AFG
70	EGH1070FFG	EGH2070FFG	EGH3070FFG	—	EGH4070FFG	—
80	EGH1080FFG	EGH2080FFG	EGH3080FFG	EGH3080AFG	EGH4080FFG	EGH4080AFG
90	EGH1090FFG	EGH2090FFG	EGH3090FFG	—	EGH4090FFG	—
100	EGH1100FFG	EGH2100FFG	EGH3100FFG	EGH3100AFG	EGH4100FFG	EGH4100AFG
125	EGH1125FFG	EGH2125FFG	EGH3125FFG	EGH3125AFG	EGH4125FFG	EGH4125AFG

Notes

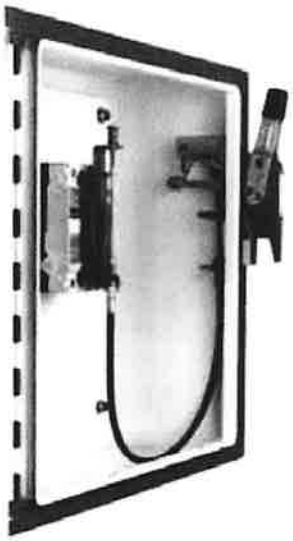
[1] 16, 32, 63A are not UL listed ratings.
[2] Adjustable thermal are not UL listed.
[3] Change the fourth digit to 7 for 100% neutral protection. Neutral is on the LH side.

Molded Case Circuit Breakers
External Accessories

EATON

03-018-101

Flange Mounted Handle Mechanisms mount on the flange of an enclosure door. The Flex Shaft™ is an extra heavy-duty mechanism that includes a flexible shaft in various lengths, 3 feet (.9 m) through 10 feet (3 m) for use with various size enclosures.





Flex Shaft Flange-Mounted Handle Mechanisms ①②

	Flexible Shaft Length in Feet (m)				
	2 (0.6)	3 (0.9)	4 (1.2)	5 (1.3)	6 (1.8)
Breaker Frame	**Catalog Number**	**Catalog Number**	**Catalog Number**	**Catalog Number**	**Catalog Number**
EG	**EHMFS02**	**EHMFS03**	**EHMFS04**	**EHMFS05**	**EHMFS06**
JG	**N/A**	**JHMFS03**	**JHMFS04**	**JHMFS05**	**JHMFS06**
LG	**N/A**	—	**LHMFS04**	—	—
NG	**N/A**	**N/A**	**F5S04C**	**F5S05C**	**F5S06C**
RG	**N/A**	**N/A**	**F6S04**	**F6S05**	**F6S06**

Note: Type 4X handle mechanisms are available. Add Suffix X to the complete Catalog Number.

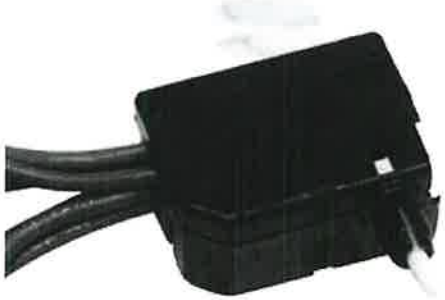
Note: When selecting the length of shaft, ensure minimum bending radius of 4 inches (101.6 mm) is maintained to operate properly.

Note: The standard method of shipment includes the mechanism preset at the factory; however, minor field adjustments may be required.

Accessories for Series G — Circuit Breakers

Cutler-Hammer

03-018-108



Auxiliary Switch

Stock No.	Mfr.'s Type	Description	Frame	Pole Location
416-0668	AUX1A1BPK	Auxiliary Switch — 1A/1B (1NO and 1NC)	EG/JG	Right
416-0669	AUX2A2BPK	Auxiliary Switch — 2A/2B (2NO and 2NC)	EG/JG	Right

CSA UL

ELEMECH INC.
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Rev: 0

Date: 4/13/2018

By: TCC

Device Tag: CB1

Job Number: HBR7281

Page # 1/1

Manuf.: . PNo: CUTLER-HAMMER: AUX1A1BPK

System pro *M* compact®
Miniature Circuit Breaker SU200 M
for branch circuit protection acc. to UL 489

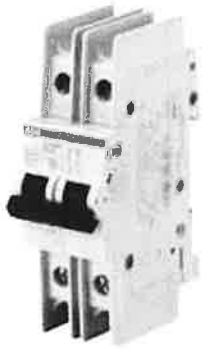
03-001-***

The miniature circuit breaker SU200 M is ABB's solution for UL 489 branch circuit protection up to 480 Y/277 V AC and 96 V DC. This circuit breaker is an all-round device for AC and DC applications for universal use in North American and global markets due to its approvals acc. to the international standards UL, CSA and IEC. Moreover, SU200 M is fully compatible with System pro *M* compact® UL 489 accessories.

Features
- High performance MCB with 10 kA interrupting capacity acc. to UL 489 / CSA 22.2 No. 5 and 15 kA breaking capacity acc. to IEC/EN 60947-2
- Certified up to I_n = 40 A at 480 Y/277 V AC acc. to UL 489 / CSA 22.2 No. 5
- Certified for AC and DC use acc. to UL and CSA
- 40 °C reference temperature acc. to UL and CSA
- Current limiting acc. to UL 489
- Clear contact position indication in red/green ("real OFF")

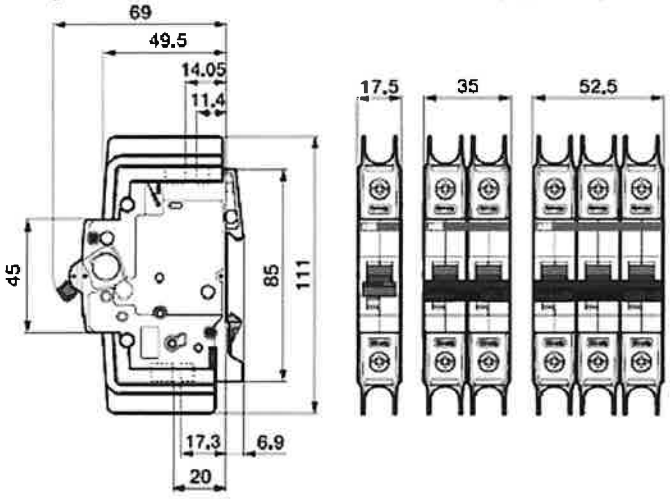
Standards	
UL 489	
CSA 22.2 No. 5	
IEC/EN 60947-2	
Approvals	
UL 489	US
CSA 22.2 No. 5	CA
VDE	DE
CCC	CN



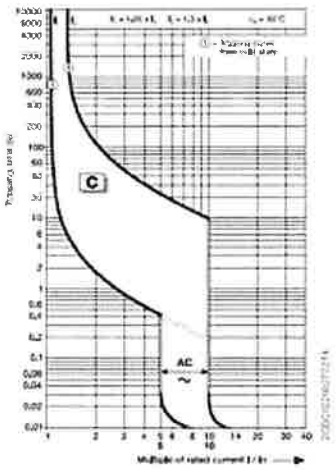




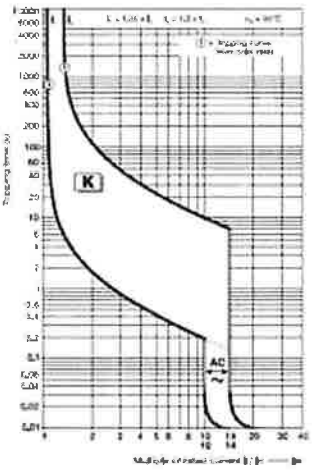
General Data		
Standards		UL 489, CSA 22.2 No. 5, IEC/EN 60947-2
Poles		1P, 2P, 3P, 4P
Tripping characteristics		C, K, Z
Rated current I_n		0.2 - 63 A
Rated frequency f		50 / 60 Hz, DC (0 Hz)
Rated insulation voltage U_i acc. to IEC/EN 60664-1		250 V AC (phase to ground), 440 V AC (phase to phase)
Overvoltage category		III
Pollution degree		3
Rated voltage	AC	1P: 277 V AC up to 40 A for C, Z char.,
	AC	277 V AC up to 35 A for K char., 240 V AC
	AC	2P, 3P, 4P: 480 Y / 277 V AC up to 40 A for C, Z char.,
	AC	480 Y / 277 V AC up to 35 A for K char., 240 V AC
Short-circuit current rating acc. to UL 489		10 kA
Application		-
Reference temperature for tripping characteristics		40 °C
Electrical endurance		6,000 ops (AC), 6,000 ops (DC); 1 cycle (1 s - ON, 9 s - OFF)
Installation		
Terminal		Failsafe bi-directional cylinder lift terminal
Cross-section of conductors (top/bottom)		solid, stranded: 35 mm² / 35 mm² flexible: 25 mm² / 25 mm² 18 – 4 AWG
Cross-section of busbars (top/bottom)		10 mm² / 10 mm² 18 – 8 AWG
Mounting		On DIN rail 35 mm acc. to EN 60715 by fast clip
Dimensions and weight		
Mounting dimensions acc. to DIN 43880		Mounting dimension 3
Pole dimensions (H x D x W)		111 x 69 x 17.5 mm
Pole weight		approx. 125 g



C characteristic



K characteristic



ELEMECH INC. 630-499-7080 · www.elemechinc.com	Rev: 0	Device Tag: CB8-11,13-	
	Date: 4/13/2018		
Manuf.: . PNo: ABB: SU201M-C2	By: TCC	Job Number: HBR7281	Page # 1/3

characteristic C

Number of poles	Rated current I_n A	Type	Order code	Weight per PCE kg	Packing unit PCE
1	0.5	SU201M-C0,5	2CDS271337R0984	0.125	10
	1	SU201M-C1	2CDS271337R0014	0.125	10
	1.6	SU201M-C1,6	2CDS271337R0974	0.125	10
	2	SU201M-C2	2CDS271337R0024	0.125	10
	3	SU201M-C3	2CDS271337R0034	0.125	10
	4	SU201M-C4	2CDS271337R0044	0.125	10
	5	SU201M-C5	2CDS271337R0054	0.125	10
	6	SU201M-C6	2CDS271337R0064	0.125	10
	8	SU201M-C8	2CDS271337R0084	0.125	10
	10	SU201M-C10	2CDS271337R0104	0.125	10
	13	SU201M-C13	2CDS271337R0134	0.125	10
	15	SU201M-C15	2CDS271337R0154	0.125	10
	16	SU201M-C16	2CDS271337R0164	0.125	10
	20	SU201M-C20	2CDS271337R0204	0.125	10
	25	SU201M-C25	2CDS271337R0254	0.125	10
	30	SU201M-C30	2CDS271337R0304	0.125	10
	32	SU201M-C32	2CDS271337R0324	0.125	10
	35	SU201M-C35	2CDS271337R0354	0.125	10
	40	SU201M-C40	2CDS271337R0404	0.125	10
	50	SU201M-C50	2CDS271337R0504	0.125	10
	60	SU201M-C60	2CDS271337R0604	0.125	10
	63	SU201M-C63	2CDS271337R0634	0.125	10

characteristic K

Number of poles	Rated current	Type	Order code	Weight per PCE	Packing unit
2	0.2	SU202M-K0,2	2CDS272337R0087	0.250	5
	0.3	SU202M-K0,3	2CDS272337R0117	0.250	5
	0.5	SU202M-K0,5	2CDS272337R0157	0.250	5
	0.75	SU202M-K0,75	2CDS272337R0187	0.250	5
	1	SU202M-K1	2CDS272337R0217	0.250	5
	1.6	SU202M-K1,6	2CDS272337R0257	0.250	5
	2	SU202M-K2	2CDS272337R0277	0.250	5
	3	SU202M-K3	2CDS272337R0317	0.250	5
	4	SU202M-K4	2CDS272337R0337	0.250	5
	5	SU202M-K5	2CDS272337R0357	0.250	5
	6	SU202M-K6	2CDS272337R0377	0.250	5
	8	SU202M-K8	2CDS272337R0407	0.250	5

Number of poles	Rated current I_n A	Type	Order code	Weight per PCE kg	Packing unit PCE
2	10	SU202M-K10	2CDS272337R0427	0.250	5
	13	SU202M-K13	2CDS272337R0447	0.250	5
	15	SU202M-K15	2CDS272337R0457	0.250	5
	16	SU202M-K16	2CDS272337R0467	0.250	5
	20	SU202M-K20	2CDS272337R0487	0.250	5
	25	SU202M-K25	2CDS272337R0517	0.250	5
	30	SU202M-K30	2CDS272337R0527	0.250	5
	32	SU202M-K32	2CDS272337R0537	0.250	5
	35	SU202M-K35	2CDS272337R0547	0.250	5
	40	SU202M-K40	2CDS272337R0557	0.250	5
	50	SU202M-K50	2CDS272337R0577	0.250	5
	60	SU202M-K60	2CDS272337R0587	0.250	5
	63	SU202M-K63	2CDS272337R0607	0.250	5
3	0.2	SU203M-K0,2	2CDS273337R0087	0.375	3
	0.3	SU203M-K0,3	2CDS273337R0117	0.375	3
	0.5	SU203M-K0,5	2CDS273337R0157	0.375	3
	0.75	SU203M-K0,75	2CDS273337R0187	0.375	3
	1	SU203M-K1	2CDS273337R0217	0.375	3
	1.6	SU203M-K1,6	2CDS273337R0257	0.375	3
	2	SU203M-K2	2CDS273337R0277	0.375	3
	3	SU203M-K3	2CDS273337R0317	0.375	3
	4	SU203M-K4	2CDS273337R0337	0.375	3
	5	SU203M-K5	2CDS273337R0357	0.375	3
	6	SU203M-K6	2CDS273337R0377	0.375	3
	8	SU203M-K8	2CDS273337R0407	0.375	3
	10	SU203M-K10	2CDS273337R0427	0.375	3
	13	SU203M-K13	2CDS273337R0447	0.375	3
	15	SU203M-K15	2CDS273337R0457	0.375	3
	16	SU203M-K16	2CDS273337R0467	0.375	3
	20	SU203M-K20	2CDS273337R0487	0.375	3
	25	SU203M-K25	2CDS273337R0517	0.375	3
	30	SU203M-K30	2CDS273337R0527	0.375	3
	32	SU203M-K32	2CDS273337R0537	0.375	3
	35	SU203M-K35	2CDS273337R0547	0.375	3
	40	SU203M-K40	2CDS273337R0557	0.375	3
	50	SU203M-K50	2CDS273337R0577	0.375	3
	60	SU203M-K60	2CDS273337R0587	0.375	3
	63	SU203M-K63	2CDS273337R0607	0.375	3

03-001-****

Category 6 • Standard RJ45 Connectors

BELDEN

57-009-***

IP20 Cord Set



Part No.				Length	
Unshielded Belden Bonded-Pair™ Cable 7940A		Shielded Belden Bonded-Pair Cable 7953A			
IP67 (Tethered Cap)	IP 20 (No Cap)	IP67 (Tethered Cap)	IP 20 (No Cap)	Meters	Feet
E600001 010S1	E601001 010S1	E604001 010S1	E605001 010S1	1	3.3
E600002 010S1	E601002 010S1	E604002 010S1	E605002 010S1	2	6.6
E600003 010S1	E601003 010S1	E604003 010S1	E605003 010S1	3	9.8
E600005 010S1	E601005 010S1	E604005 010S1	E605005 010S1	5	16.4
E600025 010S1	—	E604025 010S1	—	25	82

Solid BC Conductors • Polyolefin Insulation • Flame-Resistant Polyolefin Inner Jacket • Overall Beldfoil® Shielding • PVC Outer Jacket

7953A	23	.340	8.64	.030	.76	-40 to +75	600V UL AWM Shielded EtherNet/IP Compliant NEC: CMR, CMX-Outdoor • CEC: CMR FT4 Sunlight and Oil Resistant Bonded Pairs

ELEMECH INC.
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Manuf:. PNo: BELDEN: E605002-010S1	Rev: 0	Device Tag: CBL2	
	Date: 4/13/2018		
	By: TCC	Job Number: HBR7281	Page # 1/1

Monitoring Relays
1-Phase True RMS AC Over or Under Current
Type DIB01 100A

CARLO GAVAZZI

04-094-000

Ordering Key DIB 01 C M24 100A

- Housing
- Function
- Type
- Item number
- Output
- Power supply
- Measuring range



Input Specifications

Input (current level)	
DIB01 100A	Built-in current transformer
Measuring ranges	
Selectable by DIP-switch	**Max current**
2 to 20 A AC	120 A
5 to 50 A AC	120 A
10 to 100 A AC	120 A
Max. current for 30 s	250 A
Max. current for 1 s	2000 A

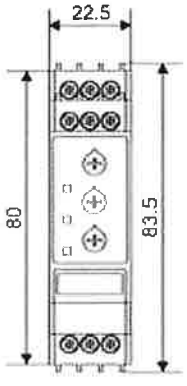
Contact input	
DIB01	Terminals A1, Y1
Disabled	Open
Enabled	< 10 kΩ
Latch disable	> 500 ms

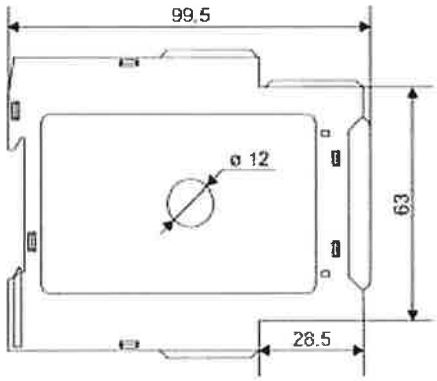
Supply Specifications

Power supply	Overvoltage cat. III (IEC 60664, IEC 60038)
Rated operational voltage through terminals: A1, A2	24 VDC - 15% +10% 24 to 240 VAC ± 15% 45 to 65 Hz
Dielectric voltage	
Supply to input	4 kV
Supply to output	4 kV
Input to output	4 kV
Rated operational power	
DC	1 W
AC	1 W / 35 VA

Output Specifications

Output		SPDT relay
Rated insulation voltage		250 VAC
Contact ratings ($AgSnO_2$)		μ
Resistive loads	AC 1	8 A @ 250 VAC
	DC 12	5 A @ 24 VDC
Small inductive loads	AC 15	2.5 A @ 250 VAC
	DC 13	2.5 A @ 24 VDC
Mechanical life		≥ 30 x 10^6 operations
Electrical life		≥ 10^5 operations (at 8 A, 250 V, cos φ = 1)
Operating frequency		≤ 7200 operations/h
Dielectric strength		
Dielectric voltage		≥ 2 kVAC (rms)
Rated impulse withstand volt.		4 kV (1.2/50 μs)





Approvals UL, CSA

ELEMECH INC.
630-499-7080 · www.elemechinc.com

Rev: 0	Device Tag: CM1-2		
Date: 4/13/2018			
Manuf:. PNo: GAVAZZI: DIB01CM24100A	By: TCC	Job Number: HBR7281	Page # 1/1

Zelio® Plug-in Relays
RXM

Telemecanique

06-058-011


RXMeAB2F7

RXM Miniature Relays (page 4)

2 pole relays; 12 A, 1/2 hp (IEC rating = 12 A)
3 pole relays; 10 A, 1/3 hp (IEC rating = 10 A)
4 pole relays; 8 A, 1/3 hp (IEC rating = 6 A)
4 pole relays; 3 A (low level), 1/18 hp (IEC rating = 3 A)

- Mechanical "relay status" indicator on all relays
- Pilot light option available
- Manual operator optional for all relays
- Built-in marking area

Insulation characteristics

Rated insulation voltage (Ui)		250 V (IEC), 300 V (UL, CSA)
Rated impulse withstand voltage (Uimp)		3.6 kV (1.2/50 µs)
Dielectric strength (rms voltage)	Between coil and contact	2,500 Vac
	Between poles	2,500 Vac
	Between contacts	1,500 Vac

Contact characteristics

Relay type			**RXM2ABeee**	**RXM3ABeee**	**RXM4ABeee**
Number and type of contacts (see page 12)			DPDT	3PDT	4PDT
Contact materials			AgNi		
Conventional thermal current (Ith)	For ambient temperature < 131 °F (55 °C)		12 A	10 A	6 A
Rated operational current	Conforming to IEC in utilization category AC-1	N.O.	12 A	10 A	6 A
		N.C.	6 A	5 A	3 A
	Conforming to UL Resistive @ 277 Vac, hp @ 120 Vac		12 A, 1/2 hp	10 A, 1/3 hp	8 A, 1/3 hp
Maximum operating rate in operating cycles/hour	No load		18,000		
	Under load		1,200		
Switching voltage	Maximum		250 Vac/Vdc		
Switching capacity	Minimum		10 mA on 17 V		
	Maximum		3,000 VA	2,500 VA	1,500 VA
Utilization coefficient			20%		
Mechanical durability in millions of operating cycles			10		
Electrical durability in millions of operating cycles	Resistive load		0.1		

Coil characteristics

Average consumption		AC	1.2 VA								
		DC	0.9 W								
Drop-out voltage threshold		AC	> 0.15 Uc								
		DC	> 0.1 Uc								
Operating time (response time)	Between coil energization and making of the N.O. contact	AC	20 ms								
		DC	20 ms								
	Between coil de-energization and making of the N.C. contact	AC	20 ms								
		DC	20 ms								
Coil voltage Uc			**12 V**	**24 V**	**48 V**	**110 V**	**120 V**	**125 V**	**220 V**	**230 V**	**240 V**
Relay coil voltage codes			**JD**	**BD**	**ED**	**FD**	—	**GD**	**MD**	—	—
DC	Average resistance at 68 °F (20 °C) ± 10%		160 Ω	650 Ω	3,600 Ω	11,000 Ω	—	11,000 Ω	14,000 Ω	—	—
	Operating voltage limits	Min.	9.6 V	19.2 V	38.4 V	88 V	—	100 V	176 V	—	—
		Max.	13.2 V	26.4 V	52.8 V	121 V	—	138 V	242 V	—	—
Relay coil voltage codes			—	**B7**	**E7**	—	**F7**	—	**M7**	**P7**	**U7**
AC	Average resistance at 68 °F (20 °C) ± 15%		—	180 Ω	770 Ω	—	4,430 Ω	—	15,000 Ω	15,000 Ω	15,500 Ω
	Operating voltage limits	Min.	—	19.2 V	38.4 V	—	96 V	—	176 V	184 V	192 V
		Max.	—	26.4 V	52.8 V	—	132 V	—	242 V	253 V	264 V

Environment

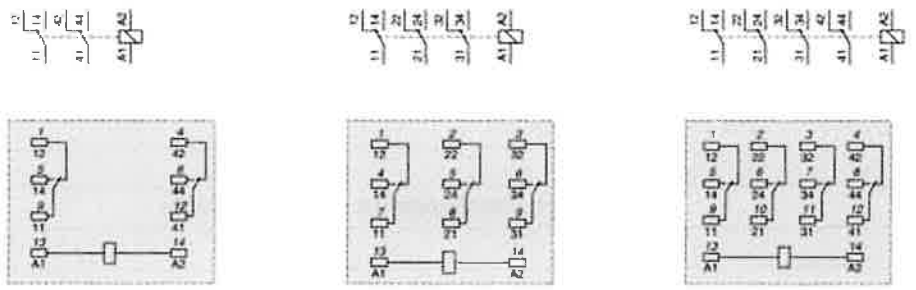
Dielectric strength	2000 V AC (between poles) 2000 V AC (between coil and contact) 1300 V AC (between contacts)
Product certifications	CSA GOST Lloyds UL
Standards	EN/IEC 61810-1 UL 508 CSA C22.2 No 14

Miniature relays with lockable test button, without LED

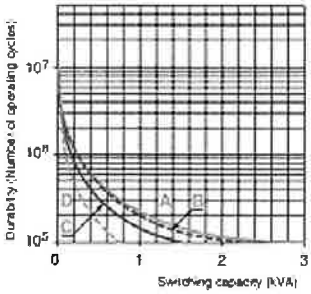
Coil Voltage	Number and type of contacts - Thermal current (Ith)								
	DPDT - 12 A			3PDT - 10 A			4PDT - 6 A		
	Catalog Number	Weight		Catalog Number	Weight		Catalog Number	Weight	
		lb.	kg		lb.	kg		lb.	kg
12 Vdc	RXM2AB1JD	0.082	0.037	RXM3AB1JD	0.084	0.038	RXM4AB1JD	0.080	0.036
24 Vdc	RXM2AB1BD	0.082	0.037	RXM3AB1BD	0.084	0.038	RXM4AB1BD	0.080	0.036
48 Vdc	RXM2AB1ED	0.082	0.037	RXM3AB1ED	0.084	0.038	RXM4AB1ED	0.080	0.036
110 Vdc	RXM2AB1FD	0.082	0.037	RXM3AB1FD	0.084	0.038	RXM4AB1FD	0.080	0.036
220 Vdc	—	—	—	—	—	—	RXM4AB1MD	0.080	0.036
24 Vac	RXM2AB1B7	0.082	0.037	RXM3AB1B7	0.084	0.038	RXM4AB1B7	0.080	0.036
48 Vac	RXM2AB1E7	0.082	0.037	RXM3AB1E7	0.084	0.038	RXM4AB1E7	0.080	0.036
120 Vac	RXM2AB1F7	0.082	0.037	RXM3AB1F7	0.084	0.038	RXM4AB1F7	0.080	0.036
230 Vac	RXM2AB1P7	0.082	0.037	RXM3AB1P7	0.084	0.038	RXM4AB1P7	0.080	0.036
240 Vac	—	—	—	—	—	—	RXM4AB1U7	0.080	0.036
Miniature relays with lockable test button, with LED									
12 Vdc	RXM2AB2JD	0.082	0.037	RXM3AB2JD	0.084	0.038	RXM4AB2JD	0.080	0.036
24 Vdc	RXM2AB2BD	0.082	0.037	RXM3AB2BD	0.084	0.038	RXM4AB2BD	0.080	0.036
48 Vdc	RXM2AB2ED	0.082	0.037	RXM3AB2ED	0.084	0.038	RXM4AB2ED	0.080	0.036
110 Vdc	RXM2AB2FD	0.082	0.037	RXM3AB2FD	0.084	0.038	RXM4AB2FD	0.080	0.036
125 Vdc	—	—	—	—	—	—	RXM4AB2GD	0.080	0.036
24 Vac	RXM2AB2B7	0.082	0.037	RXM3AB2B7	0.084	0.038	RXM4AB2B7	0.080	0.036
48 Vac	RXM2AB2E7	0.082	0.037	RXM3AB2E7	0.084	0.038	RXM4AB2E7	0.080	0.036
120 Vac	RXM2AB2F7	0.082	0.037	RXM3AB2F7	0.084	0.038	RXM4AB2F7	0.080	0.036
230 Vac	RXM2AB2P7	0.082	0.037	RXM3AB2P7	0.084	0.038	RXM4AB2P7	0.080	0.036

Miniature relays

RXM2●●●●●● RXM3●●●●●● RXM4●●●●●●

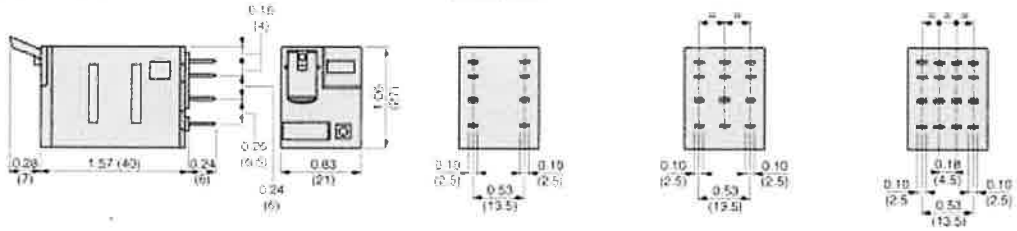


Resistive load AC



RXM ●●●●●● RXM 2 RXM 3 RXM 4

Common view Pin side view



RXZS2

bus jumper for Zelio Relay RXZ sockets with separate contacts

Schneider Electric

06-058-012



Main

Commercial Status	Commercialised
Range of product	Zelio Relay
Accessory / separate part type	Jumper
Accessory / separate part designation	Bus jumper
Sale per indivisible quantity	10

Complementary

Product compatibility	Socket RXZ
Accessory / separate part destination	All RXZ sockets with separate contacts
[Ith] conventional free air thermal current	5 A
Product weight	0.005 kg

Ordering and shipping details

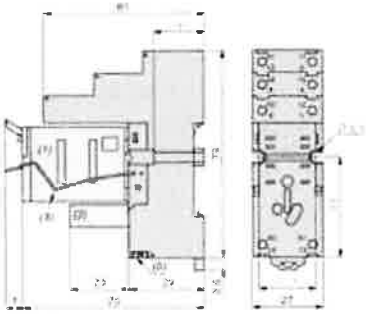
Category	21128 - ZELIO ICE CUBE RELAY ACCESSORIES
Discount Schedule	CP2
GTIN	00785901924098
Nbr. of units in pkg.	10
Package weight(Lbs)	0.01
Stock Code	Stock - Normally stocked in distribution facility
Returnability	Y
Country of origin	CN

RXZE2S108M



Complementary	
[Ith] conventional free air thermal current	12 A 5 A with bus jumper
[Ue] rated operational voltage	< 250 V
Tightening torque	<= 1 N.m (M3 screw(s))
Fixing mode	By screw mounting on panel Clip-on mounting on 35 mm symmetrical DIN rail
Marking	CE
Width	27 mm
Product weight	0.058 kg 0.07 kg

Environment	
Standards	IEC 61984
Product certifications	CSA UL
Ambient air temperature for storage	-40...85 °C
Ambient air temperature for operation	-40...55 °C
IP degree of protection	IP20 conforming to EN/IEC 60529
Dielectric strength	2500 V
RoHS EUR status	Compliant
RoHS EUR conformity date	0801



1 Relay
2 Protection Module
3 Carriage Stirrup
5 2 Links connection

Approvals for Sockets

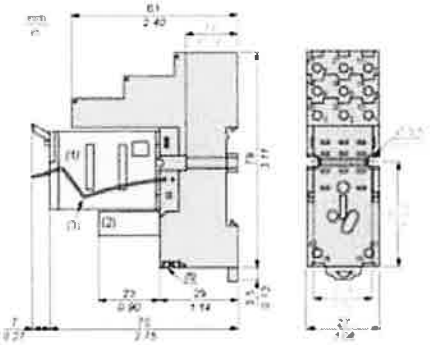
RXZE2S111M



Complementary	
[Ith] conventional free air thermal current	10 A 5 A with bus jumper
[Ue] rated operational voltage	< 250 V
Tightening torque	<= 1 N.m (M3 screw(s))
Fixing mode	By screw mounting on panel Clip-on mounting on 35 mm symmetrical DIN rail
Marking	CE
Width	27 mm
Product weight	0.066 kg

Environment	
Standards	IEC 61984
Product certifications	CSA UL
Ambient air temperature for storage	-40...85 °C
Ambient air temperature for operation	-40...55 °C
IP degree of protection	IP20 conforming to EN/IEC 60529
Dielectric strength	2500 V
RoHS EUR status	Compliant
RoHS EUR conformity date	0801

Dimensions



(1) Relays
(2) Protection module
(3) Maintaining clamp
(4) 2 elongated holes Ø 3.5 mm x 6.5 mm / Ø 0.13 in x 0.25 in
(5) 2 bus jumpers

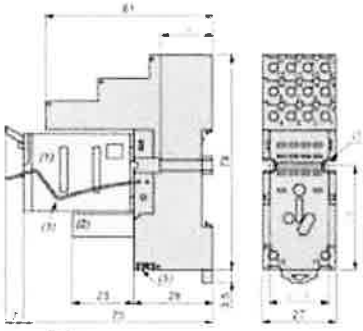
Approvals for Sockets

RXZE2S114M



Complementary	
[Ith] conventional free air thermal current	10 A 5 A with bus jumper
[Ue] rated operational voltage	< 250 V
Tightening torque	<= 1 N.m (M3 screw(s))
Fixing mode	By screw mounting on panel Clip-on mounting on 35 mm symmetrical DIN rail
Marking	CE
Width	27 mm
Product weight	0.058 kg 0.07 kg

Environment	
Standards	IEC 61984
Product certifications	CSA UL
Ambient air temperature for storage	-40...85 °C
Ambient air temperature for operation	-40...55 °C
IP degree of protection	IP20 conforming to EN/IEC 60529
Dielectric strength	2500 V
RoHS EUR status	Compliant
RoHS EUR conformity date	0801



1 Relay
2 Protection Module
3 Carriage Stirrup
5 2 Links connection

Approvals for Sockets

wieland

General Data

Part No: 07.311.4053.1
Description: End Cover – Black
Type of end plate – Yes
Snap in - Yes
Inflammability Class of insulation material acc. With UL94 – V0



07-063-000

ELEMECH INC. 630-499-7080 · www.elemechinc.com	Rev: 0	Device Tag: DB1	
	Date: 4/13/2018		
Manuf:. PNo: WIELAND: 07.311.4053.1	By: TCC	Job Number: HBR7281	Page # 1/1

wieland

Cross connectors, (jumper bars) uninsulated

07-063-001

Type	Part no.	Std. pack
WKM 4/15	**6 mm spacing Screw: M 3**	
2pole 9215 - 2	Z7.210.3227.0	50
3pole 9215 - 3	Z7.210.3327.0	50
4pole 9215 - 4	Z7.210.3427.0	50
5pole 9215 - 5	Z7.210.3527.0	50
6pole 9215 - 6	Z7.210.3627.0	50
70pole 9215 M-70	Z7.210.3027.0	10



General

Colour	Other
Type	Cross connector
Modular spacing	6 mm
Number of bridged clamps	4
Mounting method	Screwable
Insulated	No

Accessories

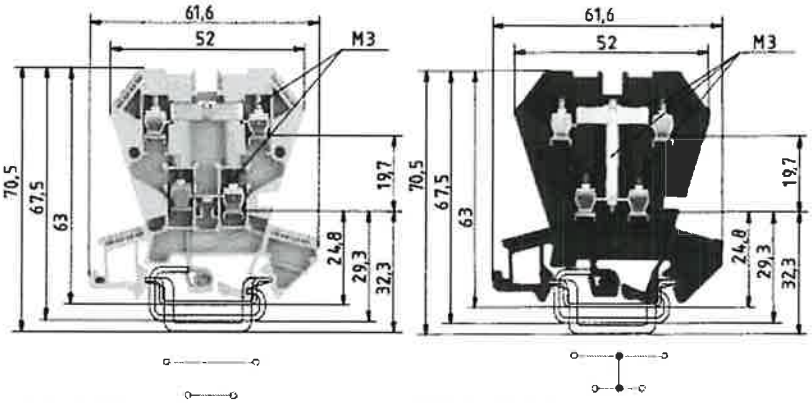
Type	Cross connector
Mounting method	Screwable
Insulated	No
Colour	Other
Number of bridged clamps	4
Modular spacing	6 mm

wieland

07-063-002

Multi-tier blocks with screw connection

selos



		WK 4 E/U				WK 4 E/U /VB			
		fine-stranded	solid	V	A	fine-stranded	solid	V	A
0344 Ex II 2GD IM2		0.5–4 mm²	0.5–4 mm²	400V/6kV/3	32	0.5–4 mm²	0.5–4 mm²	400V/6kV/3	32
Ex e I/II									
EN 60 947-7-1:2002									
EN 60 947-7-2:2002									
UL ratings	Field/factory wiring	No. 22-10 AWG		300V	20	No. 22-10 AWG		300V	20
CSA ratings		No. 20-12 AWG		300V	10	No. 20-12 AWG		300V	10
KEMA 02 ATEX 2114 U[1]	EN 60 079-0/EN 60 079-7	0.5–4 mm²	0.5–4 mm²	275 V	24/24[2]	0.5–4 mm²	0.5–4 mm²	275 V	24
Width	Wire strip length	6 mm			9 mm	6 mm			9 mm
Approvals									

		Type	Part No.	Std. Pack	Type	Part No.	Std. Pack
Multi-tier block	gray	WK 4 E/U	57.404.7055.0	100			
Multi-tier block, vert. connected	black				WK 4 E/U/VB SCHWARZ	57.404.6955.1	100
Multi-tier ground block	green/yellow						
Function block	red						
Function block	orange						
Accessories							
1. Mounting rail TS 35, DIN rail 7.5 mm high	L = 2 m	35 x 27 x 7.5 EN 60715	98.300.0000.0	1	35 x 27 x 7.5 EN 60715	98.300.0000.0	1
Mounting rail TS 35, DIN rail, 15 mm high	L = 2 m	35 x 24 x 15 EN 60715	98.360.0000.0	1	35 x 24 x 15 EN 60715	98.360.0000.0	1
Mounting rail TS 32, G rail*	L = 2 m	9005 EN 60715 G-32	98.190.0000.0	1	9005 EN 60715 G-32	98.190.0000.0	1
2. End clamp with U-foot*	10mm wide	WE 1/U	Z5.523.5753.0	100	WE 1/U	Z5.523.5753.0	100
End clamp TS 35, with screw	8mm wide	9708/2 S 35	Z5.522.8553.0	100	9708/2 S 35	Z5.522.8553.0	100
End clamp TS 35, without screw	8mm wide	9708	Z5.522.7053.0	100	WEF 1/35	Z5.523.9353.0	100
3. End plate	gray	AP 4 E	07.311.4055.0	10	AP 4 E	07.311.4055.0	10
	blue						
4. Partition	gray	TW 4 E	07.311.5055.0	10	TW 4 E	07.311.5055.0	10
	blue						
5. Cross connector with screws	2 pole	9215-2	Z7.210.3227.0	50	9215-2	07.210.3227.0	1
for top tier	3 pole	9215-3	Z7.210.3327.0	50	9215-3	07.210.3327.0	1
	up to 6 pole	9215-6	Z7.210.3627.0	50	9215-6	07.210.3627.0	1
Jumper comb for lower tier block	2 pole	IVBS WK 4 E-2	Z7.256.4227.0	10	IVBS WK 4 E-2	Z7.256.4227.0	10
insulated, angled	up to 6 pole	IVBS WK 4 E-6	Z7.256.4627.0	10	IVBS WK 4 E-6	Z7.256.4627.0	10
Jumper comb for lower tier block	2 pole	IVB WK 4 E-2	Z7.255.2227.0	10	IVB WK 4 E-2	Z7.255.2227.0	10
insulated, straight	up to 6 pole	IVB WK 4 E-6	Z7.255.2627.0	10	IVB WK 4 E-6	Z7.255.2627.0	10
6. Partition plate with marking facility							
7. Single cover with marking facility		ADVB 4/15 GELB	04.326.2953.8	10	ADVB 4/15 GELB	04.326.2953.8	10
8. Cover with warning symbol over 4 blocks							

For more accessories see pages 60-77
For marking systems see pages 70-75

[1] Please note the mounting instructions on the cover page
[2] With end plates 500 V/6 kV/3
[3] Fittings to adjacent feed-through blocks of the same series and size
[4] For the current carrying capability of the mounting rail see AT catalog section *facts* & data
[5] With/without jumper
[6] Donot use in Ex environments

ELEMECH INC.
630-499-7080 · www.elemechinc.com

Manuf:. PNo: WIELAND: 57.404.6955.1	Rev: 0	Device Tag: DB1	
	Date: 4/13/2018		
	By: TCC	Job Number: HBR7281	Page # 1/1

Ratings:

Volts	1000VAC/DC
Amps	65 to 2200A based on NEC table 310.15(B)(16) 75°C ampacities
SCCR	100kA with properly sized fuse

(See Mersen's PDB SCCR guide at ep.mersen.com or contact Mersen technical services)

Approvals:

- UL Listed to subject 1953. File E352417
- CSA Certified Class 6228 01



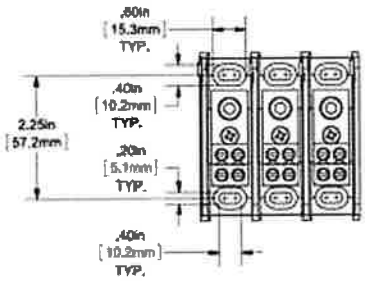


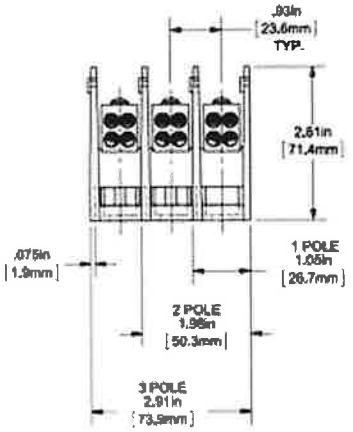
07-030-A004

MPDB62 and MPDB63 Open-Style PDBs

Catalog Numbers (Miniature)

Miniature (MPDB63133 shown for reference)





Line		Load		Catalog Numbers - Aluminum Number of Poles				Catalog Numbers - Copper Number of Poles				Amp Rating per Pole	
Wire Range	Openings per Pole	Wire Range	Openings per Pole	ADDER	1-P	2-P	3-P	ADDER	1-P	2-P	3-P	Al Wire	Cu Wire
Box-Box Configuration													
4 - 14	1	4 - 14	1	MPDB63100	MPDB63101	MPDB63102	MPDB63103	MPDB62100	MPDB62101	MPDB62102	MPDB62103	65	85
			4	MPDB63160	MPDB63161	MPDB63162	MPDB63163	MPDB62160	MPDB62161	MPDB62162	MPDB62163		
		2/0 - 14	1	MPDB63150	MPDB63151	MPDB63152	MPDB63153	MPDB62150	MPDB62151	MPDB62152	MPDB62153		
2/0 - 14	1	2 - 14	2	MPDB63190	MPDB63191	MPDB63192	MPDB63193	MPDB62190	MPDB62191	MPDB62192	MPDB62193	135	175
		4 - 14	4	MPDB63130	MPDB63131	MPDB63132	MPDB63133	MPDB62130	MPDB62131	MPDB62132	MPDB62133		
Box-Stud Configuration													
2/0 - 14	1	1/4-20 x 5/8	1	MPDB63140	MPDB63141	MPDB63142	MPDB63143	-	-	-	-	135	175
Stud-Stud Configuration													
1/4-20 x 5/8	1	1/4-20 x 5/8	1	-	-	-	-	MPDB62200	MPDB62201	MPDB62202	MPDB62203	240	240

Hinged Safety Cover for MPDB62 and MPDB63 series: Catalog number **MPDBC6263**

End Barrier for MPDB62 and MPDB63 series: Catalog Number **MPDBE6263**

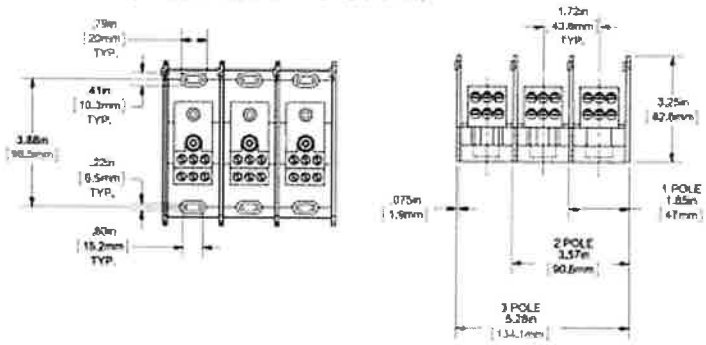
MPDB66 and MPDB67 Open-Style PDBs

MERSEN

07-030-A004

Catalog Numbers (Intermediate)

Intermediate (MPDB67583 shown for reference)



Line		Load		Catalog Numbers - Aluminum Number of Poles				Catalog Numbers - Copper Number of Poles				Amp Rating per Pole	
Wire Range	Openings per Pole	Wire Range	Openings per Pole	ADDER	1-P	2-P	3-P	ADDER	1-P	2-P	3-P	Al Wire	Cu Wire
Box-Box Configuration													
		2/0 - 14	1	MPDB67050	MPDB67051	MPDB67052	MPDB67053	MPDB66050	MPDB66051	MPDB66052	MPDB66053		
		2 - 14	4	MPDB67570	MPDB67571	MPDB67572	MPDB67573	MPDB66570	MPDB66571	MPDB66572	MPDB66573		
2/0 - 14	1	2 - 14	6	MPDB67560	MPDB67561	MPDB67562	MPDB67563	MPDB66560	MPDB66561	MPDB66562	MPDB66563	135	175
		2 - 14	8	MPDB67580	MPDB67581	MPDB67582	MPDB67583	MPDB66580	MPDB66581	MPDB66582	MPDB66583		
		6 - 14	10	MPDB67590	MPDB67591	MPDB67592	MPDB67593	MPDB66590	MPDB66591	MPDB66592	MPDB66593		
		10 - 14	12	MPDB67110	MPDB67111	MPDB67112	MPDB67113	MPDB66110	MPDB66111	MPDB66112	MPDB66113		
		350 - 6	1	MPDB67000	MPDB67001	MPDB67002	MPDB67003	MPDB66000	MPDB66001	MPDB66002	MPDB66003		
		2/0 - 14	2	MPDB67010	MPDB67011	MPDB67012	MPDB67013	MPDB66010	MPDB66011	MPDB66012	MPDB66013		
		2 - 14	4	MPDB67670	MPDB67671	MPDB67672	MPDB67673	MPDB66670	MPDB66671	MPDB66672	MPDB66673		
350 - 6	1	2 - 14	6	MPDB67660	MPDB67661	MPDB67662	MPDB67663	MPDB66660	MPDB66661	MPDB66662	MPDB66663	250	310
		2 - 14	8	MPDB67630	MPDB67631	MPDB67632	MPDB67633	MPDB66630	MPDB66631	MPDB66632	MPDB66633		
		6 - 14	10	MPDB67650	MPDB67651	MPDB67652	MPDB67653	MPDB66650	MPDB66651	MPDB66652	MPDB66653		
		10 - 14	15	MPDB67620	MPDB67621	MPDB67622	MPDB67623	MPDB66620	MPDB66621	MPDB66622	MPDB66623		
		500 - 4	1	MPDB67400	MPDB67401	MPDB67402	MPDB67403	MPDB66400	MPDB66401	MPDB66402	MPDB66403		
		350-6 & 2-14	1 & 3	MPDB67450	MPDB67451	MPDB67452	MPDB67453	MPDB66450	MPDB66451	MPDB66452	MPDB66453		
		4/0 - 10	2	MPDB67420	MPDB67421	MPDB67422	MPDB67423	-	-	-	-		
500 - 4	1	2/0 - 14	4	MPDB67410	MPDB67411	MPDB67412	MPDB67413	MPDB66410	MPDB66411	MPDB66412	MPDB66413	310	380
		2 - 14	6	MPDB67460	MPDB67461	MPDB67462	MPDB67463	MPDB66460	MPDB66451	MPDB66462	MPDB66463		
		2 - 14	8	MPDB67430	MPDB67431	MPDB67432	MPDB67433	-	-	-	-		
		6 - 14	10	MPDB67480	MPDB67481	MPDB67482	MPDB67483	-	-	-	-		
		10-14	18	MPDB67490	MPDB67491	MPDB67492	MPDB67493	MPDB66490	MPDB66491	MPDB66492	MPDB66493		
		2/0 - 14	2	MPDB67020	MPDB67021	MPDB67022	MPDB67023	MPDB66020	MPDB66021	MPDB66022	MPDB66023		
		2 - 14	6	MPDB67510	MPDB67511	MPDB67512	MPDB67513	MPDB66510	MPDB66511	MPDB66512	MPDB66513		
2/0 - 14	2	2 - 14	8	MPDB67610	MPDB67611	MPDB67612	MPDB67613	MPDB66610	MPDB66611	MPDB66612	MPDB66613	270	350
		6 - 14	10	MPDB67530	MPDB67531	MPDB67532	MPDB67533	MPDB66530	MPDB66531	MPDB66532	MPDB66533		
		10 - 14	15	MPDB67550	MPDB67551	MPDB67552	MPDB67553	MPDB66550	MPDB66551	MPDB66552	MPDB66553		
4/0 - 6	2	4/0 - 10	2	MPDB67520	MPDB67521	MPDB67522	MPDB67523	MPDB66520	MPDB66521	MPDB66522	MPDB66523	360	460
		2 - 14	6	MPDB67540	MPDB67541	MPDB67542	MPDB67543	MPDB66540	MPDB66541	MPDB66542	MPDB66543		

Hinged Safety Cover for MPDB66 and MPDB67 series: Catalog number **MPDBC6667**

End Barrier for MPDB66 and MPDB67 series: Catalog Number **MPDBE6667**

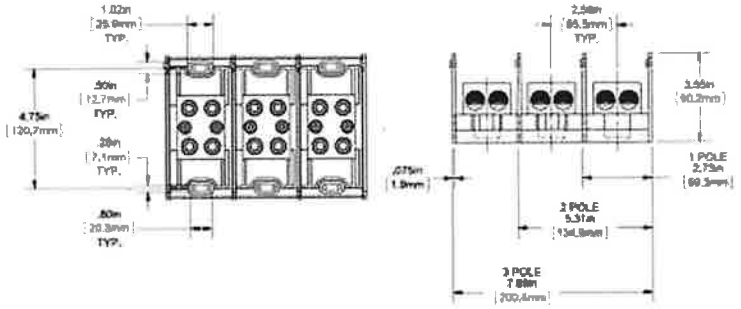
MPDB68 and MPDB69 Open-Style PDBs

MERSEN

07-030-A004

Catalog Numbers (Large)

Large (MPDB69123 shown for reference)



Line		Load		Catalog Numbers - Aluminum Number of Poles				Catalog Numbers - Copper Number of Poles				Amp Rating per Pole	
Wire Range	Openings per Pole	Wire Range	Openings per Pole	ADDER	1-P	2-P	3-P	ADDER	1-P	2-P	3-P	Al Wire	Cu Wire
Box-Box Configuration													
350 - 6	1	2/0 - 14	6	MPDB69170	MPDB69171	MPDB69172	MPDB69173	-	-	-	-	250	310
		4 - 14	12	MPDB69150	MPDB69151	MPDB69152	MPDB69153	MPDB68150	MPDB68151	MPDB68152	MPDB68153		
		500 - 4	1	MPDB69050	MPDB69051	MPDB69052	MPDB69053	-	-	-	-		
		350 - 6	2	MPDB69060	MPDB69061	MPDB69062	MPDB69063	MPDB68060	MPDB68061	MPDB68062	MPDB68063		
500 - 4	1	4/0 - 6	4	MPDB69510	MPDB69511	MPDB69512	MPDB69513	-	-	-	-	310	380
		2/0 - 14	6	MPDB69070	MPDB69071	MPDB69072	MPDB69073	-	-	-	-		
		4 - 14	12	MPDB69080	MPDB69081	MPDB69082	MPDB69083	-	-	-	-		
600 - 2	1	600 - 2	1	MPDB69640	MPDB69641	MPDB69642	MPDB69643	-	-	-	-	340	420
		1600 - 250	1	MPDB69000	MPDB69001	MPDB69002	MPDB69003	-	-	-	-		
		500 - 4	2	MPDB69010	MPDB69011	MPDB69012	MPDB69013	-	-	-	-		
1000 - 250	1	350 - 6	2	MPDB69020	MPDB69021	MPDB69022	MPDB69023	-	-	-	-	445	545
		2/0 - 14	6	MPDB69030	MPDB69031	MPDB69032	MPDB69033	-	-	-	-		
		4 - 14	12	MPDB69040	MPDB69041	MPDB69042	MPDB69043	-	-	-	-		
4 - 14	2	4 - 14	12	MPDB69180	MPDB69181	MPDB69182	MPDB69183	-	-	-	-	130	170
2/0 - 14	2	4 - 14	12	MPDB69160	MPDB69161	MPDB69162	MPDB69163	MPDB68160	MPDB68161	MPDB68162	MPDB68163	270	350
		10 - 14	20	MPDB69600	MPDB69601	MPDB69602	MPDB69603	-	-	-	-		
350 - 6	2	350 - 6	2	MPDB69120	MPDB69121	MPDB69122	MPDB69123	MPDB68120	MPDB68121	MPDB68122	MPDB68123	500	620
		4/0 - 10	4	-	-	-	-	MPDB66320	MPDB68321	MPDB68322	MPDB66323		
		2/0 - 14	6	MPDB69130	MPDB69131	MPDB69132	MPDB69133	MPDB68130	MPDB68131	MPDB68132	MPDB68133		
		4 - 14	12	MPDB69140	MPDB69141	MPDB69142	MPDB69143	MPDB68140	MPDB68141	MPDB68142	MPDB68143		
		500 - 4	2	MPDB69090	MPDB69091	MPDB69092	MPDB69093	MPDB68090	MPDB68091	MPDB68092	MPDB68093		
550 - 4	2	4/0 - 6	4	MPDB69310	MPDB69311	MPDB69312	MPDB69313	-	-	-	-	620	760
		4/0 - 10	4	-	-	-	-	MPDB68310	MPDB68311	MPDB68312	MPDB68313		
		2/0 - 14	6	MPDB69100	MPDB69101	MPDB69102	MPDB69103	MPDB68100	MPDB68101	MPDB68102	MPDB68103		
		2/0 - 14	8	MPDB69350	MPDB69351	MPDB69352	MPDB69353	-	-	-	-		
		4 - 14	12	MPDB69110	MPDB69111	MPDB69112	MPDB69113	MPDB68110	MPDB68111	MPDB68112	MPDB68113		
600 - 2	2	600 - 2	2	MPDB69650	MPDB69651	MPDB69652	MPDB69653	-	-	-	-	680	840
		4-14 & 3/0-10	4 & 4	MPDB69540	MPDB69541	MPDB69542	MPDB69543	-	-	-	-		

Hinged Safety Cover for MPDB68 and MPDB69 series: Catalog number **MPDBC6869**

End Barrier for MPDB68 and MPDB69 series: Catalog Number **MPDBE6869**

FLANGE-MOUNTED DISCONNECT TYPE 12 FLOOR STANDING ENCLOSURE

PENTAIR

ENCLOSURE CATALOG NUMBER	ENCLOSURE DIMENSIONS (IN.)	SUB-PANEL CATALOG NUMBER
A-AXBCLPFTC	A x B x C	A APB

11-035-803



INDUSTRY STANDARDS

UL 508A Listed, Type 12, File No. E61997
cUL Listed per CSA C22.2 No. 94, Type 12, File No. E61997

NEMA/ICEMAC Type 12
CSA File No. 47386, Type 12
IEC 60529, IP55

APPLICATION

A disconnect can be installed on the centerpost or right side of this enclosure. Floor stands provide additional height and access for cleaning under the enclosure.

SPECIFICATIONS

- 11 gauge steel (.121 inch)
- Seams continuously welded and ground smooth
- Body stiffeners in larger enclosures for extra rigidity
- Body flange trough excludes liquids and contaminants
- Removable centerposts permit easy panel installation
- Concealed, easy-to-remove hinges
- Heavy-duty 3-point latching mechanism operated by padlocking handle on all doors
- Heavy-duty lifting eyes anchor into reinforced top
- Data pocket is high impact thermoplastic
- 15-in. floor stands are welded to enclosure
- Provisions for mounting lights
- Oil-resistant door gasket
- Panel supports
- Collar studs provided for mounting optional panels
- Master door is right-hand door on X enclosures and left-hand door on CPX enclosures
- Integral defeater on master door handle requires a screwdriver to open
- Mechanical interlock operated by master door prevents slave door from being opened first. Doors can be closed in any order.
- Includes door hardware

FINISH

Two finishes are available: ANSI 61 gray, polyester powder paint outside and inside; or ANSI 61 outside and white, polyester powder paint inside. Optional panels have white or conductive finish.

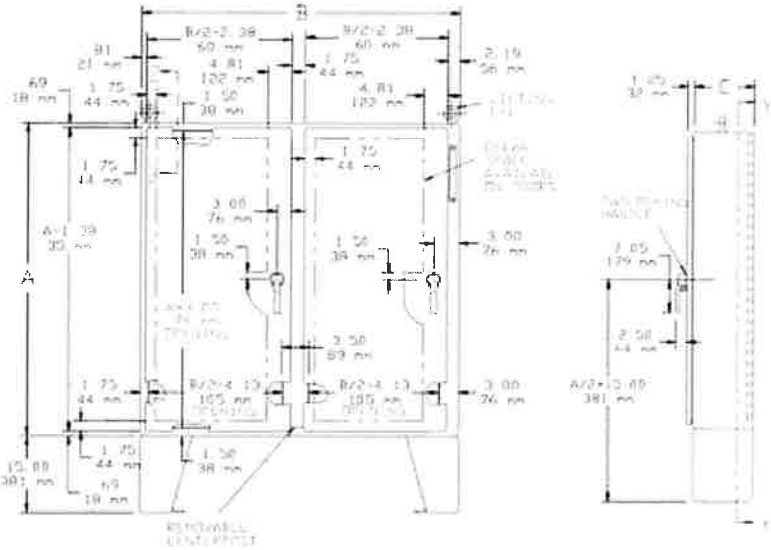
ACCESSORIES

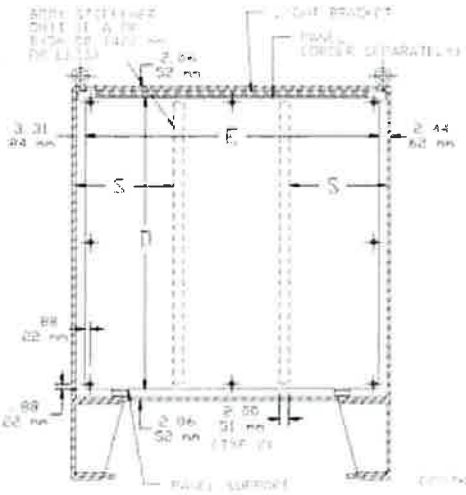
See also Accessories
Blank Adapter Plates, Mild Steel
INTERSAFE Data Interface Ports, Type 4/4X/12
Operator Adapters for Universal Cutouts
Panels for Type 3R, 4, 4X, 12 and 13 Enclosures
Steel and Stainless Steel Window Kits

MODIFICATION AND CUSTOMIZATION

Hoffman excels at modifying and customizing products to your specifications. Contact your local Hoffman sales office or distributor for complete information.

BULLETIN: A21



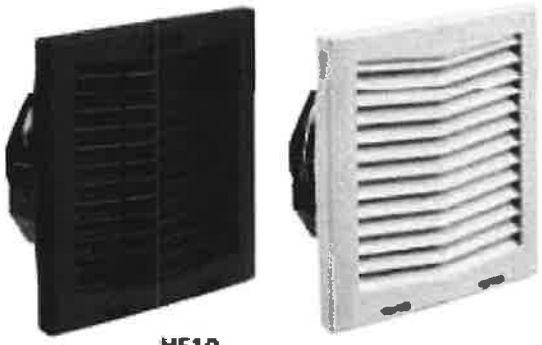


ELEMECH INC. 630-499-7080 · www.elemechinc.com	Rev: 0	Device Tag: EN1	
	Date: 4/13/2018		
Manuf.: . PNo: HOFFMAN: A-60X4912LPFTC	By: TCC	Job Number: HBR7281	Page # 1/1

FRESH AIR ENCLOSURE COOLING FILTER FANS

PENTAIR

11-035-840



HF10
159 CFM (270 m³/Hr.)

INDUSTRY STANDARDS

UL/cUL Listed; File No. E482010

CE
EAC
Type 12, IP54 standard (on all models except HF13)
Type 12, IP 55 optional (on all models except HF04)

Performance Data **HF10 159 CFM (270 m³/Hr.) Side-Mount Filter Fans**

ELECTRICAL DATA				
Rated Voltage	**115**	**230**	**24***	**48***
Frequency (Hz)	50/60	50/60	—	—
Nominal Current Maximum (Amps)	.38/.36	.18/.19	.88	.32
Power Consumption Maximum (Watts)	35/32	38/35	21.1	15.4
Power Connection		Terminal Block		
TYPE 12 / IP54 FILTER FANS				
RAL 7035 Light Gray:				
Catalog Number	**HF1016414**	**HF1026414**	**HF1024414**	**HF1048414**
RAL 9011 Black:				
Catalog Number	**HF1016413**	**HF1026413**	**HF1024413**	**HF1048413**
Free Airflow (CFM / m³/hr.)	159/270	159/270	159/270	159/270
Airflow with 1 Exhaust Grille (CFM / m³/hr.)	128/217	128/217	128/217	128/217
Airflow with 2 Exhaust Grilles (CFM / m³/hr.)	151/257	151/257	151/257	151/257
TYPE 12 / IP55 FILTER FANS				
RAL 7035 Light Gray:				
Catalog Number	**HF1016514**	**HF1026514**	**HF1024514**	**HF1048514**
RAL 9011 Black:				
Catalog Number	**HF1016513**	**HF1026513**	**HF1024513**	**HF1048513**
Free Airflow (CFM / m³/hr.)	103/175	103/175	103/175	103/175
Airflow with 1 Exhaust Grille (CFM / m³/hr.)	80/136	80/136	80/136	80/136
Airflow with 2 Exhaust Grilles (CFM / m³/hr.)	87/148	87/148	87/148	87/148
FILTER FAN UNIT CONSTRUCTION				
Fan RPM	2700/3200	2700/3200	3750	3500
Sound Pressure (dBA at 50/60 Hz)	53/56	53/56	53/56	53/56
Operating Temperature Range:				
Maximum (°F / °C)	131/55	131/55	131/55	131/55
Minimum (°F / °C)	14/-10	14/-10	14/-10	14/-10
Service Life (hours) at 40 C	97,000	97,000	76,000	76,000
Unit Dimensions - H x W x D (in. / mm)		10.13 x 10.14 x 4.68/257 x 258 x 119		
Cutout Dimensions - H x W (in. / mm)		8.78 x 8.78/223 x 223		
Weight (lb. / kg)		3.14/1.40		
TYPE 12 / IP54 EXHAUST GRILLES				
RAL 7035 Light Gray:				
Catalog Number	**HG1000404**	**HG1000404**	**HG1000404**	**HG1000404**
RAL 9011 Black:				
Catalog Number	**HG1000403**	**HG1000403**	**HG1000403**	**HG1000403**
TYPE 12 / IP55 EXHAUST GRILLES				
RAL 7035 Light Gray:				
Catalog Number	**HG1000504**	**HG1000504**	**HG1000504**	**HG1000504**
RAL 9011 Black:				
Catalog Number	**HG1000503**	**HG1000503**	**HG1000503**	**HG1000503**
ACCESSORIES				
Replacement Filters:				
Type 12 / IP54 Catalog Number	**89134426R**	**89134426R**	**89134426R**	**89134426R**
Type 12 / IP55 Catalog Number	**89136410R**	**89136410R**	**89136410R**	**89136410R**
Thermostat Catalog Number	**TWR60**	**TWR60**	**TWR60**	**TWR60**
Shroud Catalog Number		**HH10GS35001, HH10GS61001, HH10SS04001**		

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Rev: 0
Date: 4/13/2018
By: TCC

Device Tag: FAN1

Job Number: HBR7281

Page # 1/1

Manuf:. PNo: HOFFMAN: HF1016414

Fuse terminals with U-foot, Type *WK*

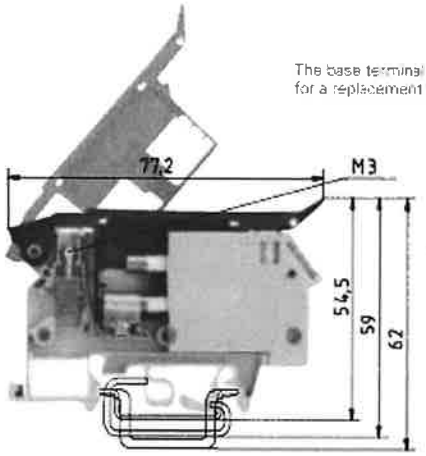
selos

42-063-027

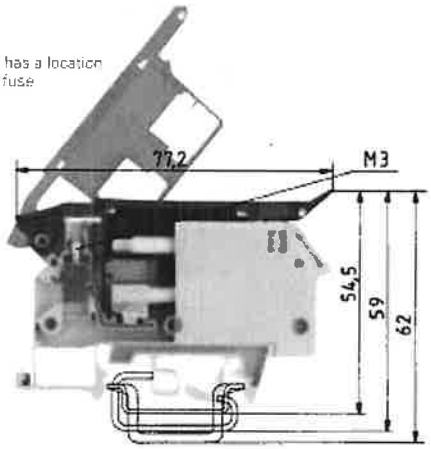
The fuse terminals of this type have a hinged disconnect lever. This takes miniature fuses of 5 x 20, 5 x 25 and 5 x 30 mm (terminal width = 8 mm) or 6,3 x 32 mm (terminal width = 10 mm). The hinged lever has locking points both in the open and closed state and can be sealed.
All the terminals are available in two versions – with or without red LEDs as indicators.
When selecting G fuse links, it should be ensured that the indicated maximum leakage loss is not exceeded.[1]
The current is determined by the fuse that is used.[II]
The voltage range is specified by the built-in LED display.[2]
Depending on the application and type of installation, the temperature-rise must be observed in closed fuse holders.
Higher ambient temperatures represent an additional load for the fuse links. The corresponding reduction of the rated current must therefore be taken into account when using the fuse links.

[1] Maximum leakage loss at temperature of 23 °C acc. to DIN EN 60947-7-3:

Type	Rated voltage	Overload protection		Exclusive short-circuit protection	
		Individual arrangement	Group arrangement	Individual arrangement	Group arrangement
THSI 5-6/32	250 V	1,6 W	1,6 W	4,0 W	2,5 W
THSI 6,3-32	500 V	2,5 W	2,5 W	4,0 W	2,5 W
THSI 5-32	500 V	1,6 W	4,0 W	4,0 W	2,5 W



for 5 mm miniature fuse



for 6,3 mm miniature fuse

WK 4 THSI 5... /U

finely stranded	single core	V	A
0,5 – 4 mm²	0,5 – 6 mm²	800 V/8 kV/3[2]	6,3[II]
No. 22-10	AWG	600 V[2]	15
No. 22-10	AWG	600 V[2]	6,3
8 mm			8 mm

EN 60 947-7-1, EN 60 127-6
UL Data — field/factory wiring
CSA Data
Overall width — Insulation strip length
Approvals

		Type	Part No.	Box Qty
Fuse terminal base terminal	colour: grey	WK 4/THSI 5 ... U	57.904.5355.0	50
– with LED 5 - 12 V ~/– power consumption	2,3 - 7 mA	WK 4/THSI 5 LED 12 U	57.904.5455.0	50
– with LED 12 - 24 V ~/– power consumption	2,5 - 6,2 mA	WK 4/THSI 5 LED 24 U	57.904.5555.0	50
– with LED 24 - 60 V ~/– power consumption	1,5 - 4 mA	WK 4/THSI 5 LED 60 U	57.904.5655.0	50
– with GL 110-250 V ~/– power consumption	0,13 - 0,55 mA	WK 4/THSI 5 GL 250 U	57.904.5755.0	50
– with GL 380 - 500 V ~/– power consumption	0,2 - 0,3 mA	WK 4/THSI 5 GL 500 U	57.904.5855.0	50
Fuse terminal	colour: grey			
– with Screw cap A DIN 41571 for fuse link DIN 41571				
– with Screw cap B DIN 41571 for fuse link DIN 41571				
– with Screw cap A DIN 41571 for fuse link				
– with Screw cap for fuse link				
Modular terminal, same dimensions as fuse terminal	colour: grey			
Accessories				
1. Mounting rail 35, DIN rail 7,5 high	L = 2 m	35 x 27 x 7,5 EN 50022	98.300.0000.0	1
Mounting rail 35, DIN rail 15 high	L = 2 m	35 x 24 x 15 EN 50022	98.360.0000.0	1
Mounting rail 32, G rail	L = 2 m	9006 DIN 50035 G-32	98.190.0000.0	1
2. End clamp with U-foot	10 mm wide	WE 1/U	Z5.523.5753.0	100
End clamp for TS 35, with screw	8 mm wide	9708/2 S 35	Z5.522.8553.0	100
End clamp for TS 32, with screw	7,5 mm wide	9708	Z5.522.7053.0	100
3. End plate 1,5 mm thick	colour: grey			
4. Jumper bars with screws, E-Cu				
uninsulated	2 pole			
	3 pole			
	up to 6 pole			
5. Transparent terminal cover (for one terminal)				
6. Marking accessories		see pages 34-41		

WK 4 THSI 6,3... /U

finely stranded	single core	V	A
0,5 – 4 mm²	0,5 – 6 mm²	800 V/8 kV/3[2]	10[II]
No. 22-10	AWG	600 V[2]	15
No. 22-10	AWG	600 V[2]	10
10 mm			8 mm

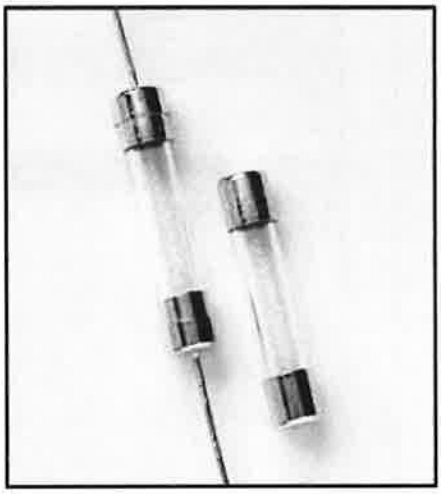
		Type	Part No.	Box Qty
Fuse terminal base terminal	colour: grey	WK 4/THSI 6,3 ... U	57.904.6355.0	50
– with LED 5 - 12 V ~/– power consumption	2,3 - 7 mA	WK 4/THSI 6,3 LED 12 U	57.904.6455.0	50
– with LED 12 - 24 V ~/– power consumption	2,5 - 6,2 mA	WK 4/THSI 6,3 LED 24 U	57.904.6555.0	50
– with LED 24 - 60 V ~/– power consumption	1,5 - 4 mA	WK 4/THSI 6,3 LED 60 U	57.904.6655.0	50
– with GL 110-250 V ~/– power consumption	0,13 - 0,55 mA	WK 4/THSI 6,3 GL 250 U	57.904.6755.0	50
– with GL 380 - 500 V ~/– power consumption	0,2 - 0,3 mA	WK 4/THSI 6,3 GL 500 U	57.904.6855.0	50
Fuse terminal	colour: grey			
– with Screw cap A DIN 41571 for fuse link DIN 41571				
– with Screw cap B DIN 41571 for fuse link DIN 41571				
– with Screw cap A DIN 41571 for fuse link				
– with Screw cap for fuse link				
Modular terminal, same dimensions as fuse terminal	colour: grey			
Accessories				
1. Mounting rail 35, DIN rail 7,5 high	L = 2 m	35 x 27 x 7,5 EN 50022	98.300.0000.0	1
Mounting rail 35, DIN rail 15 high	L = 2 m	35 x 24 x 15 EN 50022	98.360.0000.0	1
Mounting rail 32, G rail	L = 2 m	9006 DIN 50035 G-32	98.190.0000.0	1
2. End clamp with U-foot	10 mm wide	WE 1/U	Z5.523.5753.0	100
End clamp for TS 35, with screw	8 mm wide	9708/2 S 35	Z5.522.8553.0	100
End clamp for TS 32, with screw	7,5 mm wide	9708	Z5.522.7053.0	100
3. End plate 1,5 mm thick	colour: grey			
4. Jumper bars with screws, E-Cu				
uninsulated	2 pole			
	3 pole			
	up to 6 pole			
5. Transparent terminal cover (for one terminal)				
6. Marking accessories		see pages 34-41		

GDL / GDL-V

MERSEN

13-030-***

CATALOG NUMBER	AXIAL LEAD CAT. NO	AMPERE RATING	VOLTS	I.R.
GDL1/100	GDL-V1/100	1/100A	250V	1
GDL1/32	GDL-V1/32	1/32A	250V	1
GDL4/100	GDL-V4/100	4/100A	250V	1
GDL1/16	GDL-V1/16	1/16A	250V	1
GDL1/10	GDL-V1/10	1/10A	250V	1
GDL1/8	GDL-V1/8	1/8A	250V	1
GDL15/100	GDL-V15/100	15/100A	250V	1
GDL175/1000	GDL-V175/1000	175/1000A	250V	1
GDL3/16	GDL-V3/16	3/16A	250V	1
GDL2/10	GDL-V2/10	2/10A	250V	1
GDL1/4	GDL-V1/4	1/4A	250V	1
GDL3/10	GDL-V3/10	3/10A	250V	1
GDL3/8	GDL-V3/8	3/8A	250V	1
GDL4/10	GDL-V4/10	4/10A	250V	1
GDL1/2	GDL-V1/2	1/2A	250V	1
GDL6/10	GDL-V6/10	6/10A	250V	1
GDL7/10	GDL-V7/10	7/10A	250V	1
GDL3/4	GDL-V3/4	3/4A	250V	1
GDL8/10	GDL-V8/10	8/10A	250V	1
GDL1	GDL-V1	1A	250V	1
GDL1-2/10	GDL-V1-2/10	1-2/10A	250V	2
GDL1-1/4	GDL-V1-1/4	1-1/4A	250V	2
GDL1-1/2	GDL-V1-1/2	1-1/2A	250V	2
GDL1-6/10	GDL-V1-6/10	1-6/10A	250V	2
GDL1-8/10	GDL-V1-8/10	1-8/10A	250V	2
GDL2	GDL-V2	2A	250V	2
GDL2-1/4	GDL-V2-1/4	2-1/4A	250V	2
GDL2-1/2	GDL-V2-1/2	2-1/2A	250V	2
GDL2-8/10	GDL-V2-8/10	2-8/10A	250V	2
GDL3	GDL-V3	3A	250V	2
GDL3-2/10	GDL-V3-2/10	3-2/10A	250V	2
GDL4	GDL-V4	4A	250V	3
GDL5	GDL-V5	5A	250V	3
GDL6	GDL-V6	6A	250V	3
GDL6-1/4	GDL-V6-1/4	6-1/4A	250V	3
GLD7	GDL-V7	7A	250V	3
GLD8	GDL-V8	8A	250V	3
GLD10	GDL-V10	10A	125V	4
GDL12	GDL-V12	12A	125V	4
GDL15	GDL-V15	15A	125V	4
GDL20	GDL-V20	20A	32V	5
GDL25	GDL-V25	25A	32V	5
GDL30	GDL-V30	30A	32V	5



Glass Body
Time Delay
1/4" x 1-1/4"

1/100A through 8A, 250VAC - UL Listed and CSA Certified
10A through 15A, 125VAC - UL Listed and CSA Certified
20A through 30A, 32VAC - UL Recognized

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Manuf:. PNo:
FERRAZ-SHAWMUT: GDL-2

Rev: 0
Date: 4/13/2018
By: TCC

Device Tag: FU2,3
Job Number: HBR7281
Page # 1/1

Product Bulletin for SmartlockPro® Self-Test GFCIs

LEVITON

14-071-A003



Ordering Information
Commercial Spec Grade - Back and Side Wired

Description	Color	Cat. No.		Cat. No.	
NEMA		NEMA 5-15R		NEMA 5-20R	
Rating		15A-125V @ Receptacle 20A-125V Feed-Through		20A-125V @ Receptacle 20A-125V Feed-Through	
		TR	Non-TR	TR	Non-TR
Duplex with LED Indicator (with self-grounding clip)	White	GFTR1-W	GFNT1-W	GFTR2-W	GFNT2-W
	Ivory	GFTR1-I	GFNT1-I	GFTR2-I	GFNT2-I
	Light Almond	GFTR1-T	GFNT1-T	GFTR2-T	GFNT2-T
	Gray	GFTR1-GY	GFNT1-GY	GFTR2-GY	GFNT2-GY
	Black	GFTR1-E	GFNT1-E	GFTR2-E	GFNT2-E
	Brown	GFTR1	GFNT1	GFTR2	GFNT2
	Red	-	-	-	GFNT2-R

Self-Test
- Provides continuous ground fault protection - detects and trips on actual ground fault even when self-test is being conducted
- On initial power up, tests the GFCI within 3 seconds
- Auto-monitoring exceeds the UL requirement
- Auto adapts and shifts to more frequent testing if potential problem is detected
- Testing frequency regularly updates protection status
- Electronics are designed to minimize any false triggers

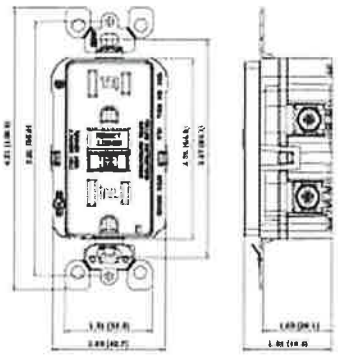
General Features
- Patented bridge contact provides individual sets of contacts for GFCI receptacle face and downstream receptacles; no power will be delivered to receptacle face if improperly wired (line-load reversed)
- Trip threshold meets or exceeds UL requirements for tripping time
- Improved immunity to high frequency noise reduces nuisance tripping
- Advanced electronics provides superior resistance to electrical surges and over-voltages
- Patented Lockout Action prevents reset if GFCI is damaged and cannot respond to a ground fault
- Status Indicator Light provides simple, intuitive feedback on power and protection status as well as indication of line/load reversal
- Silver alloy contacts
- Impact-resistant thermoplastic cover and body
- One-piece T-design trip latch mechanism provides efficient operation
- Available in 15A and 20A versions, all with Feed Spec rating
- TEST and RESET button colors match device face
- Compatible with all Decora® devices and wallplates, available in select Decora colors
- Limited Two-Year Product Warranty

Tamper-Resistant (TR) Models
- Complies with NEC® requirement mandating that all 15A and 20A receptacles installed in dwelling units be listed as tamper-resistant
- Shutter mechanism inside the receptacle blocks access to the contacts unless a two- or three-prong plug is inserted

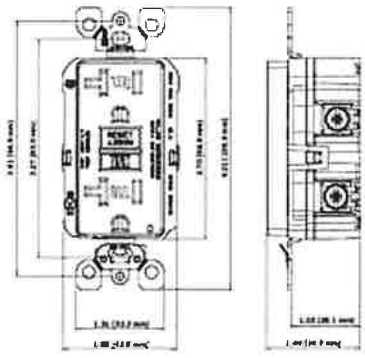
Duplex Guide Light Models
- Sensor provides automatic ON/OFF based on ambient lighting
- Dual lens provides visible light with a variety of plugs or transformers
- Custom designed lenses with edge-mounted LEDs improve light dispersion
- Energy-efficient (~1W of electricity). No bulbs to replace
- Saves space by eliminating the need to use an outlet for a plug-in night light

Weather-Resistant Models
- Designed for wet and damp locations to meet the requirements of NEC Section 406.8
- Stainless steel strap and screws
- Conformal coated PC board to protect critical components from moisture
- Cold impact resistant face and buttons
- UV stabilized plastics

Audible Models
- Audible alarm sounds when the GFCI trips, providing an alert that power has been disconnected from load(s) plugged into or fed from the GFCI
- Indicator light provides visual status



15A SmartlockPro® Self-Test GFCI



20A SmartlockPro® Self-Test GFCI

Agency Standards and Compliance
- Meets the latest UL requirements
- UL Standard 943 Class A (GFCI) and 498 (Receptacles)
- UL Listed (File #E-48380)
- CSA Certified (File #LR-57811)
- NOM Certified
- Meets Federal Specification W-C-596G (blank face - exception)

Material Characteristics
- Environmental: Flammability UL-94 V2 Rating
- Operating Temperature: -35°C to 66°C
- Material: Face, Thermoplastic; Body, Polycarbonate

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Rev:	Device Tag:
0	GFCI
Date: 4/13/2018	
Manuf.: . PNo: LEVITON: GFNT1-I ASSEMBLY	By: TCC
Job Number: HBR7281	Page # 1/1

15-011-000

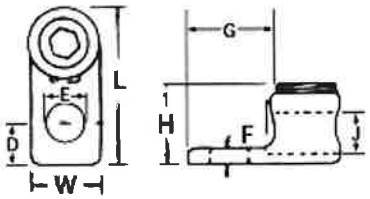


Copper Connectors
T&B Catalog Number: L70
UPC Number: 78378613002
Status: Active
Description:

Type L - Copper Single Conductor, One-Hole Mount for Conductor Range 14 Sol.-4 Str.

Features

Cold forged from pure electrolytic copper with 99 percent conductivity.



General

Style	Type L - Copper Single Conductor, One-Hole Mount
Material	Copper
Wire Range	14 Sol.-4 Str.

Dimension Information

Length (inches)	1 1/8
Width (inches)	17/32
Height (inches)	35/64
D (inches)	9/32
E (inches)	9/32
F (inches)	3/32
G (inches)	21/32
J (inches)	9/32

Packaging

T&B Inner Pack	100
Package in Units	1000
T&B Sold in UOM	Each
T&B Weight Per UOM	3.32 lbs. per 100

Notes

Available with screwdriver slot head screws only.
UL 486A tested.

Certifications

RoHS Compliance	Yes

Certifications

File Nbr:
E9809

For further technical assistance, please contact us...

Thomas & Betts - USA
8155 T&B Blvd.
Memphis, TN 38125
www.tnb.com

T&B Technical Support
MS 3B-50
8155 T&B Blvd.
Memphis, TN 38125

Hours: 7AM - 6PM CDT
Monday-Friday
Phone: (888) 862-3289
Fax: (901) 252-1321
Email:techsupport@tnb.com

Zelio® Plug-In Relays
RPM power relays



Telemecanique

06-058_***

General characteristics

Conforming to standards			IEC/EN 61810-1 (iss. 2), UL 508, CSA C22-2 n° 14
Product certifications			cULus File E164862 CCN NLDX, NLDX7; cURus File E164862 CCN NLDX2, NLDX8; CSA; CE; RoHS compliant
Ambient air temperature around the device	Storage	°C (F)	- 40... + 85 (-40... +185)
	Operation	°C (F)	- 40... + 55 (-40... +131)
Vibration resistance conforming to IEC/EN 60068-2-6	In operation		3 gn (10...150 Hz/± 1 mm / 5g/5 cycles)
	Not operating		5 gn (10...150 Hz/± 1 mm / 5g/5 cycles)
Degree of protection	Conforming to IEC/EN 60529		IP 40
Shock resistance conforming to IEC/EN 60068-2-27	Opening		15 gn
	Closing		15 gn
Protection category			RT I
Mounting position			Any

Insulation characteristics

Rated insulation voltage (Ui)	Conforming to IEC/EN 60947	V	250 (IEC), 300 (UL, CSA)
Rated impulse withstand voltage (Uimp)		kV	4 (1.2/50 µs)
Dielectric strength (rms voltage)	Between coil and contact	∼ V	1550
	Between poles	∼ V	1550
	Between contacts	∼ V	1500

Contact characteristics

Relay type				**RPM1•••**	**RPM2•••**	**RPM3•••**	**RPM4•••**
Number and type of contacts				1 C/O	2 C/O	3 C/O	4 C/O
Contact materials				AgNi			
Conventional thermal current (Ith)	For ambient temperature ≤ 55 °C		A	15			
Rated operational current in utilization categories AC-1 and DC-1	Conforming to IEC	NO	A	15			
		NC	A	7.5			
	Conforming to UL		A	15			
Switching current	Minimum		mA	10			
Switching voltage	Maximum		V	∼/⎓ 250 (IEC)			
	Minimum		V	17			
Nominal load (resistive)			A	15 / 250 ∼ V			
			A	15 / 28 ⎓ V			
Switching capacity	Maximum	∼	VA	3750			
		⎓	W	420			
	Minimum		mW	170			
Maximum operating rate In operating cycles/hour	No-load			18 000			
	Under load			1200			
Utilization coefficient				20 %			
Mechanical durability	In millions of operating cycles			10			
Electrical durability in millions of operating cycles	Resistive load			0.1		0.06	
	Inductive load			See curves below			

Electrical durability of contacts
Resistive load ∼

Reduction coefficient for inductive load ∼ (depending on power factor cos φ)

Maximum switching capacity on resistive load ⎓

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Manuf.: . PNo: SQUARE D: RPM12F7	By: TCC	Job Number: HBR7281	Page # 1/2

Power relays without LED (sold in lots of 10)

Control circuit voltge	Number and type of contacts - Thermal current (Ith) 1 C/O - 15 A		2 C/O - 15 A		3 C/O - 15 A		4 C/O - 15 A	
	Catalog number	Weight	Catalog number	Weight	Catalog number	Weight	Catalog number	Weight
V		kg		kg		kg		kg
⎓ 12	RPM11JD	0.026	RPM21JD	0.036	RPM31JD	0.054	RPM41JD	0.071
⎓ 24	RPM11BD	0.026	RPM21BD	0.036	RPM31BD	0.054	RPM41BD	0.071
⎓ 48	RPM11ED	0.026	RPM21ED	0.036	RPM31ED	0.054	RPM41ED	0.071
⎓ 110	RPM11FD	0.026	RPM21FD	0.036	RPM31FD	0.054	RPM41FD	0.071
~ 24	RPM11B7	0.026	RPM21B7	0.036	RPM31B7	0.054	RPM41B7	0.071
~ 48	RPM11E7	0.026	RPM21E7	0.036	RPM31E7	0.054	RPM41E7	0.071
~ 120	RPM11F7	0.026	RPM21F7	0.036	RPM31F7	0.054	RPM41F7	0.071
~ 230	RPM11P7	0.026	RPM21P7	0.036	RPM31P7	0.054	RPM41P7	0.071

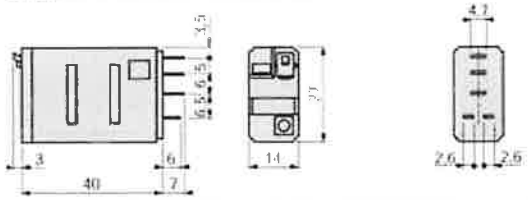
Power relays with LED (sold in lots of 10)

⎓ 12	RPM12JD	0.026	RPM22JD	0.036	RPM32JD	0.054	RPM42JD	0.071
⎓ 24	RPM12BD	0.026	RPM22BD	0.036	RPM32BD	0.054	RPM42BD	0.071
⎓ 48	RPM12ED	0.026	RPM22ED	0.036	RPM32ED	0.054	RPM42ED	0.071
⎓ 110	RPM12FD	0.026	RPM22FD	0.036	RPM32FD	0.054	RPM42FD	0.071
~ 24	RPM12B7	0.026	RPM22B7	0.036	RPM32B7	0.054	RPM42B7	0.071
~ 48	RPM12E7	0.026	RPM22E7	0.036	RPM32E7	0.054	RPM42E7	0.071
~ 120	RPM12F7	0.026	RPM22F7	0.036	RPM32F7	0.054	RPM42F7	0.071
~ 230	RPM12P7	0.026	RPM22P7	0.036	RPM32P7	0.054	RPM42P7	0.071

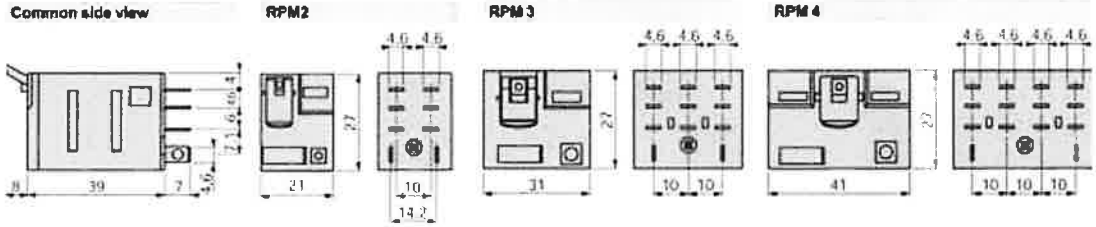
Dimensions (mm):

Power relays

RPM 1



Common side view **RPM 2** **RPM 3** **RPM 4**

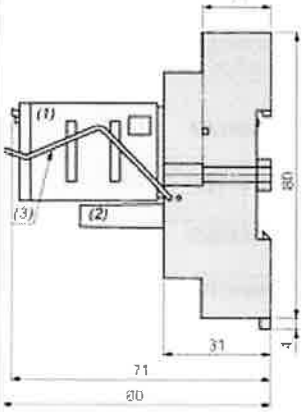


ELEMECH INC. 630-499-7080 · www.elemechinc.com	Rev: 0	Device Tag: IR1-32	
	Date: 4/13/2018		
Manuf:. PNo: SQUARE D: RPM12F7	By: TCC	Job Number: HBR7281	Page # 2/2

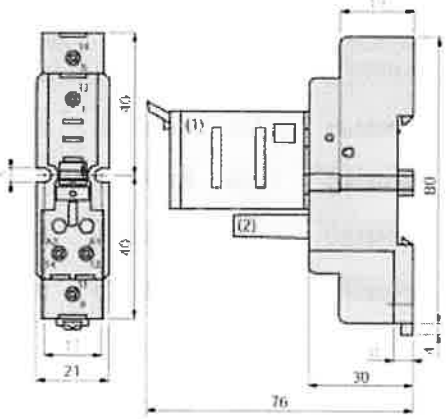
Sockets

Telemecanique

RPZF1



RPZF2



Common side view

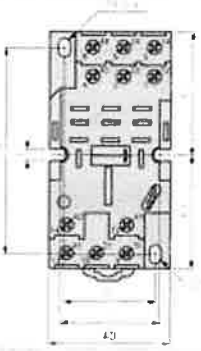


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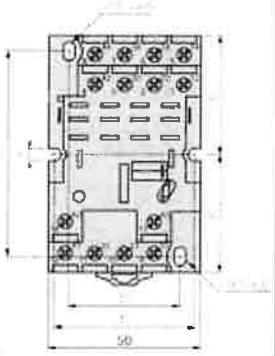
Socket characteristics

		RPZF1	RPZF2	RPZF3	RPZF4
Socket type		RPZF1	RPZF2	RPZF3	RPZF4
Relay types used		RPM1●●●	RPM2●●●	RPM3●●●	RPM4●●●
Protection module types used		RXM02●●● RXM04●●●	RXM02●●● RXM04●●●	RUW24●●●	RUW24●●●
Contact terminal arrangement		Mixed			
Wire connection method		Screw clamp terminals			
Product certifications		cURus File E172326 CCN 5WIV2, 5WIV8; CSA; CE; RoHS compliant			
Conforming to standards		IEC 61984, CE			

RPZF3



RPZF4



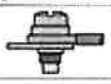
Electrical characteristics

Conventional thermal current (Ith)		A	16	
Maximum operating voltage		V	250 (IEC)	

Insulation characteristics

Between adjacent output contacts		Vrms	2500	
Between input and output contacts		Vrms	2500	
Between contacts and DIN rail		Vrms	2500	

General characteristics

Ambient air temperature around the device	Operation		°C	-40 ... +55	
	Storage		°C	-40 ... +85	
Degree of protection	Conforming to IEC/EN 60529			IP 20	
Connection	Solid wire without cable end	1 conductor		0.5 ... 1.5 mm² - AWG 20 ... AWG 16	0.5 ... 2.5 mm² - AWG 20 ... AWG 14
		2 conductors		0.5 ... 1.5 mm² - AWG 20 ... AWG 16	0.5 ... 2.5 mm² - AWG 20 ... AWG 14
	Flexible wire with cable end	1 conductor		0.25 ... 1 mm² - AWG 22 ... AWG 17	0.25 ... 1.5 mm² - AWG 22 ... AWG 16
		2 conductors		0.25 ... 1 mm² - AWG 22 ... AWG 17	0.25 ... 1.5 mm² - AWG 22 ... AWG 16
Maximum tightening torque / Screw size			Nm	1 / M3 screw	1 / M3.5 screw
Mounting				35 mm DIN rail / panel mount	
Mounting on DIN rail				By red plastic clip	
Terminal referencing				IEC, NEMA	
Compatibility with the metal hold-down clip				Yes	No
Timer module compatibility				No	Yes
Protection module				RXM040W, RXM041●●, RXM021●●	RUW24●●
Clip-in ID tags				No	
Wire connection method	Screw clamp terminals				

Sockets

Contact terminal arrangement	Connection	Relay type	Sold in lots of	Catalog number	Weight kg
Mixed	Screw clamp terminals	RPM1●●●	10	RPZF1	0.042
		RPM2●●●	10	RPZF2	0.054
		RPM3●●●	10	RPZF3	0.072
		RPM4●●●	10	RPZF4	0.094

c UL us

CSA

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Rev: 0	Device Tag: IR1-32		
Date: 4/13/2018			
Manuf.: . PNo: SQUARE D: RPZR235	By: TCC	Job Number: HBR7281	Page # 1/1

100

Line/Load Reactors



MTE CORPORATION

19-045-022

Input Voltage & Hz	% Impedance	0.25 HP 0.18 kw	0.33 HP 0.25 kw	0.5 HP 0.37 kw	0.75 HP 0.55 kw	1.0 HP 0.75 kw	1.5 HP 1.1 kw	2.0 HP 1.5 kw	3.0 HP 2.2 kw	5.0 HP 3.7 kw	7.5 HP 5.5 kw	10.0 HP 7.5 kw	15.0 HP 11.0 kw	20.0 HP 15.0 kw	25.0 HP 18.5 kw	30.0 HP 22.0 kw
Three Phase Input or Output Applications Selected by Motor																
208V 60 Hz	3%	RL-00204	RL-00204	RL-00401	RL-00401	RL-00802	RL-00801	RL-01201	RL-01801	RL-02501	RL-03501	RL-04501	RL-05501	RL-08001	RL-10001	RL-13001
208V 60 Hz	5%	RL-00201	RL-00201	RL-00402	RL-00803	RL-00802	RL-01202	RL-01802	RL-02502	RL-03502	RL-04502	RL-05502	RL-08002	RL-10002	RL-13002	RL-16002
240V 60 Hz	3%	RL-00201	RL-00204	RL-00204	RL-00401	RL-00401	RL-00801	RL-01201	RL-01801	RL-02501	RL-03501	RL-04501	RL-05501	RL-08001	RL-10001	RL-13001
240V 60 Hz	5%	RL-00202	RL-00201	RL-00401	RL-00402	RL-00803	RL-00802	RL-00802	RL-01202	RL-01802	RL-02502	RL-03502	RL-04502	RL-08002	RL-10002	RL-13002
400V 50 Hz	3%	RL-00103	RL-00103	RL-00202	RL-00202	RL-00201	RL-00403	RL-00402	RL-00803	RL-01202	RL-01202	RL-01802	RL-02502	RL-02502	RL-04502	RL-04502
400V 50 Hz	5%	RL-00102	RL-00102	RL-00203	RL-00203	RL-00203	RL-00404	RL-00404	RL-00804	RL-01203	RL-01203	RL-01803	RL-02503	RL-03503	RL-04503	RL-04503
480V 60 Hz	3%	RL-00103	RL-00103	RL-00104	RL-00201	RL-00201	RL-00402	RL-00402	RL-00803	RL-01202	RL-01802	RL-02502	RL-03502	RL-03502	RL-04502	
480V 60 Hz	5%	RL-00102	RL-00102	RL-00103	RL-00202	RL-00202	RL-00403	RL-00403	RL-00803	RL-01203	RL-01803	RL-02503	RL-03503	RL-03503	RL-04503	
600V 60 Hz	3%	RL-00102	RL-00102	RL-00103	RL-00202	RL-00202	RL-00201	RL-00403	RL-00402	RL-00803	RL-01202	RL-01202	RL-01802	RL-02502	RL-02502	RL-03502
600V 60 Hz	5%	RL-00101	RL-00101	RL-00102	RL-00203	RL-00203	RL-00202	RL-00404	RL-00404	RL-00804	RL-01203	RL-01203	RL-01803	RL-02503	RL-03503	RL-03503

Input Voltage & Hz	% Impedance	40.0 HP 30.0 kw	50.0 HP 37.5 kw	60.0 HP 45.0 kw	75.0 HP 55.0 kw	100.0 HP 75.0 kw	125.0 HP 93.0 kw	150.0 HP 112.0 kw	200.0 HP 150.0 kw	250.0 HP 187.0 kw	300.0 HP 225.0 kw	350.0 HP 262.0 kw	400.0 HP 300.0 kw	500.0 HP 375.0 kw	600.0 HP 450.0 kw	700.0 HP 550.0 kw
Three Phase Input or Output Applications Selected by Motor																
208V 60 Hz	3%	RL-13001	RL-16001	RL-20001B14	RL-25001B14	RL-32001B14	RL-50001B14	RL-50001B14	RL-60001	RL-75001	RL-85001B14	RL-100001B14	RL-120001B14	RL-140001		
208V 60 Hz	5%	RL-13001	RL-16001	RL-20002B14	RL-25002B14	RL-32001B14	RL-50002	RL-50002	RL-60001	RL-75002	RL-85001B14	RL-100002B14	RL-120002B14	RL-140001		
240V 60 Hz	3%	RL-13001	RL-13001	RL-16001	RL-20001B14	RL-25001B14	RL-32001B14	RL-40001B14	RL-50001B14	RL-60001	RL-75001	RL-85001B14	RL-100001B14	RL-120001B14		
240V 60 Hz	5%	RL-13002	RL-13001	RL-16002	RL-20002B14	RL-25002B14	RL-32002B14	RL-40002B14	RL-50002	RL-60002	RL-75002	RL-85002B14	RL-100002B14	RL-120002B14		
400V 50 Hz	3%	RL-08502	RL-08002	RL-13002	RL-13002	RL-16002	RL-20002B14	RL-25002B14	RL-32002B14	RL-40002B14	RL-40002B14	RL-50002	RL-60002	RL-75002	RL-90002B14	RL-100002B14
400V 50 Hz	5%	RL-08503	RL-08003	RL-13003	RL-13003	RL-16003	RL-20003B14	RL-25003B14	RL-32003B14	RL-40003B14	RL-40003B14	RL-50003	RL-60003	RL-75003	RL-90003B14	RL-100003B14
480V 60 Hz	3%	RL-08502	RL-08002	RL-08002	RL-13002	RL-13002	RL-16002	RL-20002B14	RL-25002B14	RL-32002B14	RL-40002B14	RL-40002B14	RL-50002	RL-50002	RL-60002	RL-75002	RL-85002B14
480V 60 Hz	5%	RL-08503	RL-08003	RL-08003	RL-13003	RL-13003	RL-16003	RL-20003B14	RL-25003B14	RL-32003B14	RL-40003B14	RL-40003B14	RL-50003	RL-60003	RL-75003	RL-85003B14
600V 60 Hz	3%	RL-08502	RL-08002	RL-08002	RL-08002	RL-13002	RL-13002	RL-16002	RL-20002B14	RL-25002B14	RL-32002B14	RL-40002B14	RL-40002B14	RL-50002	RL-60002	RL-75002
600V 60 Hz	5%	RL-08503	RL-08003	RL-08003	RL-08003	RL-13003	RL-13003	RL-16003	RL-20003B14	RL-25003B14	RL-32003B14	RL-40003B14	RL-40003B14	RL-50003	RL-60003	RL-75003

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Rev: 0	Device Tag: LLR1,2
Date: 4/13/2018	
By: TCC	Job Number: HBR7281
Manuf:. PNo: MTE: RL-00803	Page # 1/2

Open					
Open Part Number	Amps Rating	Inductance mh	Watts Loss	Open Weight (lbs.)	Size (in.) (H x W x D)
RL-00101	1	100	13,5	2,2	3,5 X 3,5 X 1,2
RL-00102	1	50	12,8	2,1	3,5 X 3,5 X 1,2
RL-00103	1	36	11,9	2,1	3,5 X 3,5 X 1,2
RL-00104	1	18	9,6	2	3,5 X 3,5 X 1,2
RL-00201	2	12	7,5	4	4,3 X 4,4 X 2,8
RL-00202	2	20	11,3	4	4,3 X 4,4 X 2,8
RL-00203	2	32	16	4	4,3 X 4,4 X 2,8
RL-00204	2	6	10,7	3	4,3 X 4,4 X 2,5
RL-00301	4	3	14,5	4	4,3 X 4,4 X 2,8
RL-00402	4	6,5	20	4	4,3 X 4,4 X 2,8
RL-00403	4	9	21	5	4,3 X 4,4 X 3,4
RL-00404	4	12	21	6	4,3 X 4,4 X 3,4
RL-00601	6	1,5	19,5	7	4,8 X 4,8 X 3
RL-00602	6	3	29	8	4,8 X 6,8 X 3
RL-00603	6	5	25,3	11	4,8 X 6,8 X 3,4
RL-00604	6	7,5	28	13	4,8 X 6,8 X 3,4
RL-01201	12	1,3	26	9	5 X 6 X 3,3
RL-01202	12	2,5	31	10	5 X 6 X 3,3
RL-01203	12	4,7	41	15	5 X 6 X 3,9
RL-01801	18	0,6	35	9	5,3 X 6 X 3,2
RL-01802	18	1,2	43	12	5,3 X 6 X 3,6
RL-01803	18	2,5	40	16	6,1 X 6,1 X 4
RL-02501	25	0,5	48	11	5,8 X 7,2 X 3,5
RL-02502	25	1,2	52	14	5,8 X 7,2 X 3,5
RL-02503	25	1,8	61	20	5,8 X 7,2 X 4,3
RL-03501	35	0,4	49	14	5,8 X 7,2 X 4
RL-03502	35	0,8	54	16	5,8 X 7,2 X 4
RL-03503	35	1,2	54	20	7,4 X 9 X 4,7
RL-04501	45	0,3	54	23	7,4 X 9 X 5,7
RL-04502	45	0,7	62	28	7,4 X 9 X 4,7
RL-04503	45	1,2	65	36	7,3 X 9 X 5,3
RL-05501	55	0,3	64	24	7,3 X 9 X 5,3
RL-05502	55	0,5	67	27	7 X 9 X 5,3
RL-05503	55	0,9	71	41	7 X 9 X 6
RL-07501	80	0,2	82	25	7,2 X 9 X 6,3
RL-07502	80	0,4	80	33	7,2 X 9 X 6,5
RL-07503	80	0,7	96	61	8,5 X 10,8 X 6,8
RL-10001	100	0,2	94	29	7,3 X 9 X 6,5
RL-10002	100	0,3	84	37	7,3 X 9 X 6,8
RL-10003	100	0,5	108	74	8,25 X 10,8 X 6,16
RL-13001	130	0,1	108	29	7 X 9 X 6,66
RL-13002	130	0,2	180	43	7,2 X 9 X 6,8
RL-13003	130	0,3	128	64	8,5 X 11 X 6,16

Open					
Open Part Number	Amps Rating	Inductance mh	Watts Loss	Open Weight (lbs.)	Size (in.) (H x W x D)
RL-16001	160	0,1	116	41	7,2 X 9 X 6,8
RL-16002	160	0,2	140	51	8,5 X 10,8 X 6
RL-16003	160	0,2	150	72	8,5 X 11,5 X 9
RL-20001B14	200	0,1	134	39	7,5 X 9 X 7,5
RL-20002B14	200	0,1	166	54	7,5 X 9 X 8,3
RL-20003B14	200	0,2	146	100	8,9 X 10,8 X 10
RL-25001B14	250	0	154	47	7,5 X 9 X 7
RL-25002B14	250	0,1	231	80	8,5 X 10,8 X 9
RL-25003B14	250	0,2	219	125	11,3 X 14,4 X 10,3
RL-32001B14	320	0	224	60	9 X 10,8 X 8,3
RL-32002B14	320	0,1	264	107	9 X 10,8 X 10
RL-32003B14	320	0,1	331	160	11,25 X 14,4 X 10,5
RL-40001B14	400	0	221	84	10 X 10,8 X 10
RL-40002B14	400	0,1	330	139	11,25 X 15 X 11,5
RL-40003B14	400	0,1	290	140	11,25 X 14,4 X 13,5
RL-50001B14	500	0	246	93	9 X 10,8 X 10,5
RL-50002	500	0,1	340	118	11,5 X 14,4 X 11,5
RL-50003	500	0,1	422	210	11,5 X 14,4 X 13,3
RL-60001	600	0	307	120	11,5 X 14,4 X 10
RL-60002	600	0	414	175	11,25 X 15,6 X 12
RL-60003	600	0,1	506	270	11,25 X 14,4 X 15
RL-75001	750	0	427	160	11,5 X 14,4 X 11
RL-75002	750	0	537	190	11,5 X 14,4 X 12,5
RL-75003	750	0	582	265	14,5 X 14,4 X 14
RL-85001B14	850	0	795	195	15,5 X 17,8 X 14,5
RL-85002B14	850	0	930	275	15,5 X 17,8 X 15,5
RL-85003B14	850	0	1130	315	15,5 X 17,8 X 17,5
RL-90001B14	900	0	800	200	16,8 X 17,8 X 12
RL-90002B14	900	0	1020	215	15,5 X 17,8 X 15,5
RL-90003B14	900	0	1345	315	15,8 X 17,8 X 17,1
RL-100001B14	1000	0	940	144	14,6 X 17,8 X 12,7
RL-100002B14	1000	0	1090	215	15,5 X 17,8 X 15,5
RL-100003B14	1000	0	1288	315	15,8 X 17,8 X 17,5
RL-120001B14	1200	0	950	195	15,5 X 17,8 X 14,5
RL-120002B14	1200	0	1130	275	15,9 X 17,8 X 17,8
RL-120003B14	1200	0	1550	390	15,4 X 17,4 X 18,3
RL-140001	1400	0	1235	500	17 X 22 X 22
RL-140002	1400	0	1523	525	17 X 19 X 19
RL-140003	1400	0	1680	650	17 X 22 X 22
RL-150001	1500	0	1432	535	17 X 22 X 22
RL-150002	1500	0	1691	575	17 X 16,9 X 16
RL-150003	1500	0	1815	900	17 X 22 X 22

19-045-022

ELEMECH INC.
630-499-7080 · www.elemechinc.com

Manuf.: . PNo: MTE: RL-00803	Rev: 0	Device Tag: LLR1,2	
	Date: 4/13/2018		
	By: TCC	Job Number: HBR7281	Page # 2/2

Pilot Light Devices
30.5 mm

Allen-Bradley

32-005-***

800 T ___ – P T ___ 16 G
a b c d e f g



a

Protection Rating	
Code	Description
T	Metal, Type 4/13
H	Plastic, Type 4/4X/13

b

Finger-Safe Guards	
Code	Description
Blank	No guards
C	Guards on terminals

c

800T Type 4/13	Description	800H Type 4/4X/13
Code		Code
P	Transformer (or dual input)	PR
Q	Full voltage/ Universal	QR

d

Lamp Test Options	
Code	Description
Blank	No test option
T	Push-to-test
D	Dual input — diode▲
DT	Dual input — transformer relay
Note: Push-to-test supplied with factory jumpered contact block.	

e

Illumination Options	
Code	Description
Blank	Incandescent
H	LED•

f

Voltage	
Transformer	
Code	Description
16	120V AC 50/60 Hz
26	240V AC 50/60 Hz
46	480V AC 50/60 Hz
56	600V AC 50/60 Hz
Full Voltage — Incandescent	
12	12V AC/DC
24	24V AC/DC
48	48V AC/DC
10	120V AC/DC
20	240V AC/DC
Universal — LED	
2	12…130V AC/DC
Dual Input	
16	120V AC
24	24V AC/DC (Dual input diode only)

g

Lens Color		
Code	Color	Glass Code ▲
Blank	No lens	Blank
A	Amber	D
B	Blue	E
C	Clear	F
G	Green	H
R	Red	J
W	White	K

Specifications•

Electrical Ratings		
Contact ratings		Refer to the contact ratings tables on page 10-4.
Dielectric strength		2200V for one minute, 1300V for one minute (Logic Reed)
Electrical design life cycles		1 000 000 at max. rated load, 200 000 at max. rated load (Logic Reed)
Mechanical Ratings		
Vibration		10…2000 Hz, 1.52 mm displacement (peak-to-peak) max./ 10 G max. (except Logic Reed)
Shock		1/2 cycle sine wave for 11 ms ≥ 25 G (contact fragility) and no damage at 100 G
Degree of protection		Type 1/4/12/13 (800T); Type 1/4/4X/12/13 (800H); EN/IEC 60529 IP66/65
Mechanical design life cycles		
Push buttons	(Momentary, non-illuminated)	10 000 000 min.
	(Momentary, illuminated)	250 000 min.
	(Push-pull/twist-to-release)	250 000 min.
Selector switches	(Non-illuminated)	1 000 000 min.
	(Illuminated, key-operated)	200 000 min.
Potentiometers		25 000 min.
All other devices		200 000 min.
Contact operation		Shallow, mini, and low-voltage contact blocks: Slow, double make and break Logic Reed and sealed switch contact blocks: Single break magnetic
Wire gauge/Terminal screw torque		#18…14 AWG (#18…10 Max Duty) / 6…8 lb•in
Typical operating forces		
Operators without contact blocks		Flush, extended button, standard mushroom, jumbo plastic mushroom: 2 lbs max. Jumbo and extended aluminum mushroom head: 3.95 lbs max. Maintained selector switch: 3.6 in•lb max.
Spring return selector switches		3.6 in•lb to stop, 0.2 in•lb to return
Illuminated push buttons and push-to-test pilot lights		5 lb max.
2-position push-pull		8.0 lb max. push or pull
3-position push-pull		8 lb max. push to in position or pull to center position (15 lb max. pull to out position)
Twist-to-release or push-pull		9 lbs max. push or pull 30 in•oz max. twist, 6 in•oz minimum return
Potentiometer		Rotational torque 3…12 in•oz; stopping torque 12 in•lb (minimum)
Contact blocks	Standard	1 lb
	Logic Reed	1 lb max.
	Sealed switch	3 lb max. at 0.205 in. plunger travel
	Stackable sealed switch	1 lb max.
	MaxDuty	1.4 lb max.
	PenTUFF	1.4 lb max.
	Self Monitoring	1.6 lb
Environment		
Temperature range	Operating	-40…+131 °F (-40…+55 °C)
	Storage	-40…+185 °F (-40…+85 °C)
Note: Operating temperatures below freezing are based on the absence of moisture and liquids. Consult your local Rockwell Automation sales office or Allen-Bradley distributor for use in lower temperature applications.		
Humidity		50…95% RH from 77…140 °F (25…60 °C) per Procedure IV of MIL-STD-810C, Method 507.1 cycling test

Certifications

UL Listed
(File No. E14840, E10314
Guide No. NKCR, NOIV)

CSA Certified
(File No. LR1234, LR11924)

CSA C22.2, No. 14

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Rev: 0
Date: 4/13/2018
By: TCC

Device Tag: LT2,4,8,10

Job Number: HBR7281

Page # 1/1

Manuf:. PNo: ALLEN-BRADLEY: 800H-QRTH2G

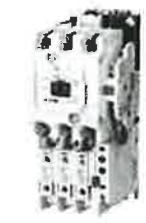
NEMA Contactors and Starters

Cutler-Hammer
EATON

22-018-003

Type AN16/AN56 NEMA—Manual or Automatic Reset Overload Relay—Non-Reversing and Reversing [1]

NEMA Size	Continuous Ampere Rating	Service-Limit Current Rating (Amperes) [1]	Maximum UL Horsepower [2] Single-Phase 115V	Single-Phase 230V	Three-Phase 208V	Three-Phase 240V	Three-Phase 480V	Three-Phase 600V	Three-Pole Non-Reversing [3] Catalog Number	Three-Pole Reversing [3] Catalog Number	Vertical Reversing [3] Catalog Number
00	9	11	1/3	1	1-1/2	1-1/2	2	2	AN16AN0_C	AN56AN0_C	—
0	18	21	1	2	3	3	5	5	AN16BN0_C	AN56BN0_C	AN56BNV0_
1	27	32	2	3	7-1/2	7-1/2	10	10	AN16DN0_B	AN56DN0_B	AN56DNV0_
2	45	52	3	7-1/2	10	15	25	25	AN16GN0_B	AN56GN0_B	AN56GNV0_
3	90	104	—	—	25	30	50	50	AN16KN0_	AN56KN0_	AN56KNV0_
4	135	156	—	—	40	50	100	100	AN16NN0_	AN56NN0_	AN56NNV0_
5	270	311	—	—	75	100	200	200	AN16SN0_B	AN56SN0_B	—
6	540	621	—	—	150	200	400	400	AN16TN0_C	AN56TN0_C	—
7	810	932	—	—	200	300	600	600	AN16UN0_B	AN56UN0_B	—
8 [4]	1215	1400	—	—	400	450	900	900	AN16VN0_B	AN56VN0_B	—





NEMA Size	00	0	1	2	3	4	5	6	7	8
Horsepower	1-1/2	5	10	25	50	75	150	300	600	900

AC Suffix

Coil Volts and Hertz	Code Suffix
120/60 or 110/50	A
240/60 or 220/50	B
480/60 or 440/50	C
600/60 or 550/50	D
208/60	E
277/60	H
208–240/60 [5]	J
240/50	K

Coil Volts and Hertz	Code Suffix
380–415/50	L
550/50	N
24/60, 24/50 [7]	T
24/50	U
32/50	V
48/60	W
48/50	Y
48/50	Y

Technical Data and Specifications

Wire (75°C) Sizes—AWG or kcmil—NEMA Sizes 00–2—Open and Enclosed

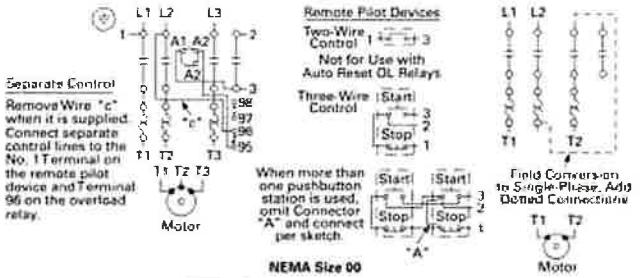
NEMA Size	Wire Size [1] Cu Only
Power Terminals—Line	
00	12–16 AWG stranded, 12–14 AWG solid
0	8–16 AWG stranded, 10–14 AWG solid
1	8–14 AWG stranded or solid
2	3–14 AWG (upper) and/or 5–14 AWG (lower) stranded or solid [6]
Power Terminals—Load—Cu Only (stranded or solid)	
00–0	14–6 AWG stranded or solid
1–2	14–2 AWG stranded or solid
Control Terminals—Cu Only	
12–16 AWG stranded, 12–14 AWG solid	

Standards and Certifications

- Meets UL 508 single-phasing requirements
- UL listed, CSA certified and NEMA compliance

UL Listed CSA

Three-Phase and Single-Phase Applications



Freedom Series

Auxiliary Contacts

Cutler-Hammer
EATON

22-018-007

Contact Configuration Code

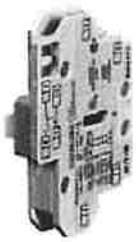
This two-digit code is found on the auxiliary contact to assist in identifying the specific contact configuration. The first digit indicates the quantity of NO contacts and the second indicates the quantity of NC contacts.

NEMA Sizes 00–2—IEC Sizes A–K

The auxiliary contacts listed on this page are designed for installation on Freedom Series starters and contactors. Snap-on design facilitates quick, easy installation.

These bifurcated design contact blocks, featuring silver cadmium alloy contacts, are well suited for use in very low energy (logic level) circuits.

Side Mounted



Top Mounted



Side Mounted

1NO	10	**C320KGS1**
1NC	01	**C320KGS2**
1NO-1NC	11	**C320KGS3**
2NO	20	**C320KGS4**
2NC	02	**C320KGS5**
1NO-1NCI	N/A	**C320KGS6**
1NO (EC)-1NC (LO)	N/A	**C320KGS7**
1NCI	N/A	**C320KGS8**

Top Mounted

1NO	10	**C320KGT1**
1NC	01	**C320KGT2**
1NO-1NC	11	**C320KGT3**
2NO	20	**C320KGT4**
2NC	02	**C320KGT5**
1NO-1NCI	N/A	**C320KGT6**
1NO (EC)-1NC (LO)	N/A	**C320KGT7**
1NCI	N/A	**C320KGT8**
3NO	30	**C320KGT9**
2NO-1NC	21	**C320KGT10**
1NO-2NC	12	**C320KGT11**
3NC	03	**C320KGT12**
4NO	40	**C320KGT13**
3NO-1NC	31	**C320KGT14**
2NO-2NC	22	**C320KGT15**
1NO-3NC	13	**C320KGT16**
4NC	04	**C320KGT17**
3NO-1NCI	N/A	**C320KGT18**
2NO-1NCI-1NC	N/A	**C320KGT19**
2NO-1NO (EC)-1NC (LO)	N/A	**C320KGT20**
1NO-1NC-1NO (EC)-1NC (LO)	N/A	**C320KGT21**

Auxiliary Contact Ratings (Amperes)

Ratings—NEMA A600

Current	AC Volts 120V
Make and interrupting	60
Break	6
Continuous	10

UL listed: UL File #E1491, Guide #NLDX—Open and NEMA 1, 4, 12 Enclosed

CSA Certified: CSA File #LR353, Class #321104 Open and NEMA 1 Enclosed

GV2 Manual Starter and Protector

Schneider Electric

23-058-***



GV2P21 with
GV2GH7 installed

Table 47: GV2 Manual Motor Controller and Protector Horsepower Ratings

Catalog Number		Thermal Trip Setting Range (A)	Maximum Horsepower Ratings						
			1 Ø			3 Ø			
Push Button GV2ME [1]	Rotary Handle GV2P		120 V	208 V	240 V	208 V	240 V	480 V	600 V [2]
GV2ME01	GV2P01	0.11–0.16	—	—	—	—	—	—	—
GV2ME02	GV2P02	0.016–0.25	—	—	—	—	—	—	—
GV2ME03	GV2P03	0.25–0.40	—	—	—	—	—	—	—
GV2ME04	GV2P04	0.40–0.63	—	—	—	—	—	—	—
GV2ME05	GV2P05	0.63–1	—	—	—	—	—	—	—
GV2ME06	GV2P06	1–1.6	—	—	0.1	—	—	0.75	0.75
GV2ME07	GV2P07	1.6–2.5	—	0.16	0.16	0.5	0.5	1	1.5
GV2ME08	GV2P08	2.5–4	0.125	0.25	0.33	0.75	0.75	2	3
GV2ME10	GV2P10	4–6.3	0.25	0.5	0.5	1	1.5	3	5
GV2ME14	GV2P14	6–10	0.5	1	1.5	2	3	5	7.5
GV2ME16	GV2P16	9–14	0.75	2	2	3	3	10	10
GV2ME20	GV2P20	13–18	1	2	3	5	5	10	15
GV2ME21	GV2P21	17–23	1.5	3	3	5	7.5	15	20
GV2ME22	GV2P22	20–25	2	3	—	7.5	—	15	20
GV2ME32 [3]	GV2P32	24–32	2	5	5	7.5	10	20	25

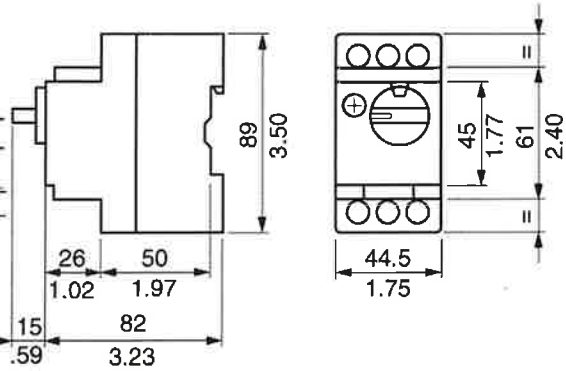
Additional GV2 Wiring Accessories

Description	Application	Sold in Lots of	Catalog Number	Weight, lb (kg)
Incoming line insulator	For GV2P when used in UL 508 Type E applications	10	GV2GH7	0.09 (0.040)

Table 55: Accessories for GV3P

Description	For Manual Motor Controllers	Catalog Number	Weight lb (kg)
Cover, large spacing, UL 508 Type E (only one cover is required on the supply side)	GV3P••	GV3G66 [1]	0.44 (0.02)

Product certifications: CCC, UL, DNV, GL, EAC, CSA, RINA, BV, ATEX

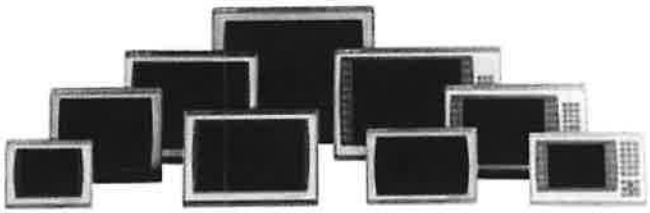


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Rev: 0	Device Tag: MSP1,2
Date: 4/13/2018	
By: TCC	Job Number: HBR7281
Manuf:. PNo: SQUARE D: GV2P14	Page # 1/1

PanelView Plus 7 Performance Terminals

Allen-Bradley



cULus Listed Industrial Control Equipment for use in Hazardous Locations (E103314) per standards ANSI / ISA 12.12.01 and CSA C22.2 No. 213, rated:
- Class I, Div 2, Groups A, B, C, D

Enclosure type ratings per UL50 and CSA C22.2 No. 94.2-07.
Enclosure ingress protection classified by UL per IEC 60529

26-005-071

Attribute	7-in. Touch		7-in. Touch with Keypad		9-in. Touch	
	2711P--T7C22D9P	2711P-T7C22A9P	2711P-B7C22D9P	2711P-B7C22A9P	2711P-T9W22D9P	2711P-T9W22A9P
Operator input	Touch		Touch with keypad		Touch	
Display type	TFT Color					
Display size, diagonal	6.5 in.				9 in. widescreen	
Viewing area (WxH)	132 x 99 mm				196 x 118 mm	
Display resolution	640 x 480 VGA, 18-bit color graphics				800 x 480 WVGA, 18-bit color graphics	
Aspect ratio	4:3				5:3	
Brightness, typical	300 cd/m^2 (Nits)					
Backlight life	White LED, solid-state Life: 50,000 h min at 40° C to half-brightness, backlight is not replaceable					
Touch screen	Analog resistive Actuation rating: 1 million presses Operating force: 100 grams					
Battery (real-time clock backup)	Accuracy: +/- 2 minutes per month. Battery life: 4 years min at 25 °C (77 °F) Replacement: CR2032 lithium coin cell					
Memory System User	 1 GB 512 MB					
Secure Digital (SD) card slot	One SD card slot for external storage; supports cat. no. 1784-SDx cards					
USB ports Host Device	 Two USB high-speed 2.0 host ports (type A) support removable flash drives for external storage One high-speed 2.0 device port (type B) which will be functional in a future release					
Operating system	Windows CE with Extended Features and MS Office Viewers (includes FTP, VNC client server, ActiveX controls, PDF reader, third-party device support)					
Ethernet ports	Two 10/100Base-T, Auto MDI/MDI-X Ethernet ports that support (device-level ring) DLR, linear, or star network topologies					
Software	FactoryTalk View Studio for Machine Edition, FactoryTalk ViewPoint, version 2.6 or later					
Electrical						
Input voltage	24V DC nom (18…30V DC)	100…240V AC	24V DC nom (18…30V DC)	100…240V AC	24V DC nom (18…30V DC)	100…240V AC
Power consumption	50 W max (2.1 A at 24V DC)	105VA	50 W max (2.1 A at 24V DC)	105VA	50 W max (2.1 A at 24V DC)	105VA
Power supply	Supports (SELV) and (PELV) 24V DC supplies[1]	—	Supports (SELV) and (PELV) 24V DC supplies[1]	—	Supports (SELV) and (PELV) 24V DC supplies[1]	—
Mechanical						
Weight, approx	1.2 kg (2.65 lb)		1.47 kg (3.25 lb)		1.58 kg (3.48 lb)	
Dimensions, (HxWxD), approx	170 x 212 x 69.6 mm 6.69 x 8.35 x 2.74 in.		179 x 285 x 69.6 mm 7.05 x 11.22 x 2.74 in.		190 x 280 x 69.6 mm 7.48 x 11.02 x 2.74 in.	
Cutout dimensions, (HxW), approx	142 x 184 mm 5.59 x 7.24 in.		142 x 237 mm 5.59 x 9.33 in.		162 x 252 mm 6.38 x 9.92 in.	

ELEMECH INC.
630-499-7080 · www.elemechinc.com

Rev: 0
Date: 4/13/2018
By: TCC

Device Tag: OIU1

Job Number: HBR7281

Page # 1/3

Manuf:. PNo:
ALLEN BRADLEY: 2711P-T10C22D9P

Attribute	10-in. Touch		10-in. Touch with Keypad		12-in. Touch	
	2711P-T10C22D9P	2711P-T10C22A9P	2711P-B10C22D9P	2711P-B10C22A9P	2711P-T12W22D9P	2711P-T12W22A9P
Operator input	Touch		Touch with keypad		Touch	
Display type	TFT Color					
Display size, diagonal	10.4-in.				12.1-in.	
Viewing area (WxH)	211 x 158 mm				261 x 163 mm	
Display resolution	800 x 600 SVGA, 18-bit color graphics				1280 x 800 WXGA, 18-bit color graphics	
Aspect ratio	4:3				16:10	
Brightness, typical	300 cd/m^2 (Nits)					
Backlight life	White LED, solid-state Life: 50,000 h min at 40° C to half-brightness, backlight is not replaceable					
Touch screen	Analog resistive Actuation rating: 1 million presses Operating force: 100 grams					
Battery (real-time clock backup)	Accuracy: +/-2 minutes per month. Battery life: 4 years min at 25 °C (77 °F) Replacement: CR2032 lithium coin cell					
Memory System User	1 GB 512 MB					
Secure Digital (SD) card slot	One SD card slot for external storage; supports cat. no. 1784-SDx cards					
USB ports Host Device	Two USB high-speed 2.0 host ports (type A) support removable flash drives for external storage One high-speed 2.0 device port (type B) which will be functional in a future release					
Operating system	Windows CE with Extended Features and MS Office Viewers (includes FTP, VNC client server, ActiveX controls, PDF reader, third-party device support)					
Ethernet ports	Two 10/100Base-T, Auto MDI/MDI-X Ethernet ports that support (device-level ring) DLR, linear, or star network topologies					
Software	FactoryTalk View Studio for Machine Edition, FactoryTalk ViewPoint, version 2.0 or later					
Electrical						
Input voltage	24V DC nom (18…30V DC)	100…240V AC	24V DC nom (18…30V DC)	100…240V AC	24V DC nom (18…30V DC)	100…240V AC
Power consumption	50 W max (2.1 A at 24V DC)	105VA	50 W max (2.1 A at 24V DC)	105VA	50 W max (2.1 A at 24V DC)	105VA
Power supply	Supports (SELV) and (PELV) 24V DC supplies[1]	—	Supports (SELV) and (PELV) 24V DC supplies[1]	—	Supports (SELV) and (PELV) 24V DC supplies[1]	—
Mechanical						
Weight, approx	2.28 kg (5.03 lb)		2.58 kg (5.69 lb)		2.54 kg (5.60 lb)	
Dimensions, (HxWxD), approx	252 x 297 x 69.6 mm 9.92 x 11.69 x 2.74 in.		252 x 385 x 69.6 mm 9.92 x 15.16 x 2.74 in.		240 x 340 x 69.6 mm 9.69 x 13.39 x 2.74 in.	
Cutout dimensions, (HxW), approx	224 x 269 mm 8.82 x 10.59 in.		224 x 335 mm 8.82 x 13.19 in.		218 x 312 mm 8.58 x 12.28 in.	

26-005-071

Attribute	15-in. Touch		15-in. Touch with Keypad		19-in. Touch	
	2711P-T15C22D9P	2711P-T15C22A9P	2711P-B15C22D9P	2711P-B15C22A9P	2711P-T19C22D9P	2711P-T19C22A9P
Operator input	Touch		Touch with keypad		Touch	
Display type	TFT Color					
Display size, diagonal	15-in.				19-in.	
Viewing area (WxH)	304 x 228 mm				376 x 301 mm	
Display resolution	1024 x 768 XGA, 18-bit color graphics				1280 x 1024 SXGA, 18-bit color graphics	
Aspect ratio	4:3				5:4	
Brightness, typical	300 cd/m^2 (Nits)					
Backlight life	White LED, solid-state Life: 50,000 h min at 40° C to half-brightness, backlight is not replaceable					
Touch screen	Analog resistive Actuation rating: 1 million presses Operating force: 100 grams					
Battery (real-time clock backup)	Accuracy: +/-2 minutes per month. Battery life: 4 years min at 25 °C (77 °F) Replacement: CR2032 lithium coin cell					
Memory System User	 1 GB 512 MB					
Secure Digital (SD) card slot	One SD card slot for external storage; supports cat. no. 1784-SDx cards					
USB ports Host Device	 Two USB high-speed 2.0 host ports (type A) support removable flash drives for external storage One high-speed 2.0 device port (type B) which will be functional in a future release					
Operating system	Windows CE with Extended Features and MS Office Viewers (Includes FTP, VNC client server, ActiveX controls, PDF reader, third-party device support)					
Ethernet ports	Two 10/100Base-T, Auto MDI/MDI-X Ethernet ports that support (device-level ring) DLR, linear, or star network topologies					
Software	FactoryTalk View Studio for Machine Edition, FactoryTalk ViewPoint, version 2.6 or later					
Electrical						
Input voltage, DC	24V DC nom (18…30V DC)	100…240V AC	24V DC nom (18…30V DC)	100…240V AC	24V DC nom (18…30V DC)	100…240V AC
Power consumption, DC	50 W max (2.1 A at 24V DC)	105VA	50 W max (2.1 A at 24V DC)	105VA	50 W max (2.1 A at 24V DC)	105VA
Power supply	Supports (SELV) and (PELV) 24V DC supplies[1]	—	Supports (SELV) and (PELV) 24V DC supplies[1]	—	Supports (SELV) and (PELV) 24V DC supplies[1]	—
Mechanical						
Weight, approx	3.69 kg (8.14 lb)		4.14 kg (9.13 lb)		5.62 kg (12.40 lb)	
Dimensions, (HxWxD), approx	318 x 381 x 69.6 mm 12.52 x 15.00 x 2.74 in		329 x 484 x 69.6 mm 12.95 x 19.06 x 2.74 in		411 x 485 x 69.6 mm 16.18 x 19.09 x 2.74 in	
Cutout dimensions, (HxW), approx	290 x 353 mm 11.42 x 13.90 in		290 x 418 mm 11.42 x 16.46 in		383 x 457 mm 15.08 x 17.99 in	

Environmental Specifications

Temperature, operating[1]	0…55 °C (32…131 °F)
Temperature, nonoperating	-25…70 °C (-13…158 °F)
Relative humidity	5…95% without condensation
Vibration	0.012 peak, 10…57 Hz 2g peak at 57…500 Hz[2]
Shock, operating	15 g at 11 ms
Shock, nonoperating	30 g at 11 ms
Enclosure ratings	NEMA and UL Type 12, 13, 4X, also rated IP66 as Classified by UL

(1) The 19-inch terminals (2711P-T19C22D9P and 2711P-T19C22A9P) are rated up to 50 °C (122 °F) operating temperature.

(2) Typical BTU measurements were taken at 25 °C.

Heat dissipation[2]

7 in. DC (both touch only and combo), 51 BTU (typ)
7 in. AC (both touch only and combo), 53 BTU (typ)
9 in. DC, 55 BTU (typ)
9 in. AC, 58 BTU (typ)
10 in. DC (both touch only and combo), 51 BTU (typ)
10 in. AC (both touch only and combo), 56 BTU (typ)
12 in. DC, 60 BTU (typ)
12 in. AC, 67 BTU (typ)
15 in. DC (both touch only and combo), 61 BTU (typ)
15 in. AC (both touch only and combo), 68 BTU (typ)
19 in. DC, 114 BTU (typ)
19 in. AC, 119 BTU (typ)

26-005-071

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Rev: 0
Date: 4/13/2018
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Device Tag: OIU1
Job Number: HBR7281
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Manuf:. PNo:
ALLEN BRADLEY: 2711P-T10C22D9P

NEMA Contactors and Starters

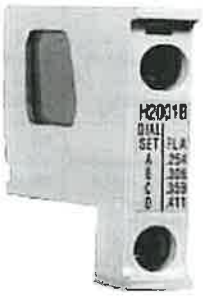
Freedom Series

Standards and Certifications

- Meets UL 508 single-phasing requirements
- UL listed, CSA certified and NEMA compliance

EATON
Powering Business Worldwide

28-018-009



Heater Pack Selection

Heater packs H2001B to H2017B and H2101B to H2117B are to be used only with Series B overload relays Catalog Numbers C306DN3B (Part No. 10-7016) and C306GN3B (Part No. 10-7020). The load lugs are built into the overload relay base to allow load wiring prior to heater pack installation. The previous heater design had integral load lugs. The Series B heater packs are electrically equivalent to the previous heater design. Heaters H2018-3 to H2024-3 have not changed.

Starters with Series B Overload Relays [1]

NEMA—AN Type		IEC—AE Type	
Size	**Series**	**Size**	**Series**
00–0	**C**	A–F	**C**
1–2	**B**	G–K	**B**
5	**B**	G–K	**B**
6	**C**	G–K	**B**
7–8	**B**	G–K	**B**

Standard Trip—Class 20 Heater

	Motor Full Load Ampere Rating Dial Position				
Overload Relay Size	**A**	**B**	**C**	**D**	**Catalog Number [2]**
For Use with NEMA Sizes 00–0 Series C, NEMA Sizes 1–2 Series B; IEC Sizes A–F Series C, IEC Sizes G–K Series B					
32A or 75A	0.254	0.306	0.359	0.411	**H2001B-3**
	0.375	0.452	0.530	0.607	**H2002B-3**
	0.560	0.676	0.791	0.907	**H2003B-3**
	0.814	0.983	1.15	1.32	**H2004B-3**
	1.20	1.45	1.71	1.96	**H2005B-3**
	1.79	2.16	2.53	2.90	**H2006B-3**
	2.15	2.60	3.04	3.49	**H2007B-3**
	3.23	3.90	4.56	5.23	**H2008B-3**
	4.55	5.50	6.45	7.40	**H2009B-3**
	6.75	8.17	9.58	11.0	**H2010B-3**
	9.14	10.8	12.4	14.0	**H2011B-3**
	14.0	16.9	19.9	22.8	**H2012B-3**
	18.7	22.7	26.7	30.7	**H2013B-3**
	23.5	28.5	33.5	38.5	**H2014B-3**
For Use with NEMA Size 2, IEC Sizes G–K Only, Series B					
75A	29.0	34.0	39.1	44.1	**H2015B-3**
	39.6	45.5	51.5	57.4	**H2016B-3**
	53.9	60.9	67.9	74.9	**H2017B-3**

Notes

[1] The series of a starter is the last digit of the listed catalog number. Example: AN16DN0AB.

[2] Heater packs are shipped three to a carton. catalog numbers are for three heater packs.

Bulletin 800T/H

30.5 mm Push Buttons

Emergency Stop Operators

Allen-Bradley

29-005-117

2-Position Red Trigger Action Twist-to-Release, Non-Illuminated

- Tamper resistant – front-of-panel mounting and non-removable operator head
- Compliant with global E-stop standards, including EN ISO 13850 and EN 60947-5-5



Cat. No. 800T-TFXJET6



Cat. No. 800T-TFXLET6



Cat. No. 800T-TFXK6



Cat. No. 800H-TFRXT6

Contact Type	Operator Position: Out	Operator Position: In	Type 4/13: 45 mm Plastic	Type 4/13: 63 mm Metal	Type 4/13: Key Release	Type 4/4X/13: 45 mm Plastic
			Cat. No.•※‡	Cat. No.•§	Cat. No.•▲	Cat. No.•※‡
No contacts	—	—	**800T-TFXT6**	**800T-TFXLT6**	**800T-TFXK6**	**800H-TFRXT6**
1 N.C.	X	O	800T-TFXT6D2	800T-TFXLT6D2	800T-TFXK6D2	800H-TFRXT6D2
1 N.O. - 1 N.C.	O X	X O	**800T-TFXT6A**	800T-TFXLT6A	**800T-TFXK6A**	**800H-TFRXT6A**
1 S.M.C.B.▪	X	O	800TC-TFXT6D4S	800TC-TFXLT6D4S	800TC-TFXK6D4S	800HC-TFRXT6D4S

• For finger-safe contact block terminals, add a **C** to the cat. no. Example: Cat. No. 800T**C**-TFXT6 or 800H**C**-TFRXT6.
※ To order a device with a jumbo (60 mm) plastic head add the letter **J** after **X**. Example: Cat. No. 800T-TFX**J**T6A or 800H-TFRX**J**T6A.
† To order a jumbo head device with "E-STOP" printed on the cap add the letters **JE** after **X**. Example: Cat. No. 800T-TFX**JE**T6 or 800H-TFRX**JE**T6.
§ To order a device with "E-STOP" engraved on the cap add the letter **E** after **L**. Example: Cat. No. 800TC-TFX**LE**T6D4S.
▲ Provided with two DO18 keys.
▪ Self-monitoring contact block.

Standards Compliance

UL 508

CCC

Certifications

UL Listed
(File No. E14840, E10314
Guide No. NKCR, NOIV)

CSA Certified
(File No. LR1234, LR11924)

CSA C22.2, No. 14

EN/IEC: 60947-5-1

800 T — – T FX T 6 D2
a b c d e

a

Protection Rating	
Code	**Description**
T	Metal, Type 4/13
H	Plastic, Type 4/4X/13

b

Finger-Safe Guards	
Code	**Description**
Blank	No guards
C	Guards on terminals

c

Head Type‡		
800T Type 4/13 Code	Description	800H Type 4/4X/13 Code
FX	Standard (45 mm) mushroom head	FRX
FXJ	Jumbo (60 mm) mushroom head	FRXJ
FXJE	Jumbo (60 mm) mushroom head with "E-STOP"	FRXJE
FXK	45 mm mushroom head key release	—
FXL	63 mm anodized aluminum head	—
FXLE	63 mm anodized aluminum head with "E-STOP"	—

d

Release Function	
Code	**Color**
Blank	Key release⌘
T	Twise release

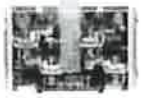
Note: X = Closed/O = Open
⌘ Configurable only with **FXK** head type.

e

Contact Block(s)			
Code	Operator Position: Out	Operator Position: In	Description
Blank	—	—	No contacts on operator
Standard			
D1	O	X	1 N.O.
D2	X	O	1 N.C.
D4	X	O	1 N.C.L.B.
A	O X	X O	1 N.O. - 1 N.C.
A1	O X	X O	1 N.O. - 1 N.C.L.B.
A5	X X	O O	2 N.C.L.B.
Pen*TUFF* (Low Voltage)			
D1V	O	X	1 N.O.
D2V	X	O	1 N.C.
D4V	X	O	1 N.C.L.B.
AV	O X	X O	1 N.O. - 1 N.C.
Class 1, Div. 2/Zone 2			
Logic Reed			
D1R	O	X	1 N.O.
D2R	X	O	1 N.C.
AR	O X	X O	1 N.O. - 1 N.C.
Sealed Switch			
D1P	O	X	1 N.O.
D2P	X	O	1 N.C.
AP	O X	X O	1 N.O. 1 N.C.
Stackable Sealed Switch			
D1Y	O	X	1 N.O.
D2Y	X	O	1 N.C.
AY	O X	X O	1 N.O. - 1 N.C.

Allen-Bradley

02-005-002


Shallow Block


PenTUFF™ (Low Voltage) Contact Block


Logic Reed Block


Sealed Switch Block


Stackable Sealed Switch Block

Contact Type	Shallow Block+*		PenTUFF (Low Voltage) Block+*		Logic Reed Block‡		Sealed Switch Block‡		Stackable Sealed Switch Block‡	
	Cat. No.	Code	Cat. No.	Code	Cat. No.	Code	Cat. No.	Code	Cat. No.	Code
1 N.O.	800T-XD1	D	800T-XD1V	H	800T-XD1R	V	800T-XD1P	R	800T-XD1Y	5
1 N.C.	800T-XD2	E	800T-XD2V	U	800T-XD2R	W	800T-XD2P	S	800T-XD2Y	6
1 N.O.E.M.	800T-XD3	G	800T-XD3V	I	—	—	—	—	—	—
1 N.C.L.B.	800T-XD4	J	800T-XD4V	O	—	—	—	—	—	—
1 N.O. - N.C.	800T-XA	A	800T-XAV	F	800T-XAR	T	800T-XAP	P	800T-XAY	7
2 N.O.	800T-XA2§	M	—	—	800T-XA2R§	Y	—	—	800T-XA2Y	8
2 N.C.	800T-XA4	N	—	—	800T-XA4R	Z	—	—	800T-XA4Y	9
1 N.C.L.B. - 1 N.O.	800T-XA1	B	—	—	—	—	—	—	—	—
1 N.C.L.B. - 1 N.C.	800T-XA7	C	—	—	—	—	—	—	—	—

Note: Modular suffix codes can be used when specifying selector switches with multiple contact blocks.

PenTUFF™ (Low Voltage) Contact Ratings

Minimum DC: 5V, 1 mA
Maximum thermal continuous current I_{th} 2.5 A AC/1.0 A DC. Bulletin 800T units with 800T-XAV contacts have ratings as follows:

Max. Opertnl. Volts U_e	Utilization Category		Rated Operational Currents		
	IEC	NEMA	Volts U_e	Make	Break
AC 300	AC-15	C300	120...300 0...120	1800VA 15 A	180VA 1.5 A
DC 150	DC-13	R150	24...150 0...24	28VA 1.0 A	

Stackable Sealed Switch Contact Ratings

Minimum: 5V, 10 mA (digital); 24V, 1 mA (analog)

Maximum continuous current I_{th} 2.5 A. Bulletin 800T units have control circuit ratings with sealed switch contact blocks as follows:

Max. Opertnl. Volts U_e	Utilization Category		Rated Operational Currents		
	IEC	NEMA	Volts U_e	Make	Break
AC 300	AC-15	C300	120...300 0...120	1800VA 15 A	180VA 1.5 A
DC 150	DC-13	Q150	24...150 0...24	69VA 2.5 A	

MaxDuty Contact Rating

Maximum thermal continuous current I_{th} 24 A.
Pilot Duty — 120V AC, 12 A; 24V DC, 10 A
Motor Ratings — 120V AC, 1.5 Hp; 240V AC, 3 Hp; 24V DC, 10 A FLA/60 A LRA

Logic Reed Contact Ratings

Minimum — DC: 5V, 1 mA
Maximum — DC: 30V, 0.06 A, AC: 150V, 0.15 A
Should only be used with resistive loads.

Product Certifications

Certifications	UR/UL, CSA, CCC, CE
Standards Compliance — CE Marked	NEMA ICS-5; UL 508, EN ISO 13850, EN 60947-1, EN 60947-5-1, EN 60947-5-5

30.5 mm Push Buttons

Allen-Bradley

29-005-002

800 T ___ – A 1 ___ A
a b c d e f



a

Protection Rating	
Code	Description
T	Metal, Type 4/13
H	Plastic, Type 4/4X/13

b

Finger-Safe Guards	
Code	Description
Blank	No guards
C	Guards on terminals

c

Operator Type		
800T Type 4/13	Description	800H Type 4/4X/13
Code		Code
A	Flush head	AR
B	Extended head	BR
D	Mushroom head	DR
DX	Mushroom head less color cap	DRX
—	Bootless guarded head	GR
—	Booted head	R•

d

Color Cap	
Code	Description
Blank	Used only when ordering Operator Type DX/DRX
1	Green
2	Black
3	Orange•

Color Cap	
Code	Description
4	Grey•
5	White•
6	Red
7	Blue
9	Yellow

e

Special Mushroom Head	
Code	Description
J§	Jumbo mushroom head — plastic
L§	Jumbo mushroom head — metal

Note: Special mushroom head options only apply to mushroom head operator type code D/DR (Table c).

f

Contact Block(s)	
Code	Description
Blank	No contacts
Standard	
D1	1 N.O.
D2	1 N.C.
D3	1 N.O.E.M.
D4	1 N.C.L.B.
D5	1 N.O. (Mini)
D6	1 N.C. (Mini)
A1	1 N.C.L.B. - 1 N.O.
A2	2 N.O.‡
A4	2 N.C.
A7	1 N.C.L.B. - 1 N.C.
A	1 N.O. - 1 N.C.
B	2 N.O. - 2 N.C.

Certifications

UL Listed
(File No. E14840, E10314
Guide No. NKCR, NOIV)

CSA Certified
(File No. LR1234, LR11924)

CSA C22.2, No. 14

Specifications-

Electrical Ratings		
Contact ratings		Refer to the contact ratings tables on page 10-4.
Dielectric strength		2200V for one minute, 1300V for one minute (Logic Reed)
Electrical design life cycles		1 000 000 at max. rated load, 200 000 at max. rated load (Logic Reed)
Mechanical Ratings		
Vibration		10...2000 Hz, 1.52 mm displacement (peak-to-peak) max./ 10 G max. (except Logic Reed)
Shock		1/2 cycle sine wave for 11 ms ≥ 25 G (contact fragility) and no damage at 100 G
Degree of protection		Type 1/4/12/13 (800T); Type 1/4/4X/12/13 (800H); EN/IEC 60529 IP66/65
Mechanical design life cycles		
Push buttons	(Momentary, non-illuminated)	10 000 000 min.
	(Momentary, illuminated)	250 000 min.
	(Push-pull/twist-to-release)	250 000 min.
Selector switches	(Non-illuminated)	1 000 000 min.
	(Illuminated, key-operated)	200 000 min.
Potentiometers		25 000 min.
All other devices		200 000 min.
Contact operation		Shallow, mini, and low-voltage contact blocks: Slow, double make and break Logic Reed and sealed switch contact blocks: Single break magnetic
Wire gauge/Terminal screw torque		#18...14 AWG (#18...10 Max Duty) / 6...8 lb•in
Typical operating forces		
Operators without contact blocks		Flush, extended button, standard mushroom, jumbo plastic mushroom: 2 lbs max. Jumbo and extended aluminum mushroom head: 3.95 lbs max. Maintained selector switch: 3.6 in•lb max.
Spring return selector switches		3.6 in•lb to stop, 0.2 in•lb to return
Illuminated push buttons and push-to-test pilot lights		5 lb max.
2-position push-pull		8.0 lb max. push or pull
3-position push-pull		8 lb max. push to in position or pull to center position (15 lb max. pull to out position)
Twist-to-release or push-pull		9 lbs max. push or pull 30 in•oz max. twist, 6 in•oz minimum return
Potentiometer		Rotational torque 3...12 in•oz; stopping torque 12 in•lb (minimum)
Contact blocks	Standard	1 lb
	Logic Reed	1 lb max.
	Sealed switch	3 lb max. at 0.205 in. plunger travel
	Stackable sealed switch	1 lb max.
	MaxDuty	1.4 lb max.
	PenTUFF	1.4 lb max.
	Self Monitoring	1.6 lb
Environment		
Temperature range	Operating	-40...+131 °F (-40...+55 °C)
	Storage	-40...+185 °F (-40...+85 °C)
Note: Operating temperatures below freezing are based on the absence of moisture and liquids. Consult your local Rockwell Automation sales office or Allen-Bradley distributor for use in lower temperature applications.		
Humidity		50...95% RH from 77...140 °F (25...60 °C) per Procedure IV of MIL-STD-810C, Method 507.1 cycling test

Spec D Lite

DURAY LIGHTING

54-092-001

CATALOG No.	LAMP	BALLAST TYPE	LENGTH
DUC108-ES	1-8WT5	Electronic	12¼"
DUC113-ES	1-13WT5	Electronic	21½"
DUC208-ES	2-8WT5	Electronic	24½"
DUC813-ES	1-8WT5 1-13WT5	Electronic	33½"
DUC213-ES	2-13WT5	Electronic	42½"

CATALOG No.	LAMP	BALLAST TYPE	LENGTH
DUC114	1-14WT5	ELECTRONIC	22-11/16"
DUC121	1-21WT5	ELECTRONIC	34-1/2"
DUC128	1-28WT5	ELECTRONIC	46-5/16"

CODE	DESCRIPTION	CODE	DESCRIPTION
K	Convenience outlet	N	Rocker Switch
40	Connector	SPTW6'	6' Cord/plug/white

Accessories rated for 120 volt ballast.
Additional options and accessories available. Contact factory for details.

SPECIFICATIONS

HOUSING: Entire construction rigidly die formed of code gauge steel.

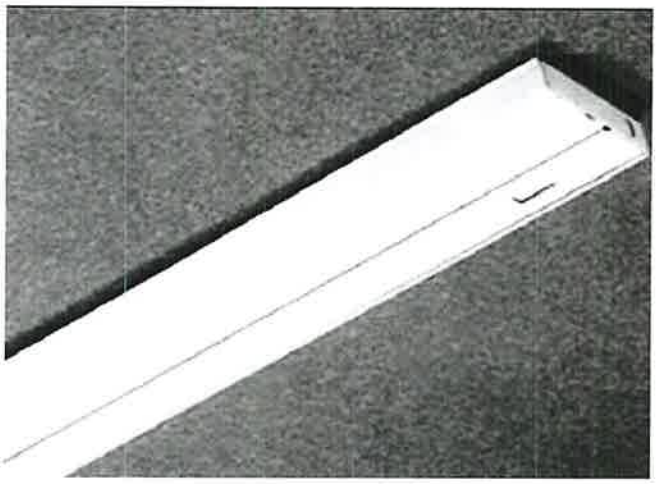
SHIELDING: White ribbed acrylic diffuser easily installed and removable by finger pressure.

FINISH: High gloss white enamel.

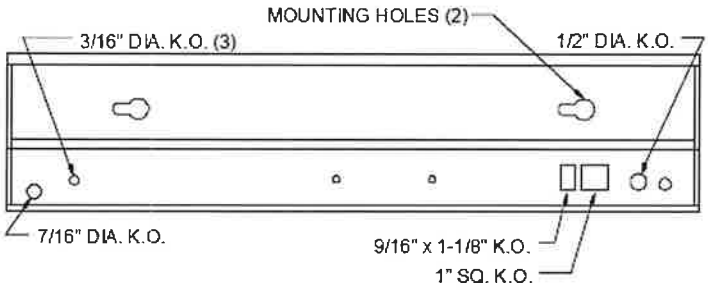
ELECTRICAL: All units wired with "A" sound rated ballasts incorporating Class P thermal protection, for 120 vold, 60 cycle AC. Ballasts mounted in direct contact with housing for maximum heat dissipation. Sockets completely wired.

INSTALLATION: Units may be surface mounted, individually or in continuous rows.

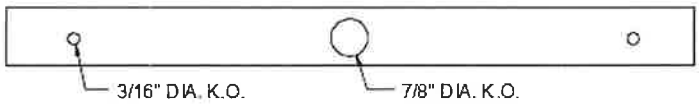
LABELS: U/L and I.B.E.W.

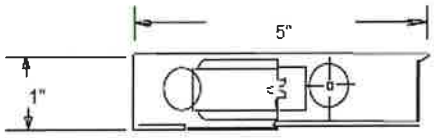


Bottom Without Diffuser



Back





ELEMECH INC.
630-499-7080 · www.elemechinc.com

Manuf:. PNo: DURAY: DUC108-ES-N-L

Rev: 0
Date: 4/13/2018
By: TCC

Device Tag: PL1,2
Job Number: HBR7281
Page # 1/1

Compact™ 120V ac Input Module

Allen-Bradley

33-005-025

(Catalog Number 1769-IA16)

c UL us

General Specifications

Specification	Value
Dimensions	118 mm (height) x 87 mm (depth) x 35 mm (width) height including mounting tabs is 138 mm 4.65 in. (height) x 3.43 in (depth) x 1.38 in (width) height including mounting tabs is 5.43 in.
Approximate Shipping Weight (with carton)	280g (0.61 lbs.)
Storage Temperature	-40°C to +85°C (-40°F to +185°F)
Operating Temperature	0°C to +60°C (32°F to +140°F)
Operating Humidity	5% to 95% non-condensing
Operating Altitude	2000 meters (6561 feet)
Vibration	Operating: 10 to 500 Hz, 5G, 0.030 inches maximum peak-to-peak Relay Operation: 2G
Shock	Operating: 30G panel mounted (20G DIN rail mounted) Relay Operation: 7.5G panel mounted (5G DIN rail mounted) Non-Operating: 40G panel mounted (30G DIN rail mounted)
Agency Certification	• C-UL certified (under CSA C22.2 No. 142) • UL 508 listed • CE compliant for all applicable directives
Hazardous Environment Class	Class I, Division 2, Hazardous Location, Groups A, B, C, D (UL 1604, C-UL under CSA C22.2 No. 213)
Radiated and Conducted Emissions	EN50081-2 Class A
Electrical /EMC:	*The module has passed testing at the following levels:*
• ESD Immunity (IEC1000-4-2)	• 4kV contact, 8 kV air, 4 kV indirect
• Radiated Immunity (IEC1000-4-3)	• 10 V/m, 80 to 1000 MHz, 80% amplitude modulation, +900 MHz keyed carrier
• Fast Transient Burst (IEC1000-4-4)	• 2 kV, 5 kHz
• Surge Immunity (IEC1000-4-5)	• 2 kV common mode, 1 kV differential mode
• Conducted Immunity (IEC1000-4-6)	• 10V, 0.15 to 80 MHz[1]

1. Conducted Immunity frequency range may be 150 kHz to 30 MHz if the Radiated Immunity frequency range is 30 MHz to 1000 MHz.

Input Specifications

Specification	1769-IA16
Voltage Category	100/120V ac
Operating Voltage Range	79V ac to 132V ac at 47 Hz to 63 Hz
Number of Inputs	16
Bus Current Draw (max.)	115 mA at 5V dc (0.575W)
Heat Dissipation	3.30 Total Watts *(The Watts per point, plus the minimum Watts, with all points energized.)*
Signal Delay (max.)	On Delay: 20.0 ms Off Delay: 20.0 ms
Off-State Voltage (max.)	20V ac
Off-State Current (max.)	2.5 mA
On-State Voltage (min.)	79V ac
On-State Current	5.0 mA at 79V ac (min.) 12 mA at 120V ac (nominal)
Inrush Current (max.)[1]	250 mA
Nominal Impedance	12K Ω at 50 Hz 10K Ω at 60 Hz
IEC Input Compatibility	Type 1+
Power Supply Distance Rating	8 (The module may not be more than 8 modules away from the power supply or controller.)
Input Point to Bus Isolation	Verified by one of the following dielectric tests: 1517V ac for 1 sec. or 2145V dc for 1 sec. 132V ac working voltage (IEC Class 2 reinforced insulation)
Isolated Groups	Group 1: inputs 0 to 15 (internally connected commons)
Vendor I.D. Code	1
Product Type Code	7
Product Code	82

1. A current limiting resistor can be used to limit inrush current; however, the operating characteristics of the ac input circuit will be affected. If a 6.8K Ω (2.5W minimum) resistor is placed in series with the input, the inrush current is reduced to 35 mA. In this configuration the minimum on-state voltage increases to 92V ac.
   Before adding the resistor in a hazardous environment, be sure to consider the operating temperature of the resistor and the temperature limits of the environment. The operating temperature of the resistor must remain below the temperature limit of the environment.

1769-IF4

Allen-Bradley

Compact voltage/current analog input module

33-005-031

Technical Specifications - 1769-IF4

Attribute	1769-IF4
Power supply distance rating	8 modules
Terminal screw torque	0.68 N•m (6 lb•in)
Retaining screw torque	0.46 N•m (4.1 lb•in)
Wire size	(22…14 AWG) solid (22…16 AWG) stranded
Wire type	Cu-90 °C (194 °F)
Replacement terminal block	1769-RTBN18 (1 per kit)
Replacement door label	1769-RL2 series B (2 per kit)
Replacement door	1769-RD (2 per kit)
Vendor ID code	1
Product type code	10
Product code	35
Enclosure type rating	None (open-style)

Agency Certification	• C-UL certified (under CSA C22.2 No. 142) • UL 508 listed • CE compliant for all applicable directives

Technical Specifications - 1769-IF4

Allen-Bradley

33-005-031

Attribute	1769-IF4
Inputs	4 differential or single-ended
Input range	±10V 0...10V 0...5V 1...5V 0...20 mA 4...20 mA
Full scale range[1]	±10.5V -0.5...10.5V -0.5...5.25V 0.5...5.25V 0...21 mA 3.2...21 mA
Current draw @ 5.1V	120 mA
Current draw @ 24V	60 mA
Heat dissipation, max	2.52 W
Converter type	Delta Sigma
Resolution [2]	14 bits (unipolar) 14 bits plus sign (bipolar)
Rated working voltage[3]	30V AC/30V DC
Common mode voltage range[4]	±10V DC max per channel
Common mode rejection	> 60 dB @ 50 and 60 Hz with the 50 or 60 Hz filter selected, respectively
Normal mode rejection ratio	-50 dB @ 50 and 60 Hz with the 50 or 60 Hz filter selected, respectively
Input impedance	Voltage: 220 kΩ Current: 250 Ω
Accuracy[5]	Voltage: ±0.2% full scale @ 25 °C (77 °F) Current: ±0.35% full scale @ 25 °C (77 °F)
Accuracy drift with temperature	Voltage: ±0.003% per °C Current: ±0.0045% per °C
Nonlinearity	±0.03%
Repeatability[6]	±0.03%
Module error	Voltage: ±0.3% Current: ±0.5%
Overload at input terminals, max[7]	Voltage: ±30V DC continuous, 0.1 mA Current: ±32 mA continuous, ±7.6V DC
Isolation voltage	500V AC or 710V DC for 1 minute (qualification test), group to bus 30V AC/30V DC working voltage (IEC Class 2 reinforced insulation)
Weight, approx.	300 g (0.65 lb)
Dimensions (HxWxD), approx.	118 x 35 x 87 mm (4.65 x 1.38 x 3.43 in.) Height with mounting tabs 138 mm (5.43 in.)
Slot width	1
Module location	DIN rail or panel mount
Power supply	1769-PA2, 1769-PB2, 1769-PA4, 1769-PB4
Optional 24V DC Class 2 power supply voltage range[8]	20.4...26.4V DC

Compact I/O Expansion Power Supplies

Allen-Bradley

33-005-046

Catalog Numbers 1769-PA2, 1769-PB2, 1769-PA4, 1769-PB4

c UL us

1769-PA2, 1769-PB2, 1769-PA4, 1769-PB4 - Technical Specifications

Attribute	1769-PA2	1769-PB2	1769-PA4	1769-PB4
Input voltage range	85...265V AC	19.2...31.2V DC	85...132V AC or 170...265V AC, switch selectable	19.2...32V DC
Input frequency range	47...63 Hz	N/A	47...63 Hz	N/A
Power supply distance rating[1]	8 (8 I/O modules can be connected on either side of the power supply for a maximum of 16 modules.)			
Operating altitude	2000 m (6562 ft)			
Isolation voltage	265V (continuous), Reinforced Insulation Type (IEC Class 1 grounding required) Routine tested at 2596V DC for 1s, AC Power Input to System and AC Power Input to 24V DC User Power	75V (continuous), Reinforced Insulation Type (IEC Class 1 grounding required) Routine tested at 1697V DC for 1s, DC Power Input to System	265V (continuous), Reinforced Insulation Type (IEC Class 1 grounding required) Routine tested at 2596V DC for 1s, AC Power Input to System	75V (continuous), Reinforced Insulation Type (IEC Class 1 grounding required) Routine tested at 1697V DC for 1s, DC Power Input to System
Power consumption	100 VA @ 120V AC 130 VA @ 240V AC	50 VA @ 24V DC	200 VA @ 120V AC 240 VA @ 240V AC	100 VA @ 24V DC
Power dissipation	8 W @ 60 °C	7.5 W @ 60 °C	18 W @ 60 °C	14.5 W @ 60 °C
Current capacity at 5V	2.0 A	2.0 A	4.0 A	4.0 A
Current capacity at 24V	0.8 A	0.8 A	2.0 A	2.0 A
Inrush current, max	25 A @ 132V AC	30 A @ 31.2V DC	25 A @ 132V AC	30 A @ 31.2V DC
Fuse type	Wickmann 19195-3.15A Littelfuse 02183.15MXP	Wickmann 19193-6.3A Littelfuse 021706.3MXP	Wickmann 19195-3.15A Littelfuse 02183.15MXP	Wickmann 19193-6.3A Littelfuse 021706.3MXP
Dimensions (HxWxD), approx.	118 x 70 x 87 mm (4.65 x 2.76 x 3.43 in.) height including mounting tabs is 138 mm (5.43 in.)			
Shipping weight, approx	525 g (1.16 lb)		630 g (1.39 lb)	
Wiring category[2]	1 on power ports	2 on power ports	1 on power ports	2 on power ports

Certification[1]	1769-PA2, 1769-PA4	1769-PB2, 1769-PB4
c-UL-us	UL Listed for Class 1, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E10314	

Compact™ 16-Point AC/DC Relay Output Module

Allen-Bradley

(Catalog Number 1769-OW16)

33-005-129

Output Specifications

Specification	1769-OW16
Voltage Category	AC/DC normally open relay
Operating Voltage Range	5 to 265V ac 5 to 125V dc
Number of Outputs	16
Bus Current Draw (max.)	205 mA at 5V dc line 180 mA at 24V dc line
Heat Dissipation	4.75 Total Watts *(The Watts per point, plus the minimum Watts, with all points energized.)*
Signal Delay (max.) – resistive load	turn-on = 10 ms turn-off = 10 ms
Off-State Leakage (max.)	0 mA
On-State Current (min.)	10 mA at 5V dc
Continuous Current per Point (max.)	2.5A (Also see "Relay Contact Ratings" on page 16.)
Continuous Current per Common (max.)	10A
Continuous Current per Module (max.)	20A
Power Supply Distance Rating	8 (The module may not be more than 8 modules away from the power supply.)
Output Point to Bus Isolation	Verified by one of the following dielectric tests: 1836V ac for 1 sec. or 2596V dc for 2 sec. 265V ac working voltage (IEC Class 2 reinforced insulation)
Isolated Groups	Group 1: outputs 0 to 7 Group 2: outputs 8 to 15
Output Group to Output Group Isolation	Verified by one of the following dielectric tests: 1836V ac for 2 sec. or 2596V dc for 2 sec. 265V ac working voltage (basic insulation) 150V ac working voltage (IEC Class 2 reinforced insulation)
Vendor I.D. Code	1
Product Type Code	7
Product Code	85

General Specifications

Specification	Value
Dimensions	118 mm (height) x 87 mm (depth) x 52.5 mm (width) height including mounting tabs is 138 mm 4.65 in. (height) x 3.43 in (depth) x 2.07 in (width) height including mounting tabs is 5.43 in.
Approximate Shipping Weight (with carton)	450g (0.99 lbs.)
Storage Temperature	-40°C to +85°C (-40°F to +185°F)
Operating Temperature	0°C to +60°C (32°F to +140°F)
Operating Humidity	5% to 95% non-condensing
Operating Altitude	2000 meters (6561 feet)[1]
Vibration	Operating: 10 to 500 Hz, 5G, 0.030 inches maximum peak-to-peak Relay Operation: 2.0G
Shock	Operating: 30G panel mounted (20G DIN rail mounted) Relay Operation: 10G panel mounted (5G DIN rail mounted) Non-Operating: 40G panel mounted (30G DIN rail mounted)
Agency Certification	• C-UL certified (under CSA C22.2 No. 142) • UL 508 listed • CE and C-Tick compliant for all applicable directives
Hazardous Environment Class	Class I, Division 2, Hazardous Location, Groups A, B, C, D (UL 1604, C-UL under CSA C22.2 No. 213)
Radiated and Conducted Emissions	EN50081-2 Class A
Electrical /EMC:	*The module has passed testing at the following levels:*
ESD Immunity (IEC61000-4-2)	• 4kV contact, 8 kV air, 4 kV indirect
Radiated Immunity (IEC61000-4-3)	• 10 V/m, 80 to 1000 MHz, 80% amplitude modulation, +900 MHz keyed carrier
Fast Transient Burst (IEC61000-4-4)	• 2 kV, 5 kHz
Surge Immunity (IEC61000-4-5)	• 2 kV common mode, 1 kV differential mode
Conducted Immunity (IEC61000-4-6)	• 10V, 0.15 to 80 MHz[2]

(1) For operation above 2000 meters, consult the factory.

(2) Conducted Immunity frequency range may be 150 kHz to 30 MHz if the Radiated Immunity frequency range is 30 MHz to 1000 MHz.

Allen-Bradley

CompactLogix 5370 L3 Controllers

33-005-200

Catalog Numbers 1769-L30ER, 1769-L30ERM, 1769-L30ER-NSE, 1769-L33ER, 1769-L33ERM, 1769-L36ERM

CompactLogix 5370 L3 Controllers

In a CompactLogix 5370 L3 controller system, the 1769 I/O modules can be placed to the left and the right of the power supply. As many as eight modules can be placed on each side of the power supply. The CompactLogix 5370 L3 controller comes with:

- dual EtherNet/IP ports for ring topologies.
- USB port for firmware download and programming.

Characteristic	1769-L30ER	1769-L30ERM	1769-L30ER-NSE	1769-L33ER	1769-L33ERM	1769-L36ERM
Available user memory	1 MB	1 MB	1 MB No capacitor	2 MB	2 MB	3 MB
Memory card	1784-SD1 (1 GB), shipped with controller 1784-SD2 (2 GB)					
Communication ports	• 2 EtherNet/IP • 1 USB					
EtherNet/IP connections	• 256 EtherNet/IP • 128 TCP	• 256 EtherNet/IP • 128 TCP	• 256 EtherNet/IP • 128 TCP	• 256 EtherNet/IP • 128 TCP	• 256 EtherNet/IP • 128 TCP	• 256 EtherNet/IP • 128 TCP
EtherNet/IP nodes in one Logix Designer application, max	16			32		48
Integrated motion on an EtherNet/IP network	—	Supports up to 4 axes	—	—	Supports up to 8 axes	Supports up to 16 axes
Module expansion capacity	8 1769 modules 1 bank of modules			16 1769 modules 2 banks of modules		30 1769 modules 3 banks of modules
Battery	None					
Power supply distance rating	4 modules			4 modules		4 modules
Programming software support	• RSLogix 5000 software, version 20 - For controllers that use firmware revision 20.xxx. • Logix Designer application, version 21 or later - For controllers that use firmware revision 21.xxx or later.					

These controllers replace previous catalog numbers.

New Controller[1]	Replaces Previous Controller[2]	Differences
1769-L30ER 1769-L30ERM 1769-L30ER-NSE	1769-L31 1769-L32C[3] 1769-L32E	• Additional memory • Integrated motion on EtherNet/IP support (1769-L30ERM, 1769-L33ERM, 1769-L36ERM) • USB port instead of RS-232 port • Dual-port EtherNet/IP support • SD card instead of CompactFlash card
1769-L33ER 1769-L33ERM	1769-L35CR[3] 1769-L35E	
1769-L36ERM	Any previous 1769-L3x controller	

(1) IMPORTANT: Typically, you can use any of the new controllers listed in each row as replacements for any of the previous controllers listed in the corresponding cell to the right. For example, you can replace a 1769-L32E with a 1769-L30ER, 1769-L30ERM, or 1769-L30ER-NSE controller.

In some rare cases, system configuration prevents controller replacement as shown above. For example, if your system uses a 1769-L32E controller with 12 expansion modules, you cannot replace that controller with a 1769-L30ER, 1769-L30ERM, or 1769-L30ER-NSE controller. These controllers support no more than 8 expansion modules. You must replace the 1769-L32E controller with a 1769-L33ER, 1769-L33ERM, or 1769-L36ERM controller.

We recommend that before you upgrade your controllers, consider your application requirements to verify that the replacements listed above apply.

(2) These catalog numbers are still available for sale, see page 13 for details. Please contact your local Rockwell Automation sales office for ordering information.

(3) Requires converting from ControlNet connections to EtherNet/IP connections.

Table 3 - Technical Specifications - CompactLogix 5370 Controllers

Attribute	1769-L16ER-BB1B, 1769-L18ER-BB1B, 1769-L18ERM-BB1B	1769-L24ER-QB1B, 1769-L24ER-QBFC1B, 1769-L27ERM-QBFC1B	1769-L30ER, 1769-L30ER-NSE, 1769-L30ERM, 1769-L33ER, 1769-L33ERM, 1769-L36ERM
User memory	• 1769-L16ER: 384 KB • 1769-L18ER, 1769-L18ERM: 512 KB	• 1769-L24ER-QB1B, 1769-L24ER-QBFC1B: 750 KB • 1769-L27ERM-QBFC1B: 1 MB	• 1769-L30ER, 1769-L30ER-NSE, 1769-L30ERM: 1MB • 1769-L33ER, 1769-L33ERM: 2 MB • 1769-L36ERM: 3 MB
Optional nonvolatile memory	1784-SD1 card with 1 Gb of available memory (shipped with controller) 1784-SD2 card with 2 Gb of available memory (available for separate ordering)		
Number of local expansion modules, max[1]	• 1769-L16ER-BB1B: Six 1734 POINT I/O™ modules • 1769-L18ER-BB1B, 1769-L18ERM-BB1B: Eight 1734 POINT I/O modules	Four 1769 Compact I/O modules	• 1769-L30ER, 1769-L30ER-NSE, 1769-L30ERM: Eight 1769 Compact I/O™ modules • 1769-L33ER, 1769-L33ERM: Sixteen 1769 Compact I/O modules • 1769-L36ERM: Thirty 1769 Compact I/O modules
Number of I/O module banks, max	N/A	1	3
Current draw @ 5V DC, controller power	1 A	• 1769-L24ER-QB1B: 1.54 A Value rated at the following ambient temperatures: 40 °C (104 °F), 55 °C (131 °F), 60 °C (140 °F). • 1769-L24ER-QBFC1B and 1769-L27ERM-QBFC1B: 1 A Value rated at the following ambient temperatures: 40 °C (104 °F), 55 °C (131 °F), 60 °C (140 °F).	500 mA
Current draw @ 24V DC, controller power	N/A	• 1769-L24ER-QB1B: 0.95A Value rated at the following ambient temperatures: 40 °C (104 °F), 55 °C (131 °F), 60 °C (140 °F). • 1769-L24ER-QBFC1B and 1769-L27ERM-QBFC1B: 0.8 A Value rated at the following ambient temperatures: 40 °C (104 °F), 55 °C (131 °F), 60 °C (140 °F).	225 mA
Current draw @ 24V DC, field power, max	3 A - Combined total for all devices drawing current from field power connections Input: 5 mA Output: 500 mA	N/A	N/A
Power dissipation, max	11.5 W	• 1769-L24ER-QB1B: 12 W • 1769-L24ER-QBFC1B, L27ERM-QBFC1B: 21 W	4.5 W
Isolation voltage	50V (continuous), Basic Insulation Type Tested at 500V AC for 60 s, System to Field	30V (continuous), Basic Insulation Type, USB to system, Ethernet to system and Ethernet to Ethernet Type tested at 500V AC for 60 s	
Short circuit protection, field power	Internal fuse, Non-replaceable	N/A	N/A
Recommended external short circuit protection, field power	User-provided 4. . . 5 A @ 3.15. . . 5.5 A^2t fuse	N/A	N/A
Weight, approx	0.66 kg (1.5 lb)	• 1769-L24ER-QB1B = 0.63 kg (1.39 lb) • 1769-L24ER-QBFC1B and 1769-L27ERM-QBFC1B = 0.9 kg (1.9 lb)	0.31 kg (0.68 lb)

Table 3 - Technical Specifications - CompactLogix 5370 Controllers

Attribute	1769-L16ER-BB1B, 1769-L18ER-BB1B, 1769-L18ERM-BB1B	1769-L24ER-QB1B, 1769-L24ER-QBFC1B, 1769-L27ERM-QBFC1B	1769-L30ER, 1769-L30ER-NSE, 1769-L30ERM, 1769-L33ER, 1769-L33ERM, 1769-L36ERM
Module width	100.00 mm (3.94 in.)	1769-L24ER-QB1B = 115.00 mm (4.53 in.) 1769-L24ER-QBFC1B and 1769-L27ERM-QBFC1B = 140 mm (5.51 in.)	55.00 mm (2.17 in.)
Module location	DIN rail mount	DIN rail or panel mount	
Panel-mounting screw torque	N/A	1.1...1.8 N•m (10...16 lb•in) • use M4 or #8 screws	
Embedded power supply	24V DC input, isolated	24V DC input, isolated	1769-PA2, 1769-PB2, 1769-PA4, 1769-PB4
Power supply distance rating	N/A		• Controller and 1769-SDN: 4 • 1769 Compact I/O modules: 4...8, depending on module
Wire category[2]	1 - signal ports 1 - power ports 2 - communication ports		2 - communication ports
Wire type, Ethernet	RJ-45 connector according to IEC 60603-7, 2 or 4 pair Category 5e minimum cable according to TIA 568-B.1 or Category 5 cable according to ISO/IEC 24702		
Wire type, power terminals and embedded I/O connections	Copper		N/A
Wire size, power terminals[3]	0.051...3.31 mm² (30...12 AWG) solid or stranded copper wire rated at 75 °C (167 °F), or greater, 1.2 mm (3/64 in.) insulation, max Each terminal accepts 1 or 2 wires	0.25...2.50 mm² (22...14 AWG) solid copper wire rated at 75 °C (167 °F), or greater 1.2 mm (3/64 in.) insulation, max Each terminal accepts only 1 wire	N/A
Wire stripping length, power terminals[3]	10 mm (0.39 in)	8 mm (0.31 in)	N/A
Screw torque, power terminals[3]	0.5...0.6 N•m (4.4...5.3 lb•in)	1.0...1.2 N•m (8.9...10.6 lb•in)	N/A
Wire size, embedded I/O connections	0.205...1.31 mm² (24...16 AWG) solid or stranded copper wire rated at 75 °C (167 °F), or greater 1.2 mm (3/64 in.) insulation, max or 90 °C (194 °F) Each terminal accepts only 1 wire		N/A
Wire stripping length, embedded I/O connections	10 mm (0.39 in)		N/A
North American temperature code	T4A	T3C	T5
IEC temperature code	T4		T5
Enclosure type rating	None (open-style)		

(1) You can use up to the maximum number of local expansion modules with the CompactLogix 5370 L3 controllers listed as long as the total current drawn by the embedded I/O and local expansion modules does not exceed both the available POINTBus backplane current of 1 A and the field power current of 3 A. For more information on POINTBus backplane current and field power current considerations when installing local expansion modules, see page 9.

(2) Use this Conductor Category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1 and the appropriate system-level installation manual.

(3) With respect to the CompactLogix 5370 L3 controllers, this specification applies to connecting wires to the power connector that is inserted in the controller. With respect to the CompactLogix 5370 L2 controllers, this specification applies to connecting wires to power terminals built into the controller.

Table 19 - Certifications - CompactLogix 5370 Controllers

Certification[1]	1769-L16ER-BB1B, 1769-L18ER-BB1B, 1769-L18ERM-BB1B	1769-L24ER-QB1B, 1769-L24ER-QBFC1B, 1769-L27ERM-QBFC1B	1769-L30ER, 1769-L30ER-NSE, 1769-L30ERM, 1769-L33ER, 1769-L33ERM, 1769-L36ERM
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.		
CE	European Union 2004/108/EC EMC Directive, compliant with: • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B)		
RCM	Australian Radiocommunications Act, compliant with: • AS/NZS CISPR 11; Industrial Emissions		
Ex	European Union 94/9/EC ATEX Directive, compliant with: • EN 60079-15; Potentially Explosive Atmospheres, Protection "n" • EN 60079-0; General Requirements • II 3 G Ex nA IIC T4 Gc	European Union 94/9/EC ATEX Directive, compliant with: • EN 60079-15; Potentially Explosive Atmospheres, Protection "n" • EN 60079-0; General Requirements • II 3 G Ex nA IIC T4 Gc	European Union 94/9/EC ATEX Directive, compliant with: • EN 60079-15; Potentially Explosive Atmospheres, Protection "n" • EN 60079-0; General Requirements • II 3 G Ex nA IIC T5 Gc X
EtherNet/IP	ODVA conformance tested to EtherNet/IP specifications.		
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: • Article 58-2 of Radio Waves Act, Clause 3		

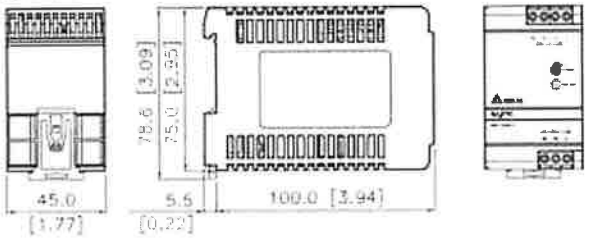
(1) When marked. See the Product Certification link at http://www.ab.com for Declarations of Conformity, Certificates, and other certification details.

Sync DIN Rail Power Supply

24V 100W Series

37-323-011





CE cULus

Specifications

Model Number	DRS-24V100W1A□	DRS-24V100W1N□

Input Ratings / Characteristics

Nominal Input Voltage	100-240Vac	
Input Voltage Range	85-264Vac	
Nominal Input Frequency	50-60Hz	
Input Frequency Range	47-63Hz	
DC Input Voltage Range*	120-375Vdc	
Input Current	< 1.2A @ 115Vac, < 0.6A @ 230Vac	
Efficiency at 100% Load	> 89% @ 115Vac & 230Vac	
Max Power Dissipation	0% load	< 0.4W @ 115Vac & 230Vac
	100% load	< 11W @ 115Vac & 230Vac
Max Inrush Current (Cold Start)	< 25A @ 115Vac, < 40A @ 230Vac	
Power Factor at 100% Load	> 0.97 @ 115Vac, > 0.9 @ 230Vac	
Leakage Current (Neutral to PE terminal)	< 0.5mA @ 264Vac	

*Fulfills test conditions for DC input. Safety approval for DC input can be obtained upon request.

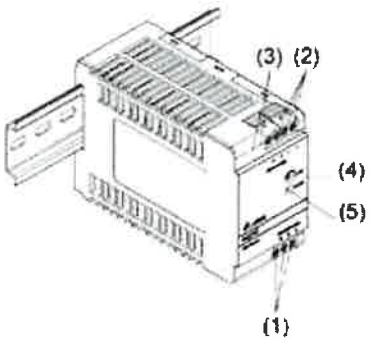
Output Ratings / Characteristics**

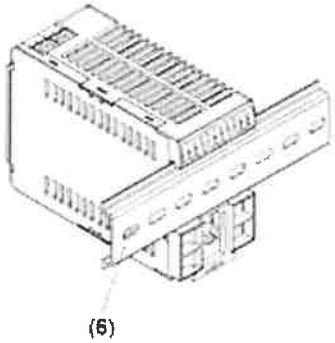
Nominal Output Voltage		24Vdc	
Factory Set Point Tolerance		24Vdc ± 2%	
Output Voltage Adjustment Range		24-28Vdc	22-24Vdc
Output Current		4.0A (96W max.)	3.8A (91.2W max.)
Output Power		96W	91.2W
Line Regulation		< 0.5% (@ 85-264Vac, 100% load)	
Load Regulation		< 1.0% (@ 85-264Vac, 0-100% load)	
PARD*** (20MHz)		< 50mVpp @ > 0°C to 70°C < 100mVpp @ 0°C to -20°C	
Rise Time		< 100ms @ nominal input (100% load)	
Start-up Time		< 2,500ms @ 115Vac (100% load) < 1,500ms @ 230Vac (100% load)	
Hold-up Time		> 50ms @ 115Vac & 230Vac (100% load)	
Dynamic Response (Overshoot & Undershoot O/P Voltage)		± 5% @ 85-264Vac input, 0-100% load (Slew Rate: 0.1A/μs, 50% duty cycle @ 5Hz to 1KHz)	
Start-up with Capacitive Loads		3,000μF Max	
Functional	DC OK Relay Contact	30V / 1A, resistive load	
	(for DRS-24V100W1AR, DRS-24V100W1NR)	The relay contact are normally "ON" (closed) when the output (Vout) is greater than 75% of its rated value and "OFF" (opened) when the output (Vout) is less than 75% typ.	

**For power de-rating from < -10°C to -20°C and 55°C to 70°C, see power de-rating on page 3

***PARD is measured with an AC coupling mode, 5cm wires, and in parallel with 0.1μF ceramic capacitor & 47μF electrolytic capacitor

DRS-24V100W1NR





1) Input terminal block connector
2) Output terminal block connector
3) DC OK relay contact
4) DC voltage adjustment potentiometer
5) DC OK LED (Green)
6) Universal mounting system

37-323-011

Environment

Surrounding Air Temperature	Operating	-20°C to +70°C (Cold start at -40°C @ 40% load)
	Storage	-40°C to +85°C
Power De-rating		-10°C to -20°C de-rate power by 2% / °C > 55°C de-rate power by 3.33% / °C
Operating Humidity		5 to 95% RH (Non-Condensing)
Operating Altitude		0 to 2,000 Meters (6,560 ft.)
Shock Test	Non-Operating	IEC60068-2-27, Half Sine Wave: 50G for a duration of 11ms; 3 times per direction, 9 times in total
	Operating	IEC 60068-2-27, Half Sine Wave, 10G for a duration of 11ms; 1 time in X axis
Vibration	Non-Operating	IEC 60068-2-6, Random: 5-500Hz, 2.09G_{rms}, 20 min per axis for all X, Y, Z directions
	Operating	IEC 60068-2-6, Sine Wave: 10-500Hz, 2G peak, displacement of 0.35mm, 1 octave per min; 60 min per axis for all X, Y, Z directions
Pollution Degree		2

Protections

Overvoltage	< 34.8V, SELV Output, Latch Mode
Overload / Overcurrent	105~140% of rated load current, Fold Forward Mode (current rises, voltage drops), Auto-recovery when the fault is removed
Over Temperature	< 75°C Surrounding Air Temperature @ 100% load, Latch Mode
Short Circuit	Hiccup Mode, Non-Latching (Auto-recovery when the fault is removed)
Internal Fuse	T3.15A
Degree of Protection	IP20
Protection Against Shock	Class I with PE* connection

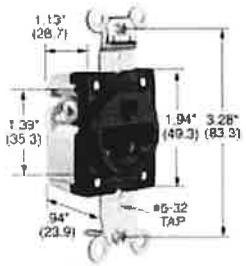
*PE: Primary Earth

14-037-A000

HBL® Extra Heavy Duty, Specification Grade, Receptacles

Single

Description	Color	Catalog Number	
Flush, nylon face, back and side wired	Black	HBL5261BK	HBL5361BK
	Brown	HBL5261	HBL5361
	Gray	-	HBL5361GRY
	Ivory	HBL5261I	HBL5361I
	White	-	HBL5361W



HBL5261

HBL® Extra Heavy Duty, Specification Grade, Receptacles

Duplex

Description	Color	Catalog Number	
Flush, nylon face, back and side wired	Black	HBL5262BK	HBL5362BK
	Blue	-	HBL5362BL
	Brown	HBL5262	HBL5362
	Gray	HBL5262GY	HBL5362GY
	Ivory	HBL5262I	HBL5362I
	Red	HBL5262R	HBL5362R
	White	HBL5262W	HBL5362W


5262 Series

HUBBELL

Wallplates, 1-Gang

Description	Color	Duplex Receptacles	Style Line® Receptacles	Single Receptacles with Face Dia. 1.40 in. (35.6)
Nylon, smooth.	Almond	NP8AL	NP26AL	NP7AL
	Black	NP8BK	NP26BK	NP7BK
	Brown	NP8	NP26	NP7
	Gray	NP8GY	NP26GY	NP7GY
	Ivory	NP8I	NP26I	NP7I


NP8

V5748 ♣†
5748 WH ♣†



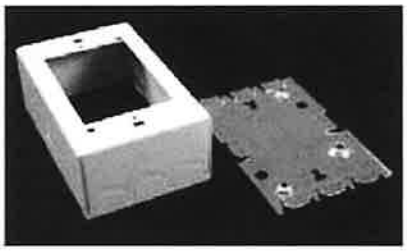
Device Box – For deep switches, receptacles and communication devices. Base has two 1/2" trade size KOs.

Wiremold®

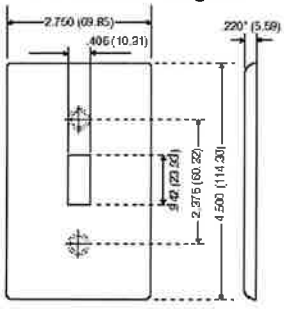
500/700 Single-Gang Switch & Receptacle Box Fitting

CAT NO.	L	W	GANG#
V5748, WH ♣	4 5/8" [118mm]	2 7/8" [73mm]	1
V5748-2, WH ♣	4 3/4" [121mm]	4 3/4" [121mm]	2"
V5748-3 ♣	4 5/8" [118mm]	6 1/2" [165mm]	3
V5748-4 ♣	4 5/8" [118mm]	8 11/32" [212mm]	1
V5748-5 ♣	4 3/4" [121mm]	10 5/32" [212mm]	2"
V5748-6 ♣	4 5/8" [118mm]	11 31/32" [165mm]	3

LEVITON Wallplate



Dimensional Diagram





86004

ELEMECH INC. 630-499-7080 · www.elemechinc.com	Rev: 0	Device Tag: RECP1	
	Date: 4/13/2018		
Manuf.: . PNo: HUBBELL: 5261-I ASSEMBLY	By: TCC	Job Number: HBR7281	Page # 1/1

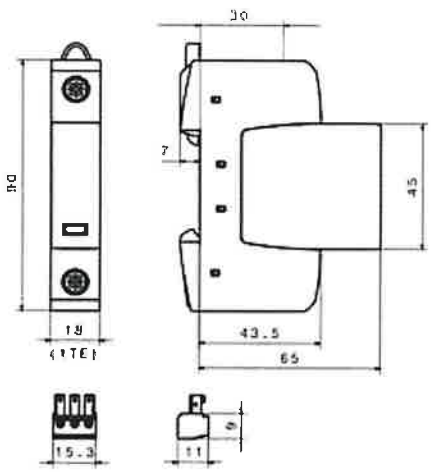
Surge Protection Made Simple™ for UL Applications

Single Pole BSP UL Series for 120, 240 and 347Vac
Single-Phase 2 Wire Systems

COOPER Bussmann

40-012-004

Dimensions - mm





BSPM1120S2G
BSPM1240S2G
BSPM1347S2G

Nominal system voltage		**120Vac**	**240, 277 or 240 and 277Vac**	**347Vac**
Max. Continuous Operating Voltage AC (MCOV) (V_c)		275Vac	385Vac	600Vac
Catalog numbers (base + modules)	W/O remote signaling	BSPM1120S2G	BSPM1240S2G	BSPM1347S2G
	W/ remote signaling	BSPM1120S2GR	BSPM1240S2GR	BSPM1347S2GR
Replacement module	MOV technology	BPM275UL	BPM385UL	BPM600UL
Specifications				
Rated voltage		120-127Vac	240-277Vac	347Vac
Voltage Protection Rating VPR		1kV	1.5kV	2kV
SCCR		200kA	200kA	125kA
Discharge current	Nom. I_n	20kA		
	Max. I_{max}	40kA		
Response time t_A		≤25 ns		
Frequency		50/60Hz		
Number of poles		1		
Number of wires/connection points		2 Wires / 2 connection points		
Operating state/fault indication		Green (good) / Red (replace)		
Cross-sectional area	Min.	14AWG - Cu stranded, solid or fine		
	Max.	2AWG - Cu solid or stranded / 4AWG - Cu fine		
Terminal torque		45 lb-in (5.1Nm)		
Mounting		35mm DIN-rail per EN 60715		
Enclosure material		Thermoplastic, UL 94V0		
Protection		IP20 (finger-safe)		
Location		Indoor		
Capacity		1 Mods, DIN 43880		
Application and standard		UL Type 2 Component Assembly, UL 1449, 4th Edition		
Agency information		cULus, RoHS Compliant		
Warranty		Five years*		
Remote contact signaling				
Signaling Type		Changeover contact		
Switching capacity (volts/amps)	AC	250V/0.5A		
	DC	250V/0.1A; 125V/0.2A; 75V/0.5A		
Conductor cross-sectional area		60/75°C Max. 1.5mm²/14AWG solid/flexible		
Ordering information		Order from catalog numbers above		

SCCR Rated
BSP UL Series (Type 2)

ELEMECH INC.
630-499-7080 · www.elemechinc.com

Rev: 0	Device Tag: SUR1	
Date: 4/13/2018		
Manuf:. PNo: BUSSMAN: BSPM1120S2GR	Job Number: HBR7281	Page # 1/1
By: TCC		

FL SWITCH SFN...24VAC

Five- and Eight-Port Standard Function Ethernet Switch with Narrow Housings for 24 V AC Power



33-098-002

Industrial Ethernet Switch - FL SWITCH SFN 5TX - 2891152

Technical data

Ambient conditions

Ambient temperature (storage/transport)	-20 °C ... 70 °C
Permissible humidity (operation)	5 % ... 95 % (non-condensing)
Permissible humidity (storage/transport)	5 % ... 95 % (non-condensing)
Air pressure (operation)	86 kPa ... 5 kPa (up to 1500 m above mean sea level)
Air pressure (storage/transport)	66 kPa ... 108 kPa (up to 3500 m above mean sea level)

Interfaces

Interface 1	Ethernet (RJ45)
No. of ports	5 (RJ45 ports)
Connection method	RJ45
Note on connection method	Auto negotiation and autocrossing
Transmission physics	Ethernet in RJ45 twisted pair
Transmission speed	10/100 MBit/s

Function

Basic functions	Unmanaged switch / auto negotiation, complies with IEEE 802.3, store and forward switching mode
Status and diagnostic indicators	LEDs: U_S, link and activity per port

Network expansion parameters

Cascading depth	Network, linear, and star structure: any
Maximum conductor length (twisted pair)	100 m

Supply voltage

Supply voltage	24 V DC
Residual ripple	3.6 V_{pp} (within the permitted voltage range)
Supply voltage range	9 V DC ... 32 V DC
Typical current consumption	90 mA (at U_S = 24 V DC)
Max. current consumption	205 mA (at 9 V DC)

General

Mounting type	DIN rail
Type AX	Block design
Net weight	416.1 g
Housing material	Aluminum

Standards and Regulations

Electromagnetic compatibility	Conformance with EMC Directive 2004/108/EC
Developed in acc. with standard	IEC 61000-6-2
Test standard	IEC 61000-4-2 (ESD)
Test result	Criterion B

General-Purpose Encapsulated Transformers

EATON
Powering Business Worldwide

41-018-A051



Standards and Certifications

- UL listed
- CSA certified

Listed

Enclosures

Eaton encapsulated transformers, Types EP and EPT, use a NEMA 3R rated enclosure as standard.

120 x 240 Volts to 120/240 Volts ①

kVA	Full Capacity Taps FCAN	FCBN	Type	°C Temp. Rise	Frame	Wiring Diagram Number	Weight Lbs (kg)	Weathershield	Style Number
0.5	—	—	EP	115	FR57P	3E	16 (7)	Indoor–Outdoor	**S10N11P51P**
1	—	—	EP	115	FR67P	3E	31 (14)	Indoor–Outdoor	**S10N11P01P**
1.5	—	—	EP	115	FR67P	3E	42 (19)	Indoor–Outdoor	**S10N11P16P**
2	—	—	EP	115	FR68P	3E	42 (19)	Indoor–Outdoor	**S10N11P02P**
3	—	—	EP	115	FR176	3E	55 (25)	Indoor–Outdoor	**S10N11S03N**
5	—	—	EP	115	FR177	3E	113 (51)	Indoor–Outdoor	**S10N11S05N**
7.5	—	—	EP	115	FR178	3E	123 (56)	Indoor–Outdoor	**S10N11S07N**
10	—	—	EP	115	FR179	3E	193 (88)	Indoor–Outdoor	**S10N11S10N**
15	—	—	EP	115	FR180	3E	216 (98)	Indoor–Outdoor	**S10N11S15N**
25	—	—	EP	115	FR182	3E	375 (170)	Indoor–Outdoor	**S10N11S25N**

240 x 480 Volts to 120/240 Volts Stainless Steel ①

kVA	Full Capacity Taps FCAN	FCBN	Type	°C Temp. Rise	Frame	Wiring Diagram Number	Weight Lbs (kg)	Weathershield	Style Number
3	—	—	EP	115	FR176	3A	65 (30)	Indoor–Outdoor	**S20N11S03SS**
5	—	—	EP	115	FR177	3A	113 (51)	Indoor–Outdoor	**S20N11S05SS**
7.5	—	—	EP	115	FR178	3A	123 (56)	Indoor–Outdoor	**S20N11S07SS**
10	—	—	EP	115	FR179	3A	193 (88)	Indoor–Outdoor	**S20N11S10SS**
15	—	—	EP	115	FR180	3A	205 (93)	Indoor–Outdoor	**S20N11S15SS**
25	—	—	EP	115	FR182	3A	375 (170)	Indoor–Outdoor	**S20N11S25SS**

208 Volts to 120/240 Volts ①

kVA	Full Capacity Taps FCAN	FCBN	Type	°C Temp. Rise	Frame	Wiring Diagram Number	Weight Lbs (kg)	Weathershield	Style Number
0.5	—	—	EP	115	FR57P	26A	16 (7)	Indoor–Outdoor	**S29N11P51P**
1	—	—	EP	115	FR67P	26A	31 (14)	Indoor–Outdoor	**S29N11P01P**
1.5	—	—	EP	115	FR67P	26A	42 (19)	Indoor–Outdoor	**S29N11P16P**
2	—	—	EP	115	FR68P	26A	42 (19)	Indoor–Outdoor	**S29N11P02P**
3	—	—	EP	115	FR176	26A	65 (30)	Indoor–Outdoor	**S29N11S03N**
5	—	—	EP	115	FR177	26A	113 (51)	Indoor–Outdoor	**S29N11S05N**
7.5	—	—	EP	115	FR178	26A	123 (56)	Indoor–Outdoor	**S29N11S07N**
10	—	—	EP	115	FR179	26A	193 (88)	Indoor–Outdoor	**S29N11S10N**
15	—	—	EP	115	FR180	26A	216 (98)	Indoor–Outdoor	**S29N11S15N**
25	—	—	EP	115	FR182	26A	395 (179)	Indoor–Outdoor	**S29N11S25N**

Notes

For 304 grade stainless steel enclosure, replace 10th character of catalog number with an "SS" suffix, e.g., P48G11S03SS
For 316 grade stainless steel enclosure, replace 10th character of catalog number with an "S6" suffix, e.g., P48G11S03S6.
For other ratings or catalog numbers not shown, or for special enclosure types (including stainless steel), refer to Eaton. Frame drawings/dimensions information begins on **Page V2-T2-215**.

EATON
Powering Business Worldwide

41-018-A051

240 x 480 Volts to 120/240 Volts

kVA	Full Capacity Taps FCAN	FCBN	Type	°C Temp. Rise	Frame	Wiring Diagram Number	Weight Lbs (kg)	Weathershield	Style Number
0.050	—	—	EP	115	FR52	3A	7 (3)	Indoor–Outdoor	**S20N11S81N**
0.075	—	—	EP	115	FR54	3A	7 (3)	Indoor–Outdoor	**S20N11S85N**
0.100	—	—	EP	115	FR54	3A	7 (3)	Indoor–Outdoor	**S20N11S82N**
0.150	—	—	EP	115	FR55	3A	8 (4)	Indoor–Outdoor	**S20N11S83N**
0.25	—	—	EP	115	FR57P	3A	12 (5)	Indoor–Outdoor	**S20N11P26P**
0.5	—	—	EP	115	FR57P	3A	16 (7)	Indoor–Outdoor	**S20N11P51P**
0.75	—	—	EP	115	FR59AP	3A	26 (12)	Indoor–Outdoor	**S20N11P76P**
1	—	—	EP	115	FR67P	3A	31 (14)	Indoor–Outdoor	**S20N11P01P**
1.5	—	—	EP	115	FR67P	3A	42 (19)	Indoor–Outdoor	**S20N11P16P**
2	—	—	EP	115	FR68P	3A	42 (19)	Indoor–Outdoor	**S20N11P02P**
3	—	—	EP	115	FR176	3A	65 (30)	Indoor–Outdoor	**S20N11S03N**
3	②	②	EP	115	FR176	3A	65 (30)	Indoor–Outdoor	**S20K11S03N**
5	—	—	EP	115	FR177	3A	113 (51)	Indoor–Outdoor	**S20N11S05N**
5	②	②	EP	115	FR177	9A	105 (48)	Indoor–Outdoor	**S20K11S05N**
7.5	—	—	EP	115	FR178	3A	165 (48)	Indoor–Outdoor	**S20N11S07N**
7.5	②	②	EP	115	FR178	9A	123 (56)	Indoor–Outdoor	**S20K11S07N**
10	—	—	EP	115	FR179	3A	193 (88)	Indoor–Outdoor	**S20N11S10N**
10	②	②	EP	115	FR179	9A	193 (88)	Indoor–Outdoor	**S20K11S10N**
15	—	—	EP	115	FR180	3A	216 (98)	Indoor–Outdoor	**S20N11S15N**
15	③	③	EP	115	FR180	23A	216 (98)	Indoor–Outdoor	**S20L11S15N**
25	—	—	EP	115	FR182	3A	385 (175)	Indoor–Outdoor	**S20N11S25N**
25	③	③	EP	115	FR182	23A	375 (170)	Indoor–Outdoor	**S20L11S25N**
37.5	④	④	EP	115	FR300A	248A	735 (334)	Indoor–Outdoor	**S20L11S37** ④

600 Volts to 120/240 Volts

kVA	Full Capacity Taps FCAN	FCBN	Type	°C Temp. Rise	Frame	Wiring Diagram Number	Weight Lbs (kg)	Weathershield	Style Number
0.5	—	2 at –5%	EP	115	FR57P	21	16 (7)	Indoor–Outdoor	**S60G11P51P**
0.75	—	2 at –5%	EP	115	FR59AP	21	26 (12)	Indoor–Outdoor	**S60G11P76P**
1	—	2 at –5%	EP	115	FR67P	21	31 (14)	Indoor–Outdoor	**S60G11P01P**
1.5	—	2 at –5%	EP	115	FR67P	21	42 (19)	Indoor–Outdoor	**S60G11P16P**
2	—	2 at –5%	EP	115	FR68P	21	42 (19)	Indoor–Outdoor	**S60G11P02P**
3	—	2 at –5%	EP	115	FR176	21	65 (30)	Indoor–Outdoor	**S60G11S03N**
5	—	2 at –5%	EP	115	FR177	21	105 (48)	Indoor–Outdoor	**S60G11S05N**
7.5	—	2 at –5%	EP	115	FR178	21	123 (56)	Indoor–Outdoor	**S60G11S07N**
10	—	2 at –5%	EP	115	FR179	21	193 (88)	Indoor–Outdoor	**S60G11S10N**
15	—	4 at –2.5%	EP	115	FR180	527A	216 (98)	Indoor–Outdoor	**S60J11S15N**
25	—	4 at –2.5%	EP	115	FR182	527A	385 (175)	Indoor–Outdoor	**S60J11S25N**
25	2 at 2.5%	4 at –2.5%	EP	115	FR132	63B	395 (180)	Indoor–Outdoor	**S60M11S25N**

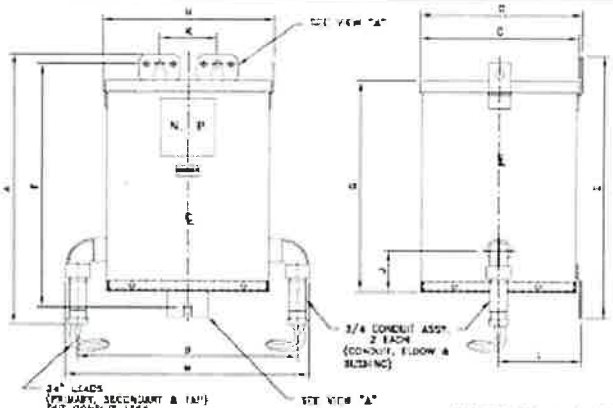
Notes

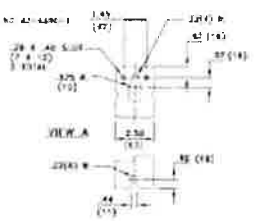
① Contact Eaton for availability of 0.05–0.25 kVA designs.
② 1 at +10% FCBN at 240 volts; 2 at +5% FCBN at 480 volts.
③ 2 at +5% FCBN at 240 volts; 4 at +2.5% FCBN at 480 volts.
④ Floor-mount only.

Contact your local Eaton sales office for CE Mark transformer requirements. For other ratings or styles not shown, or for special enclosure types (including stainless steel), refer to Eaton. Frame drawings/dimensions information begins on **Page V2-T2-213**.

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Powering Business Worldwide

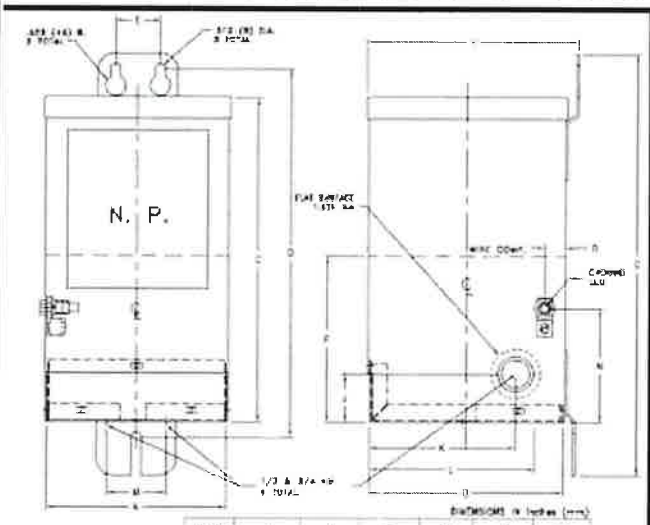
41-018-A051





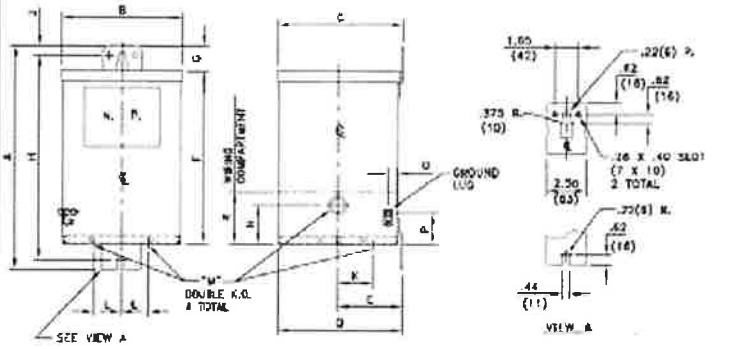
DIMENSIONS IN inches (mm)

FRAME	APPROX. NET WT. LBS(KG) ALUMINUM	COPPER	A	B	C	D	E	F
FR1726	113(51)	120(54)	16.50(420)	13.79(350)	9.87(248)	9.88(251)	16.15(410)	14.90(378)
	G		H	J	K	L	M	
	12.83(326)	10.04(256)	2.5(64)	3.50(89)	5.08(129)	15.54(395)		



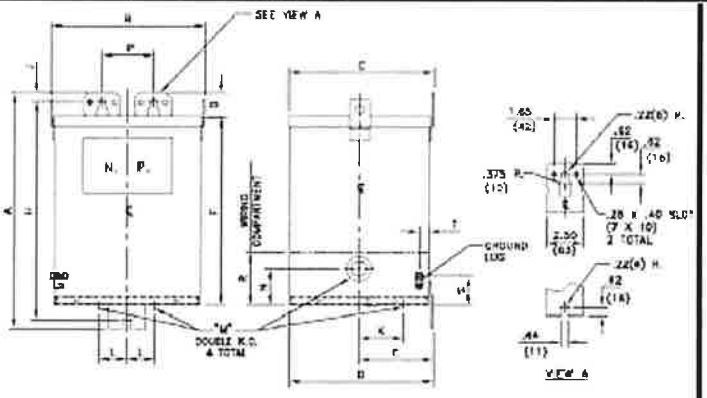
DIMENSIONS IN inches (mm)

FRAME	A	B	C	D	E	F
FR17F	5.55(141)	6.24(152)	10.00(254)	11.40(251)	1.37(35)	3.12(130)
	G	H	J	K	L	M
	13.23(331)	6.56(167)	1.50(38)	4.37(111)	5.11(130)	1.85(47)
	N	P				
	3.50(89)	2.64(67)				



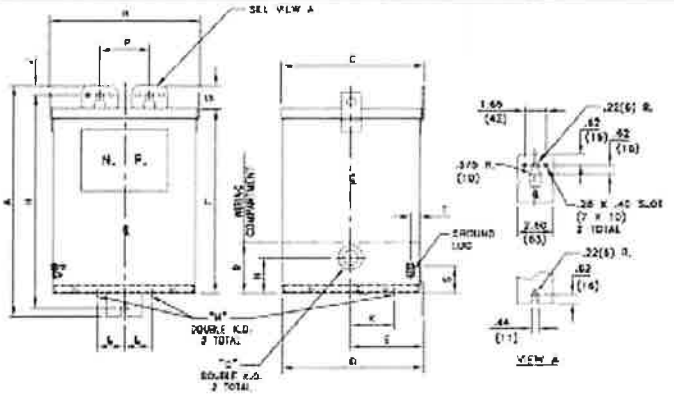
DIMENSIONS IN inches (mm)

FRAME	APPROX. NET WT LBS(KG) ALUMINUM	COPPER	A	B	C	D	E	F	G	H	J
FR17G	65(30)	69(31)	14.25(362)	7.68(195)	8.00(203)	7.94(202)	4.06(103)	11.00(281)	1.63(41)	13.00(330)	.63(16)
	K	L	M	N	P	Q					
	2.25(57)	1.75(44)	.5, .75(13,19)	2.50(64)	5.52(84)	2.06(51)	.65(17)				



DIMENSIONS IN inches (mm)

FRAME	APPROX. NET WT LBS(KG) ALUMINUM	COPPER	A	B	C	D	E	F	G	H
FR17G	123(55)	132(60)	16.50(405)	10.38(264)	9.88(251)	9.80(249)	5.06(129)	13.82(326)	1.63(41)	14.75(375)
	J	K	L	M	N	P	Q	R		
	.65(16)	3.00(76)	1.00(45)	.75, 1.25(19, 32)	2.50(64)	5.46(80)	3.61(92)			
						S	T			
						2.50(61)	.65(17)			



DIMENSIONS IN inches (mm)

FRAME	APPROX. NET WT LBS(KG) ALUMINUM	COPPER	A	B	C	D	E	F	G	H	J
FR17G	123(55)	132(60)	16.50(405)	10.38(264)	9.88(251)	9.80(249)	5.06(129)	13.82(326)	1.63(41)	14.75(375)	.63(16)
	K	L	M	N	P	Q	R	S	T		
	3.38(86)	1.88(48)	.75, 1.25 (19, 32)	2.50(64)	5.46(86)	1.00, 1.50 (25, 38)		2.00(51)	.65(17)		

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Rev: 0	Device Tag: T1
Date: 4/13/2018	
By: TCC	Job Number: HBR7281
Manuf.: . PNo: CUTLER-HAMMER: S20N11S03N ASSEMBLY	Page # 3/3

wieland

42-063-***



2,5 mm²/5 mm Width

Type		Part no.	Std. pack
Marking strips, unmarked			
9705 A/5/10		04.242.5053.0	25
Marking strips, marked			
9705 A/5/9 B	1 - 9	04.842.4053.0	25
9705 A/5/10 B*		04.842.5053.0	25
9705 A/5/10 B	1 - 10	04.845.0153.0	25
	11 - 20	04.845.0253.0	25
	21 - 30	04.845.0353.0	25
	31 - 40	04.845.0453.0	25
	41 - 50	04.845.0553.0	25
	51 - 60	04.845.0653.0	25
	61 - 70	04.845.0753.0	25
	71 - 80	04.845.0853.0	25
	81 - 90	04.845.0953.0	25
	91 - 100	04.845.1053.0	25
	⏚ (10 x)	04.855.0053.0	25
	⏚ (10 x)	04.855.0153.0	25
	+ (10 x)	04.855.0253.0	25
	– (10 x)	04.855.0353.0	25
	L1 (10 x)	04.855.0453.0	25
	L2 (10 x)	04.855.0553.0	25
	L3 (10 x)	04.855.0653.0	25
	PE (10 x)	04.855.0753.0	25
	SL (10 x)	04.855.3153.0	25
	N (10 x)	04.855.3253.0	25
	F1 (10 x)	04.855.0953.0	25
	F2 (10 x)	04.855.1053.0	25
L1, L2, L3, N, PE	(2 x)	04.855.0053.0	25
with enlarged marking area			
9705 AL/5/10		04.242.5153.0	25

*Custom marking upon request

4 mm²/6 mm Width

Type		Part no.	Std. pack
Marking strips, unmarked			
9705 A/6/10		04.242.6053.0	25
Marking strips, marked			
9705 A/6/9 B	1 - 9	04.842.5953.0	25
9705 A/6/10 B*		04.842.6053.0	25
9705 A/6/10 B	1 - 10	04.846.0153.0	25
	11 - 20	04.846.0253.0	25
	21 - 30	04.846.0353.0	25
	31 - 40	04.846.0453.0	25
	41 - 50	04.846.0553.0	25
	51 - 60	04.846.0653.0	25
	61 - 70	04.846.0753.0	25
	71 - 80	04.846.0853.0	25
	81 - 90	04.846.0953.0	25
	91 - 100	04.846.1053.0	25
	⏚ (10 x)	04.856.0053.0	25
	⏚ (10 x)	04.856.0153.0	25
	+ (10 x)	04.856.0253.0	25
	– (10 x)	04.856.0353.0	25
	L1 (10 x)	04.856.0453.0	25
	L2 (10 x)	04.856.0553.0	25
	L3 (10 x)	04.856.0653.0	25
	PE (10 x)	04.856.0753.0	25
	SL (10 x)	04.856.3153.0	25
	N (10 x)	04.856.3253.0	25
	F1 (10 x)	04.856.0953.0	25
	F2 (10 x)	04.856.1053.0	25
L1, L2, L3, N, PE	(2 x)	04.856.0853.0	25
with enlarged marking area			
9705 AL/6/10		04.242.6353.0	25

*Custom marking upon request

10 mm²/10 mm Width

16 mm²/12 mm Width

35 mm²/16 mm Width

Type	Part no.	Std. pack
10 mm²/10 mm Width		
marked for 5 blocks (every 2nd tag) *		
9705 A/5/10/5 B	04.842.5553.0	25
16 mm²/12 mm Width		
marked for 5 blocks (every 2nd tag) *		
9705 A/6/10/5 B	04.842.6553.0	25
35 mm²/16 mm Width		
marked for 5 blocks (every 2nd tag) *		
9705 A/10/10/5 B	04.842.8553.0	25

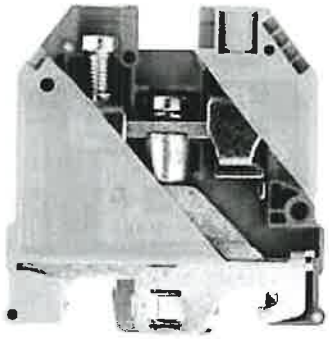
* Indicate required marking with part no.

Item No. 57.504.9055.0

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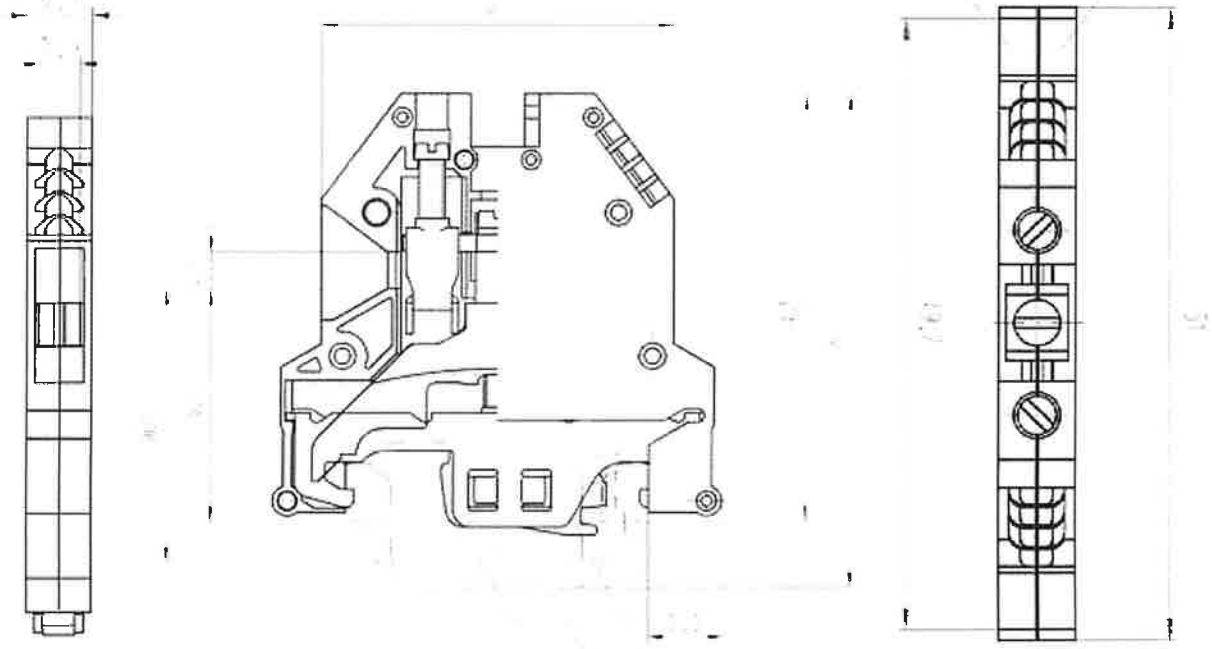
Earth terminal WK 4 SL/ U /V0

Ground DIN rail terminal block with screw connection for mounting on TS 35 and TS 32, nominal cross section 4 mm², width 6 mm, color green/yellow



42-063-004

Rated impulse voltage	8 kV
Pollution degree	3
Closing plate required	No
Length	51 mm
Type of insulation material	Thermoplastic
Cross section UL	22-10 AWG
Cross section CSA	20-10 AWG
Maximum cross section fine stranded	4 mm²
Wire strip length	9 mm
Torque conductor mounting	0.5 Nm
Torque rail mounting	0,5



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Rev: 0	Device Tag: TB,DB	
Date: 4/13/2018		
Manuf:. PNo: WIELAND: 57.504.9055.0	By: TCC	Job Number: HBR7281

Item No. Z5.522.8553.0
End bracket 9708 / 2 S 35
End clamp for mounting rail TS 35

wieland

42-063-009

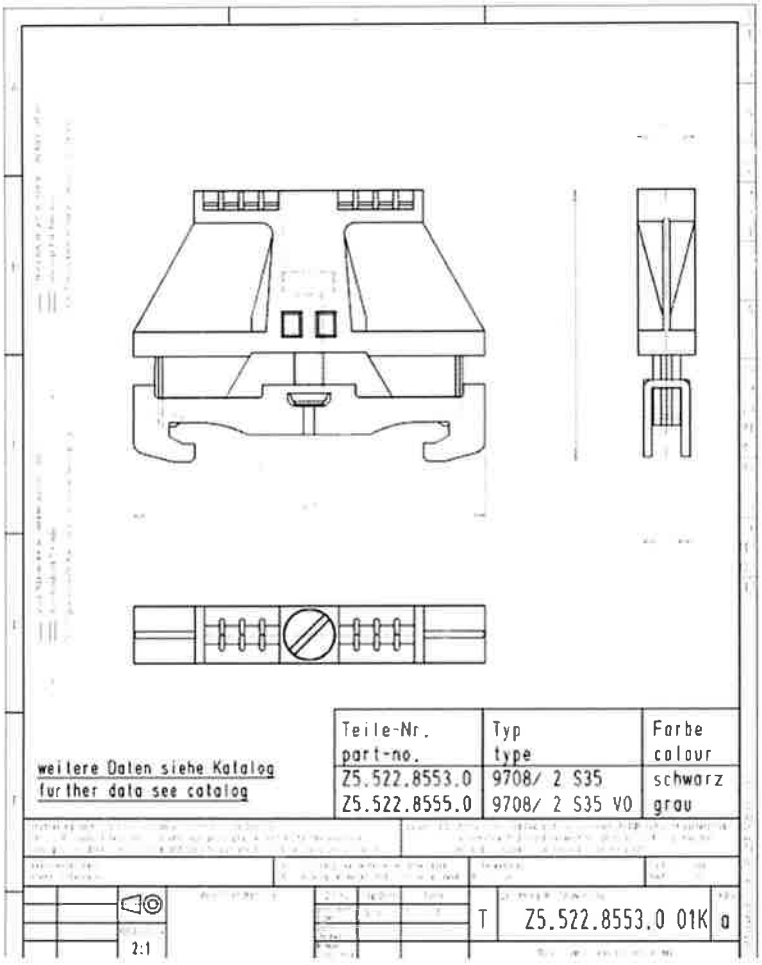


Item No	Z5.522.8553.0
EAN	4015573141766
order unit	100 Piece(s)

Technical data

Accessories

ArticlePrice	udp_no_price
Colour	Black
Inflammability class of insulation material acc. with UL94	V2
Width/grid dimension	8 mm
Latching	Screwable
Length	49 mm
Material	Metal
Mounting method	DIN rail clip (hat rail) 35/7.5 mm



ELEMECH INC. 630-499-7080 · www.elemechinc.com	Rev: 0	Device Tag: TB,DB	
	Date: 4/13/2018		
Manuf:. PNo: WIELAND: Z5.522.8553	By: TCC	Job Number: HBR7281	Page # 1/1

wieland

42-063-001



Datasheet

Art.No. 07.311.0155.0

End plate AP 2,5 -4 /V0

End plate for DIN rail terminal blocks type WK ..., color gray

Art.No.	07.311.0155.0
EAN	4015573392663
Order unit	10 pieces

Approvals

Technical data

General

Colour	Grey
Type of end plate	Yes
Type of partition	No
Thickness	1.5 mm
Snap in	Yes
Inflammability class of insulation material acc. with UL94	V0

Accessories

Type of end plate	Yes
Type of partition	No
Colour	Grey
Thickness	1.5 mm
Snap in	Yes
Inflammability class of insulation material acc. with UL94	V0

Feed-through blocks with screw connection

selos

wieland

42-063-003

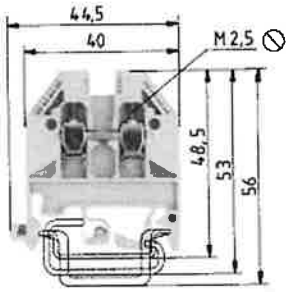


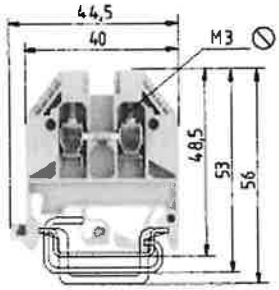
UL wire connection versions

[*] or 2 x no. 14 sol/str AWG
or 2 x no. 16 sol/str AWG
or 2 x no. 18 sol/str AWG
or 3 x no. 20 sol/str AWG or 3 x no. 22 sol/str AWG

[**] or 2 x no. 12 sol/str AWG
or 2 x no. 16 sol/str AWG
or 3 x no. 18 sol/str AWG or 3 x no. 22 sol/str AWG

[***] or 2 x no. 12 sol/str AWG
or 2 x no. 14 sol/str AWG
or 3 x no. 16 sol/str AWG





0344 Ex II 2GD IM2
Ex e I/II
EN 60947-7-1:2002
UL ratings — Field/factory wiring
CSA ratings
KEMA 02 ATEX 2114 U[1] EN 60079-0/EN 60079-7
Width — Wire strip length
Approvals

WK 2,5/U				WK 4/U			
fine-stranded	solid	V	A	fine-stranded	solid	V	A
0,5-2,5 mm²	0,5-4 mm²	800 V/8 kV/3	24	0,5-4 mm²	0,5-6 mm²	800 V/8 kV/3	32
No. 22-12 AWG		600 V	20/30	No. 22-10 AWG[4]		600 V	30/35
No. 24-12 AWG		600 V	25	No. 20-10 AWG		600 V	40
0,5-2,5 mm²	0,5-4 mm²	690 V	23	0,5-4 mm²	0,5-6 mm²	690 V	14/27[3]
5 mm			9 mm	6 mm			9 mm

		Type	Part No.	Std. Pack	Type	Part No.	Std. Pack
Feed-through block	gray	WK 2,5/U	57.503.0055.0	100	WK 4/U	57.504.0055.0	100
Feed-through block Exi	blue	WK 2,5/U BLAU	57.503.0055.6	100	WK 4/U BLAU	57.504.0055.6	100
Accessories							
1. Mounting rail TS 35, DIN rail 7.5 mm high	L = 2 m	35 x 27 x 7,5 EN 60715	98.300.0000.0	1	35 x 27 x 7,5 EN 60715	98.300.0000.0	1
Mounting rail TS 35, DIN rail, 15 mm high	L = 2 m	35 x 24 x 15 EN 60715	98.360.0000.0	1	35 x 24 x 15 EN 60715	98.360.0000.0	1
Mounting rail TS 32, G rail	L = 2 m	9005 EN 60715 G-32	98.190.0000.0	1	9005 EN 60715 G-32	98.190.0000.0	1
2. End clamp with U-foot[2]	10 mm wide	WE 1/U	Z5.523.5753.0	100	WE 1/U	Z5.523.5753.0	100
End clamp TS 35, with screw	8 mm wide	9708/2 S35	Z5.522.8553.0	100	9708/2 S35	Z5.522.8553.0	100
End clamp TS 35, without screw	8 mm wide	WEF 1/35	Z5.523.9353.0	100	WEF 1/35	Z5.523.9353.0	100
3. End plate	gray	AP 2,5 - 4	07.311.0155.0	10	AP 2,5 - 4	07.311.0155.0	10
	blue	AP 2,5 - 4 BLAU	07.311.0155.6	10	AP 2,5 - 4 BLAU	07.311.0155.6	10
4. Partition	gray	TW 2,5 - 4	07.311.1155.0	10	TW 2,5 - 4	07.311.1155.0	10
	blue	TW 2,5 - 4 BLAU	07.311.1155.6	10	TW 2,5 - 4 BLAU	07.311.1155.6	10
5. Cross connector with screws	2 pole	IVB WK 2,5 - 2	Z7.280.2227.0	10	IVB WK 4 - 2	Z7.281.1227.0	10
insulated	3 pole	IVB WK 2,5 - 3	Z7.280.2327.0	10	IVB WK 4 - 3	Z7.281.1327.0	10
	up to 12 pole	IVB WK 2,5 - 12	Z7.280.3227.0	10	IVB WK 4 - 12	Z7.281.2227.0	10
6. Partition plate with marking facility		TS 2,5 GELB	07.311.2053.8	10	TS 4 GELB	07.311.2153.8	10
7. Single cover with marking facility		AD VB 2,5 GELB	04.326.2053.8	10	AD VB 4 GELB	04.326.2153.8	10
8. Cover with warning symbol over 4 blocks		AD VB 5/4 GELB	04.343.4756.8	10	AD VB 6/4 GELB	04.343.4856.8	10

For more accessories see pages 60-77
For marking systems see pages 70-75

[*] For maintaining the proper isolation distances, the open side of a feed-through terminal block as well as both sides of a jumper are to be enclosed by partitions.
[**] Please note the mounting instructions on the cover page — [***] Do not use in Ex e environments — [****] With/without jumper

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Rev: 0	Device Tag: TB1-3	
Date: 4/13/2018		
Manuf:. PNo: WIELAND: 57.504.0055.0	By: TCC	Job Number: HBR7281

DC 24 V Supply:

KFD2-SR2-Ex2.W

AC 120 V Supply:

KFA5-SR2-Ex2.W

AC 240 V Supply:

KFA6-SR2-Ex2.W

PEPPERL+FUCHS

- Dual channel
- AC and DC supply versions
- 1 Signal output with 1 Form 'C' relay per channel
- Optional lead breakage (LB) monitoring
- Hazardous area field circuit EEx ia IIC and Class I, Div 1, Groups A-G



18-049-001

Technical data	KFD2-SR2-Ex2.W KHD2-SR2-Ex2.W	KFA5-SR2-Ex2.W KHA5-SR2-Ex2.W	KFA6-SR2-Ex2.W KHA6-SR2-Ex2.W
Power supply	Terminals 14 (L+), 15 (L-)	Terminals 14, 15	Terminals 14, 15
Nominal voltage	DC 20 V ... 30 V	AC 103.5 V ... 126 V, 45 Hz ... 65 Hz	AC 207 V ... 253 V, 45 Hz ... 65 Hz
Maximum voltage U_m	DC 40 V	DC 126.5 V	DC 253 V
Ripple	≤ 10 %	-	-
Nominal current	≤ 50 mA	-	-
Power consumption	-	≤ 1.3 W	≤ 1.3 W
Input (Intrinsically safe)	Terminals 1+, 3-; 4+, 6-		
Nominal data	per DIN 19 234 or NAMUR, ≈ DC 8 V / ≈ 8 mA		
Input pulse length / Input pulse interval	≥ 20 ms / ≥ 20 ms		
Lead breakage (LB) monitoring	Breakage J ≤ 0.1 mA		
Details of Certificate of Conformity	**PTB Nr. Ex-94.C.2086**	for additional international approvals see page 430	
U_o / I_o / P_o	10.5 V / 13 mA / 34 mW	10.6 V / 19 mA / 51 mW	10.6 V / 19 mA / 51 mW
Permissible circuit values			
Ignition protection method, category	**[EEx ia]**		
Explosion group	IIB / IIC	IIB / IIC	IIB / IIC
Max. external capacitance	2.1 µF / 0.6 µF	2.1 µF / 0.59 µF	2.1 µF / 0.59 µF
Max. external inductance	7 mH / 3 mH	5 mH / 3 mH	5 mH / 3 mH
Ignition protection method, category	**[EEx ib]**		
Explosion group	IIB / IIC	IIB / IIC	IIB / IIC
Max. external capacitance	22 µF / 3 µF	20 µF / 2.9 µF	20 µF / 2.9 µF
Max. external inductance	740 mH / 200 mH	360 mH / 100 mH	360 mH / 100 mH
Entity Parameters	**FM Control Drawing No. 116-0035**	Terminals 4+, 6-; 5+, 6-	
Suitable for Div 2 installation/mounting	No		
Voltage V_{oc}	12.9 V		
Current I_{sc}	19.8 mA		
Voltage V_i	-		
Current I_i	-		
Explosion group	A&B / C&E / D, F&G		
Max. external capacitance (C_a)	1.273 µF / 3.82 µF / 10.18 µF		
Max. external inductance (L_a)	84.88 mH / 298.7 mH / 744.4 mH		
Safety Parameters	**CSA Control Drawing No. 116-0047**	Terminals 4+, 6-; 5+, 6-	
Safety Parameters	12.6 V / 650 Ohms		

Switch Isolators
Relay Output

KFA5-SR2-Ex1.W

PEPPERL+FUCHS

18-049-000

Features

- 1-channel isolated barrier
- 115 V AC supply
- Dry contact or NAMUR inputs
- Relay contact output
- Line fault detection (LFD)
- Reversible mode of operation
- Up to SIL2 acc. to IEC 61508/IEC 61511

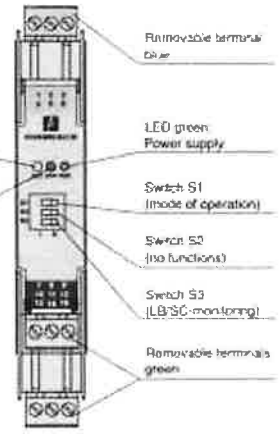
Function

This isolated barrier is used for intrinsic safety applications. It transfers digital signals (NAMUR sensors/mechanical contacts) from a hazardous area to a safe area.

The proximity sensor or switch controls a form C changeover relay contact for the safe area load. The barrier output changes state when the input signal changes state. The normal output state can be reversed using switch S1. Switch S3 is used to enable or disable line fault detection of the field circuit.

During an error condition, the relay reverts to its de-energized state and the LEDs indicate the fault according to NAMUR NE44.

Front view

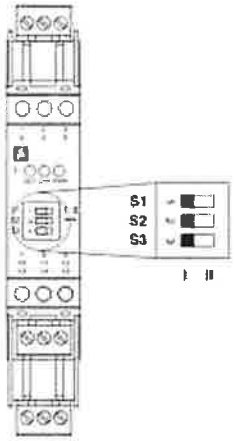


General specifications

Signal type		Digital Input
Supply		
Connection		terminals 14, 15
Rated voltage	U_n	103.5 ... 126 V AC , 45 ... 65 Hz
Power consumption		1 W
Input		
Connection		terminals 1+, 2+, 3-
Rated values		acc. to EN 60947-5-6 (NAMUR)
Open circuit voltage/short-circuit current		approx. 8 V DC / approx. 8 mA
Switching point/switching hysteresis		1.2 ... 2.1 mA / approx. 0.2 mA
Line fault detection		breakage I ≤ 0.1 mA , short-circuit I > 6 mA
Pulse/Pause ratio		≥ 20 ms / ≥ 20 ms
Output		
Connection		terminals 7, 8, 9
Output		signal, relay
Contact loading		253 V AC/2 A/cos φ > 0.7; 126.5 V AC/4 A/cos φ > 0.7; 40 V DC/2 A resistive load
Energized/De-energized delay		approx. 20 ms / approx. 20 ms
Mechanical life		10^7 switching cycles
Transfer characteristics		
Switching frequency		< 10 Hz
Electrical isolation		
Input/Output		reinforced insulation according to IEC/EN 61010-1, rated insulation voltage 300 V_{eff}
Input/power supply		reinforced insulation according to IEC/EN 61010-1, rated insulation voltage 300 V_{eff}
Output/power supply		reinforced insulation according to IEC/EN 61010-1, rated insulation voltage 300 V_{eff}
Ambient conditions		
Ambient temperature		-20 ... 60 °C (-4 ... 140 °F)
Mechanical specifications		
Degree of protection		IP20
Mass		approx. 150 g
Dimensions		20 x 119 x 115 mm (0.8 x 4.7 x 4.5 in) , housing type B2
Mounting		on 35 mm DIN mounting rail acc. to EN 60715:2001
Data for application in connection with Ex-areas		
EC-Type Examination Certificate		PTB 00 ATEX 2081 , for additional certificates see www.pepperl-fuchs.com
Group, category, type of protection		⟨Ex⟩ II (1)G [Ex ia Ga] IIC ⟨Ex⟩ II (1)D [Ex ia Da] IIIC ⟨Ex⟩ I (M1) [Ex ia Ma] I
Input		Ex ia
Voltage	U_o	10.6 V
Current	I_o	19.1 mA
Power	P_o	51 mW (linear characteristic)
Supply		
Maximum safe voltage	U_m	126.5 V AC (Attention! U_m is no rated voltage.)
Output		
Contact loading		253 V AC/2 A/cos φ > 0.7; 126.5 V AC/4 A/cos φ > 0.7; 40 V DC/2 A resistive load
Maximum safe voltage	U_m	253 V AC (Attention! The rated voltage can be lower.)
Electrical isolation		
Input/Output		safe electrical isolation acc. to IEC/EN 60079-11, voltage peak value 375 V
Input/power supply		safe electrical isolation acc. to IEC/EN 60079-11, voltage peak value 375 V
Directive conformity		
Directive 94/9/EC		EN 60079-0:2012 , EN 60079-11:2012

International approvals

FM approval	
Control drawing	116-0035
UL approval	
Control drawing	116-0145
CSA approval	
Control drawing	116-0047
IECEx approval	IECEx PTB 11.0031
Approved for	[Ex ia Ga] IIC, [Ex ia Da] IIIC, [Ex ia Ma] I



Switch position

S	Function		Position
1	Mode of operation Output I (relay) energized	with high input current	I
		with low input current	II
2	no function		
3	Line fault detection	ON	I
		OFF	II

Operating status

Control circuit	Input signal
Initiator high-impedance/ contact opened	low input current
Initiator low-impedance/ contact closed	high input current
Lead breakage, lead short-circuit	Line fault

ELEMECH INC. 630-499-7080 · www.elemechinc.com	Rev: 0	Device Tag: TIB3-6	
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Manuf.: . PNo: P&F: KFA5-SR2/EX1.W	By: TCC	Job Number: HBR7281	Page # 1/1

SMALL COMPACT THERMOSTAT

KTO 011 / KTS 011

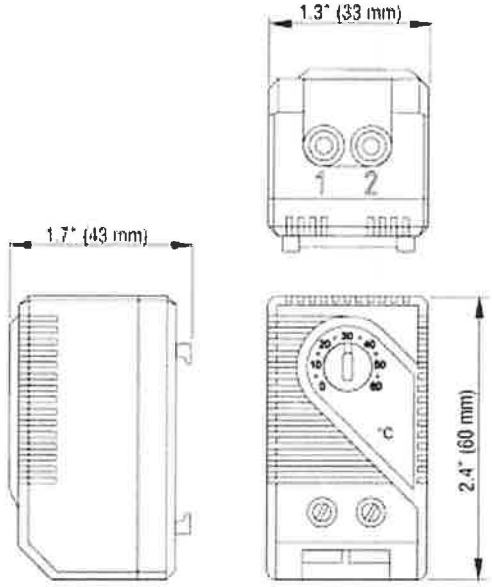
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Technical Data KT 011

Part No.	Contact type	Scale on housing
01140.9-00	normally closed	30 - 140°F
01141.9-00	normally open	30 - 140°F
01146.9-00	normally closed	0 - 60°C
01147.9-00	normally open	0 - 60°C

Sensor element:	Thermostatic bi-metal
Maximum tolerance:	±7.2°F (4K)
Switching difference (hysteresis):	12.6°F ± 5.4°F (7°C ± 3K)
Service life:	100,000 cycles
Switching capacity (max. load):	15A resistive/2A inductive @ 120 VAC 10A resistive/2A inductive @ 250 VAC DC 30W
EMI/EMC compliance:	EN 55014-1-2, EN 61000-3-2, EN 61000-3-3
Connections:	2-pole terminal for AWG 14 max. (2.5 mm²)
Mounting:	Clip for 35 mm DIN rail (EN 50022)
Dimensions (H x W x D):	2.4 x 1.3 x 1.7" (60 x 33 x 43 mm)
Housing:	Plastic, UL94V-0
Weight:	1.27 oz (36 g)
Protection type:	IP 20
Operating/storage temperature:	-49 to 158°F (-45 to 70°C)
Agency approvals:	UL, CSA



ELEMECH INC. 630-499-7080 · www.elemechinc.com	Rev: 0	Device Tag: TS1	
	Date: 4/13/2018		
Manuf:. PNo: STEGO: 01141.9-00	By: TCC	Job Number: HBR7281	Page # 1/1

Liebert® GXT3, 500VA -3000VA Models

Reliable On-Line UPS Protection In A Compact 2U Package

EMERSON

48-210-010

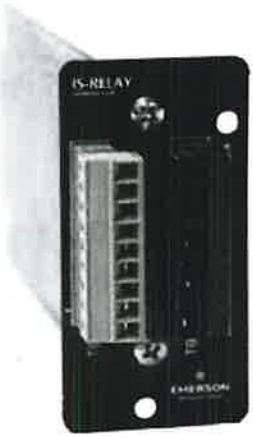




Parameters	Product model	
	GXT3-700RT230	GXT3-1000RT230
Model Rating	**700VA/630W**	**1000VA/900W**
Dimensions, D x W x H, mm (in)		
Unit	497 x 430 x 85 (19.6 x 16.9 x 3.3)	
Shipping	617 x 570 x 262 (24.3 x 22.4 x 10.3)	
Weight, kg (lb)		
Unit	16.8 (37)	
Shipping	20 (44)	
Input AC		
Voltage Range (typical)	230VAC nominal; variable based on output load	
90% ~ 100% loading	177VAC/280VAC	
70% ~ 90% loading	168VAC/280VAC	
30% ~ 70% loading	150VAC/280VAC	
0 ~ 30% loading	115VAC/280VAC	
Frequency	40Hz ~ 70Hz; Auto Sensing	
Input Power Receptacle	C14	
Output AC		
Output Receptacles	C13 × 6	
Voltage	220/230/240VAC (user configurable); ±3%	
Frequency	50Hz or 60Hz	
Waveform	Sine wave	
Mains (AC) Mode Overload	200% for 2 seconds; 150% for 1 minute with transfer to bypass	
Battery		
Type	Valve-regulated, nonspillable, lead acid	
Qty × V× Rating	4 × 12V × 5.0Ah	
Battery Mfr/Part#	YUASA/NPH5-12; CSB/ HR 1221W	
Backup Time	See **Table 14** - Battery run times	
Recharge Time	3 hours to 90% capacity after full discharge with 100% load till UPS auto-shutdown (Internal Batteries Only)	
Environmental Requirements		
Operating Temp	0°C to +40°C (+32°F to +104°F); **Table 13 - Operating temperature parameters**	
Storage Temp	-15°C to +50°C (5°F to 122°F)	
Relative Humidity	0%RH to 95%RH, non-condensing	
Operating Elevation	Up to 3000m (10,000 ft.) at 40°C (104°F) without derating	
Storage Elevation	15,240 (50,000 ft.) maximum	
Audible Noise	< 46 dBA, at 1 meter (3.2ft) from the rear < 43 dBA, at 1 meter (3.2ft) from the front or sides	
Agency		
Safety	EC/EN/AS 62040-1-1:2008	
RFI/EMI	IEC/EN/AS 62040-2 2nd Ed =CISPR22 Class A	
Surge Immunity	IEC 62040-2 2nd Ed	
Transportation	ISTA Procedure 1A	

Liebert IntelliSlot Relay Card

Hot-Swappable Relay Interface for UPS Monitoring



EMERSON
Network Power

48-210-011

This data center monitoring solution provides contact closures for remote monitoring of alarm conditions of Liebert UPS systems equipped with an Intellislot communication port. The card delivers On Battery, On Bypass, Low Battery, Summary Alarm, UPS Fault and On UPS signals to relay contact monitoring systems. The card is user-installable and hot-swappable.

Overview

Liebert Intellislot Relay Card provides contact closures for remote monitoring of alarm conditions of Liebert UPS systems equipped with an Intellislot communication port. Proactive data center monitoring is provided by On Battery, On Bypass, Low Battery, Summary Alarm, UPS Fault and On UPS signals to relay contact monitoring systems. The card is user-installable and hot-swappable.

Liebert Intellislot Relay Card supports UPS systems equipped with the Liebert Intellislot communication port. The card provides Form C contact closure output from the UPS for external systems to monitor On Battery, Low Battery, On Bypass (on-line UPS unit only), and On UPS (on-line UPS units only) alarm conditions. The card supports 24VAC/DC applications up to 1A.

Terminal Block Pin	DB25 Pin	Function	Operation
1	1	UPS Fault	Closed if no UPS failure*
—	2	Not Used	
—	3	Not Used	
4	4	UPS Fault	Closed if UPS fails*
5	5	Summary Alarm**	Closed if SUMMARY ALARM** occurs*
6	6	Summary Alarm**	Closed if no alarm conditions are present*
7	7	Signal Ground (for UPS Any Mode Shutdown)	
—	8	Not Used	
9	9	Common - Low Battery	
10	10	Low Battery	Closed if battery is OK
11	11	Low Battery	Closed if LOW BATTERY point occurs.
—	12	Not Used	
—	13	Not Used	
14	14	UPS Any Mode Shutdown (short to pin 7)	Turn UPS output OFF when connected to pin 7*
15	15	On UPS	Closed if ON UPS (inverter) power*
16	16	On Battery	Closed if ON BATTERY power (Utility failure)
17	17	Common - UPS Fault, Summary Alarm, On UPS, On Battery, On Bypass	
18	18	On Battery	Closed if not ON Battery power (Utility OK)
—	19	Not Used	
—	20	Not Used	
—	21	Not Used	
—	22	Not Used	
—	23	Not Used	
24	24	On Bypass	Closed if ON BYPASS*
—	25	Not Used	

* Feature not available on PSI products

** A Summary Alarm occurs when any of the following conditions exists:

- Utility power is out of the acceptable range (voltage and/or frequency).
- UPS is in BYPASS MODE (load not on Inverter power).
- UPS battery is LOW (<2 minutes of battery power remaining).
- UPS fault has occurred.

48-210-011

Light Duty Power Cords

McMASTER-CARR®

51-000-040



NEMA 1-15 Plug × Wire Leads



NEMA 5-15 Plug × Wire Leads



NEMA 6-15 Plug × Wire Leads



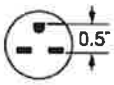
IEC 320 Plug × Wire Leads



NEMA 1-15 Plug



NEMA 5-15 Plug



NEMA 6-15 Plug



IEC 320 Plug

Wd	Cord OD	Wire Ga	Industry Designation	Current, A	Voltage	Cord Insulation Material	Temperature Range, °F	Specifications Met	Color		Each
NEMA 1-15 Plug × Wire Leads											
6 ft.											
0.19"	—	18	SPT-1	10	120V AC	PVC	0° to 140°	UL Listed, CSA Certified	Black	7248K21	$2.29
0.25"	—	18	SPT-2	10	120V AC	PVC	0° to 140°	UL Listed, CSA Certified	Black	7248K23	3.08
8 ft.											
0.25"	—	18	SPT-2	10	120V AC	PVC	0° to 140°	UL Listed, CSA Certified	Black	7248K24	3.35
9 ft.											
0.19"	—	18	SPT-1	10	120V AC	PVC	0° to 140°	UL Listed, CSA Certified	Black	7248K22	3.02
NEMA 5-15 Plug × Wire Leads											
6 ft.											
0.31"	—	18	SPT-1	10	120V AC	PVC	0° to 140°	UL Listed, CSA Certified	Black	70355K05	3.14
0.31"	—	18	SPT-2	10	120V AC	PVC	0° to 140°	UL Listed, CSA Certified	Black	7025K21	3.30
0.38"	—	18	SPT-3	10	120V AC	PVC	0° to 140°	UL Listed, CSA Certified	Black	70355K07	4.14
0.38"	—	16	SPT-2	13	120V AC	PVC	0° to 140°	UL Listed, CSA Certified	Black	7025K24	4.47
0.44"	—	16	SPT-3	13	120V AC	PVC	0° to 140°	UL Listed, CSA Certified	Black	70355K89	5.86
5 1/2 ft.											
—	0.31"	18	SJT	10	120V AC	PVC	0° to 140°	UL Listed, CSA Certified	Black	70355K76	3.92
8 ft.											
0.31"	—	18	SPT-1	10	120V AC	PVC	0° to 140°	UL Listed, CSA Certified	Black	70355K06	3.62
0.31"	—	18	SPT-2	10	120V AC	PVC	0° to 140°	UL Listed, CSA Certified	Black	7025K22	3.96
0.38"	—	18	SPT-3	10	120V AC	PVC	0° to 140°	UL Listed, CSA Certified	Black	70355K88	4.33
0.38"	—	16	SPT-2	13	120V AC	PVC	0° to 140°	UL Listed, CSA Certified	Black	7025K25	4.90
0.44"	—	16	SPT-3	13	120V AC	PVC	0° to 140°	UL Listed, CSA Certified	Black	70355K91	5.81
9 1/2 ft.											
—	0.31"	18	SJT	10	120V AC	PVC	0° to 140°	UL Listed, CSA Certified	Black	70355K02	4.81
—	0.31"	16	SJT	13	120V AC	PVC	0° to 140°	UL Listed, CSA Certified	Black	70355K83	6.19
—	0.38"	14	SJT	15	120V AC	PVC	0° to 140°	UL Listed, CSA Certified	Black	70355K84	7.76
NEMA 6-15 Plug × Wire Leads											
5 1/2 ft.											
—	0.25"	18	SVT	10	240V AC	PVC	0° to 140°	UL Listed, CSA Certified	Black	70355K93	4.12
—	0.31"	18	SJT	10	240V AC	PVC	0° to 140°	UL Listed, CSA Certified	Black	70355K77	4.31
IEC 320 Plug × Wire Leads											
5 1/2 ft.											
—	0.31"	18	SJT	10	240V AC	PVC	0° to 140°	UL Listed, CSA Certified	Black	70355K22	6.41

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Rev: 0

Date: 4/13/2018

By: TCC

Device Tag: UPS1

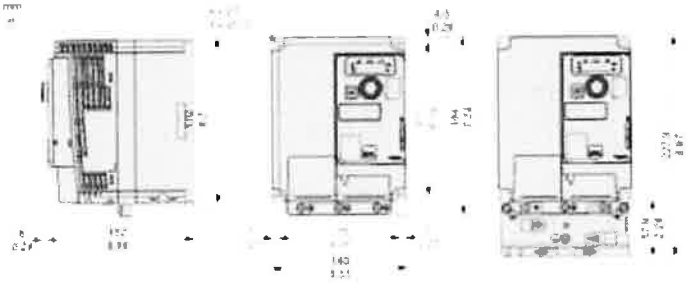
Job Number: HBR7281

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Manuf.: . PNo: MCMASTER-CARR: 70355K84

Product data sheet
ATV320U22N4C
variable speed drive ATV320 - 2.2kW - 380...500V - 3 phase - compact

50-058-126

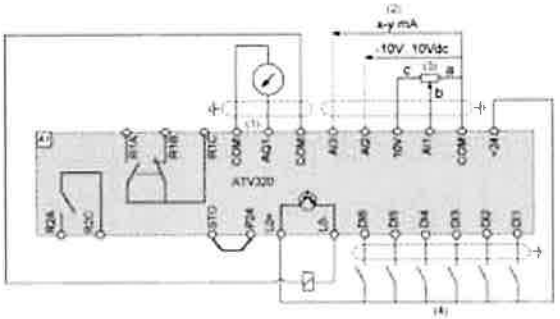




Main

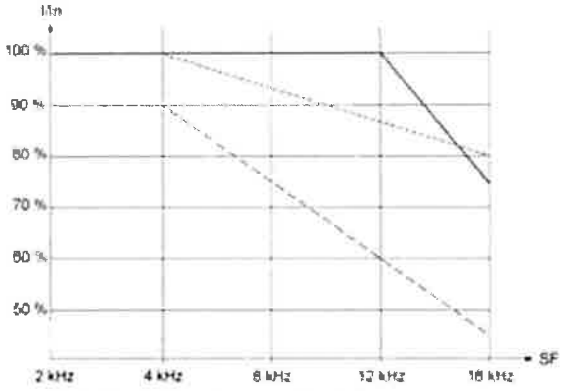
Range of product	Altivar Machine ATV320
Product or component type	Variable speed drive
Product specific application	Complex machines
Device short name	ATV320
Format of the drive	Compact
Product destination	Asynchronous motors Synchronous motors
EMC filter	Class C2 EMC filter integrated
IP degree of protection	IP20 conforming to EN/IEC 61800-5-1
Degree of protection	UL type 1 with UL type 1 conformity kit
Type of cooling	Fan
Network number of phases	3 phases
[Us] rated supply voltage	380...500 V (- 15...10 %)
Supply frequency	50...60 Hz (- 5...5 %)
Motor power kW	2.2 kW for heavy duty
Motor power hp	3 hp for heavy duty
Line current	8.7 A at 380 V for heavy duty 6.6 A at 500 V for heavy duty
Prospective line Isc	<= 5 kA
Apparent power	5.7 kVA at 500 V for heavy duty
Continuous output current	5.5 A at 4 kHz for heavy duty
Maximum transient current	8.3 A during 60 s for heavy duty
Asynchronous motor control profile	Voltage/Frequency ratio, 2 points Voltage/Frequency ratio, 5 points Flux vector control without sensor, standard Voltage/Frequency ratio - Energy Saving, quadratic U/f Flux vector control without sensor - Energy Saving
Synchronous motor control profile	Vector control without sensor
Speed drive output frequency	0.1...599 Hz
Nominal switching frequency	4 kHz
Switching frequency	4...16 kHz with current derating 2...16 kHz adjustable
Safety function	STO (safe torque off) SIL 2
Communication port protocol	CANopen Modbus
Option card	Communication module: CANopen daisy chain RJ45 Communication module: CANopen SUB-D 9 Communication module: CANopen open style terminal block Communication module: EtherCAT RJ45 Communication module: DeviceNet Communication module: Ethernet/IP Communication module: Profibus DP V1 Communication module: Profinet Communication module: Ethernet Powerlink

Control Connection Diagram in Source Mode



(1) Analog output
(2) Analog inputs
(3) Reference potentiometer (10 kOhm max)
(4) Digital inputs

Derating Curves



40 °C (104 °F) - Mounting type A, B and C
50 °C (122 °F) - Mounting type C
60 °C (140 °F) - Mounting type C
In : Nominal Drive Current
SF : Switching Frequency

Product certifications	UL NOM 117 CSA RCM EAC
Marking	CE

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Rev: 0	Device Tag: VFD1,2
Date: 4/13/2018	
By: TCC	Job Number: HBR7281
Manuf:. PNo: SQUARE D: ATV320U22N4C	Page # 1/2

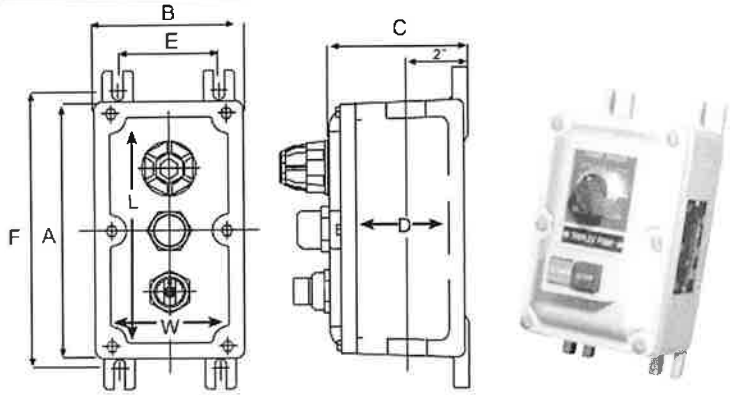
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Complementary

Output voltage	<= power supply voltage
Permissible temporary current boost	1.5 x In during 60 s for heavy duty
Speed range	1...100 with asynchronous motor in open loop mode
Speed accuracy	+/- 10 % of nominal slip 0.2 Tn to Tn
Torque accuracy	+/- 15 %
Transient overtorque	170...200 % of nominal motor torque
Braking torque	< 170 % with braking resistor during 60 s
Regulation loop	Adjustable PID regulator
Motor slip compensation	Automatic whatever the load Not available in voltage/frequency ratio (2 or 5 points) Adjustable 0...300 %
Acceleration and deceleration ramps	S U CUS Deceleration ramp automatic stop DC injection Deceleration ramp adaptation Linear Ramp switching
Braking to standstill	By DC injection
Protection type	Drive: thermal protection Drive: overcurrent between output phases and earth Drive: input phase breaks Drive: overheating protection Drive: short-circuit between motor phases
Frequency resolution	Display unit: 0.1 Hz Analog input: 0.012/50 Hz
Electrical connection	Control: screw terminal: 0.5...1.5 mm² AWG 20...AWG 16 Motor/Braking resistor: screw terminal: 2.5...6 mm² AWG 14...AWG 10 Power supply: screw terminal: 2.5...6 mm² AWG 14...AWG 10
Type of connector	1 RJ45 for Modbus/CANopen on control terminal
Physical interface	2-wire RS 485 for Modbus
Transmission frame	RTU for Modbus
Transmission rate	4.8, 9.6, 19.2, 38.4 kbit/s for Modbus 50 kbps, 125 kbps, 250 kbps, 500 kbps, 1 Mbps for CANopen
Data format	8 bits, configurable odd, even or no parity for Modbus
Type of polarization	No impedance for Modbus
Number of addresses	1...247 for Modbus 1...127 for CANopen
Method of access	Slave for CANopen
Supply	Internal supply for reference potentiometer (1 to 10 kOhm): 10.5 V DC (+/- 5 %) current <= 10 mA (overload and short-circuit protection)
Local signaling	1 LED green for CANopen run 1 LED red for CANopen error 1 LED red for drive fault
Analogue input number	3
Analogue input type	Voltage (AI1): 0...10 V DC, impedance 30000 Ohm, resolution 10 bits Bipolar differential voltage (AI2): +/- 10 V DC, impedance 30000 Ohm, resolution 10 bits Current (AI3): 0...20 mA (or 4-20 mA, x-20 mA, 20-x mA or other patterns by configuration), impedance 250 Ohm, resolution 10 bits
Discrete input number	7
Discrete input type	Programmable (sink/source) (DI1...DI4): 24...30 V DC, level 1 PLC Programmable as pulse input 20 kpps (DI5): 24...30 V DC, level 1 PLC Switch-configurable PTC probe (DI6): 24...30 V DC Safe torque off (STO): 24...30 V DC, impedance 1500 Ohm
Discrete input logic	Negative logic (sink): (DI1...DI6), > 19 V (state 0), < 13 V (state 1) Positive logic (source): (DI1...DI6), < 5 V (state 0), > 11 V (state 1)
Analogue output number	1
Analogue output type	Software-configurable current (AQ1): 0...20 mA, impedance 800 Ohm, resolution 10 bits Software-configurable voltage (AQ1): 0...10 V, impedance 470 Ohm, resolution 10 bits
Sampling duration	Analog input (AI1, AI2, AI3): 2 ms Analog output (AQ1): 2 ms
Accuracy	Analog input AI1, AI2, AI3: +/- 0.2 % for a temperature of -10...60 °C Analog input AI1, AI2, AI3: +/- 0.5 % for a temperature of 25 °C Analog output AQ1: +/- 1 % for a temperature of 25 °C Analog output AQ1: +/- 2 % for a temperature of -10...60 °C
Linearity error	Analog input (AI1, AI2, AI3): +/- 0.2...0.5 % of maximum value Analog output (AQ1): +/- 0.3 %
Discrete output number	3
Discrete output type	Configurable relay logic NO/NC (R1A, R1B, R1C): electrical durability 100000 cycles Configurable relay logic NO (R2A, R2B): electrical durability 100000 cycles Logic (LO)
Refresh time	Logic input (DI1...DI6): 8 ms (+/- 0.7 ms) Relay output (R1A, R1B, R1C): 2 ms Relay output (R2A, R2C): 2 ms
Minimum switching current	Relay output (R1, R2): 5 mA at 24 V DC
Maximum switching current	Relay output (R1) on resistive load (cos phi = 1): 3 A at 250 V AC Relay output (R1) on resistive load (cos phi = 1): 4 A at 30 V DC Relay output (R1, R2) on inductive load (cos phi = 0.4): 2 A at 250 V AC Relay output (R1, R2) on inductive load (cos phi = 0.4): 2 A at 30 V DC Relay output (R2) on resistive load (cos phi = 1): 5 A at 250 V AC Relay output (R2) on resistive load (cos phi = 1): 5 A at 30 V DC
Specific application	Machinery

Explosion-Proof Control Stations "CXI" Series

11-004-006



CXI Dimensions

Catalog Number	Nominal Inside Dimensions W	L	D	Dimensions In Inches A	B	C	F	E	Est. Lbs.	Std. Conduit Size	Mtg. Bolt Size
CXI 333-X1	3-1/2	3-1/2	3	4-9/16	4-9/16	4-1/2	5-1/2	3-1/4	5	3/4"	1/4"
CXI 363-X2	3-1/2	6	3	7-1/16	4-9/16	4-1/2	8	3-1/4	6	3/4"	1/4"
CXI 373-X3	3-1/2	7	3	8-1/16	4-9/16	4-1/2	9	3-1/4	7	3/4"	1/4"
CXI 393-X4	3-1/2	9	3	10-1/16	4-9/16	4-1/2	11	3-1/4	8	1"	1/4"
CXI 3113-X5	3-1/2	11	3	12-1/16	4-9/16	4-1/2	13	3-1/4	10	1-1/4"	1/4"
CXI 3133-X6	3-1/2	13	3	14-1/16	4-9/16	4-1/2	15	3-1/4	11	1-1/4"	1/4"
CXI 3153-X7	3-1/2	15	3	16-1/16	4-9/16	4-1/2	17	3-1/4	12	1-1/4"	1/4"
CXI 3183-X8/X9	3-1/2	18	3	19-1/16	4-9/16	4-1/2	20	3-1/4	14	1-1/4"	1/4"

CXI Dimensions

Catalog Number	Nominal Inside Dimensions W	L	D	Dimensions In Inches A	B	C	F	E	Est. Lbs.	Max. Conduit Size	Mtg. Bolt Size
CXI 484	4-1/4	8	4	10-29/64	6-45/64	5-5/8	11-1/2	5-1/4	19	2"	1/4"
CXI 6104	6-1/2	10	4	11-1/16	7-9/16	6-1/8	11-27/32	6-1/4	21	2"	1/4"
CXI 6174	6-1/2	17	4	18-5/16	7-13/16	6-1/8	18-3/4	6-1/4	33	2"	1/4"
CXI 6244	6-1/2	24	4	25-13/16	7-13/16	6-1/8	26-1/4	6-1/4	45	2"	1/4"
CXI 6304	6-1/2	30	4	31-13/16	7-13/16	6-1/8	32-1/4	6-1/4	56	2"	1/4"

Note: All dimensions are for reference only

CXI SUFFIX	Number of Operators (Vert.)
X1	1
X2	2
X3	3
X4	4
X5	5
X6	6
X7	7
X8/X9	8/9

Materials:

Enclosures: Copper-free Aluminum (less than 0.25% copper content)

Cover Bolts: Cad-Plated or Stainless Steel (please specify)

Mounting Pan (Opt.): Aluminum*;

Galvanized Steel or Phenolic Materials available upon request.

*Note: Aluminum Mounting Pan will be provided if mounting pan is requested, unless otherwise noted.

Compliances:

N.E.C. - Class. I, Div. 1 & 2 Groups B*, C & D

Class. II, Div. 1 & 2 Groups E, F & G

Class. III

NEMA 7 & 9 (Optional 3, 4X)

* - CXI 484 Only

ISO 9001 With Design

Approvals:

UL CLASSIFIED - Standard 886 - E94590

cUL (CXI 4 & 6) - Standard C22.2 No. 30-M1986 and No. 25-1966

CSA Certified (CXI 3) - Standard C22.2 No. LR64264

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Rev:	Device Tag:
0	LCS
Date: 4/13/2018	
By: TCC	Job Number: HBR7281

Manuf.: . PNo:
AKRON ELECTRIC: CXI-373-X3-N4-N5-2RP2

OPTIONAL MODIFICATIONS

11-004-006

BD=Breather or Drain with 1/2" NPT (please specify)
2BD=Breather & Drain
C1= Circuit Breaker Handle, 100 AMP - installed
C2= Circuit Breaker Handle, 225 AMP - installed
C4= Circuit Breaker Handle, 600 AMP - installed
C5= Circuit Breaker Handle, 800 AMP - installed
C8= Circuit Breaker Handle, Custom - installed
C10= Panel Board Breaker Handle
CEN= Cenelec (ATEX) Option
E1= Corrosion-Resistant Epoxy Paint (Outside only)
E2= Corrosion-Resistant Epoxy Paint (Inside & Outside)
E3= Stainless Steel (316) Triple Lead Captive Quick Thread Cover Bolts
E4= Stainless Steel Mounting Hardware (Internal Hardware)
E5= Corrosion-Resistant Epoxy Paint (Inside Only)
E8= Custom Mounting Bracket (For meter, etc.)
E9= Clear Anodizing
G1= 1" Diameter Round Window Glass (Installed)
G2= 2" Diameter Round Window Glass (Installed)
G3= 3" Diameter Round Window Glass (Installed)
G4= 4" Diameter Round Window Glass (Installed)
G5= 5-1/4" Diameter Round Window Glass (Installed)
G6= 6-3/4" Diameter Round Window Glass (Installed)
G7= 7-5/8" Diameter Round Window Glass (Installed)
G8= Custom Square or Rectangular Window Glass (Installed / Specify)
H1= Stainless Steel Hinge Kit (for AXJ12126 and smaller)
HC1= Aluminum Cast Hinge Kit (for AXJ12126 and smaller)
H2= Medium Duty Cast Aluminum Hinge Kit (for CXJ12184 to CXJ18308)
H3= Heavy Duty Cast Aluminum Hinge Kit (for CXJ18368 to CXJ346810)
HL*= Hinge Lifter Guide Pin
K+= Terminal Block (Specify Qty.)
MS= Standard XJIH Mounting Strap
MSR= Raised XJIH Mounting Strap
MSD= Diamond Shaped XJIH Mounting Strap
N1=Aluminum Mounting Panel
N2=Galvanized Mounting Panel
N3=Phenolic Mounting Panel
N4=NEMA 4 O-ring Gasket
N5=Stainless Steel Rust Proof Cover Bolts
N6= Metallic Legend Plates
JN6= Jumbo Metallic Legend Plates
MN6= Mini Metallic Legend Plates
N7= Phenolic Legend Plates
N8= Custom Legend Plates
R3 = 3/4" NPSM Close-Up Plug
RP1= 1/2" NPT Conduit Entry Close-Up Plug
RP2= 3/4" NPT Conduit Entry Close-Up Plug
RP3= 1" NPT Conduit Entry Close-Up Plug
RP4= 1-1/4" NPT Conduit Entry Close-Up Plug
RP5= 1-1/2" NPT Conduit Entry Close-Up Plug
RP6= 2" NPT Conduit Entry Close-Up Plug
RP7= 2-1/2" NPT Conduit Entry Close-Up Plug
RP8= 3" NPT Conduit Entry Close-Up Plug
RP9= 3-1/2" NPT Conduit Entry Close-Up Plug
RP10= 4" NPT Conduit Entry Close-Up Plug

* - HL is suggested for enclosures with 30" of length, or when hinges are installed on the short side of the enclosure.

Hazardous Location Push Buttons

2-Position Push-Pull Units, Non-Illuminated

Allen-Bradley

29-005-009

Contact Type	Operator Position: Maintained Out	Operator Position: Maintained In	Button Color	Push-Pull Cat. No.*
N.C.L.B.	X	O	Red	800H-FPX6D4
N.O. - N.C.L.B.	O X	X O	Red	800H-FPX6A1
N.C.L.B. - N.C.L.B.	X X	O O	Red	800H-FPX6A5

Note: X = Closed/O = Open

* For long barrel versions, add an L to the cat. no. **Example:** Cat. No. 800HL-FPX6D4.



Electrical Ratings		
Contact Ratings	Refer to the Contact Ratings tables below.	
Dielectric Strength	2200V for one minute, 1300V for one minute (Logic Reed)	
Electrical Design Life Cycles	1,000,000 at max. rated load, 200,000 at max. rated load (Logic Reed)	
Mechanical Ratings		
Vibration	10...2000 Hz 1.52 mm displacement (peak-to-peak) Max./10 G Max. (except Logic Reed)	
Shock	1/2 cycle sine wave for 11 ms ≥ 25 G (contact fragility) and no damage at 100 G	
Degree of Protection	Type 7 & 9 Explosion Proof (Type 3 and Type 4 ratings available with accessories)	
Mechanical Design Life Cycles		
Push Buttons	250,000 minimum	
Potentiometers	100,000 minimum	
All other devices	200,000 minimum	
Contact Operation	Shallow and Mini Contact Blocks:	Slow double make and break
	Logic Reed & Sealed Switch Contact Blocks:	Snap-action
Typical Operating Forces		
Operators without contact blocks:	Flush, Extended, Standard Mushroom, Jumbo Mushroom:	2.9 lbs Max.
	Jumbo and Extended Aluminum Mushroom Head:	3.95 lbs maximum
	Maintained Selector Switch:	4.0 in.-lbs maximum
Spring Return Selector Switches:	5 in.-lbs to stop, 0.2 in.-lbs to return	
Illuminated Push Buttons and Push-to-Test Pilot Lights	5.6 lbs maximum	
2-Position Push-Pull	9 lbs maximum push or pull	
3-Position Push-Pull	12 lbs maximum push to in position or pull to center position (15 lbs maximum pull to out position)	
Contact Blocks: 800T-XA	1 lb	
Logic Reed	1 lb maximum	
Sealed Switch	3 lbs maximum at 0.205" plunger travel	
Stackable Sealed Switch	1 lb maximum	
Environment		
Temperature Range: Operating	–4...+131°F (–20...+55°C)	
Storage	–40...+185°F (–40...+85°C)	
Note: Operating temperatures below freezing are based on the absence of freezing moisture and liquids.		
Humidity	50% at +104°F (+40°C)	

UL Listed (File No. E10314 Guide No. NOIV)
CSA (File No. LR11924)

When properly mounted in a Type 7 & 9 enclosure, Bulletin 800H Type 7 & 9 operators are designed to meet the requirements of the National Electrical Code for Class I, Divisions 1 & 2, Groups B, C & D Hazardous Gas; Class II, Divisions 1 & 2, Groups E, F and G Hazardous Dust; and, Class III Hazardous Fiber Locations. In addition, the single-gang shallow base, Cat. No. 800H-IHZX7, meets Class I, Group B requirements. This Type 7 & 9 equipment is listed by Underwriters Laboratories, Inc.

Hazardous Location Push Buttons

Type 7 & 9, for Divisions 1 & 2

3-Position Selector Switch Units, Non-Illuminated



39-005-***

Contact Type	Operator Position			Operator Type M = Maintained S = Spring Return	Standard Knob Cat. No.
				M M M	800H-JP2KB7
No Contacts	—	—	—	S→M M	800H-JP4KB7
				M M←S	800H-JP5KB7
				S→M←S	800H-JP91KB7
				M M M	800H-JP2KB7AXXX
1 N.O. - 1 N.C.	O X	O O	X O	S→M M	800H-JP4KB7AXXX
				M M←S	800H-JP5KB7AXXX
				S→M←S	800H-JP91KB7AXXX
				M M M	800H-JP2KB7AAXX
2 N.O. - 2 N.C.	O X O X	O O O O	X O X O	S→M M	800H-JP4KB7AAXX
				M M←S	800H-JP5KB7AAXX
				S→M←S	800H-JP91KB7AAXX

Note: X = Closed/O = Open

UL Listed (File No. E10314 Guide No. NOIV)
CSA (File No. LR11924)

Milltronics MFA 4p

MILLTRONICS
PETERBOROUGH, ONTARIO, CANADA.

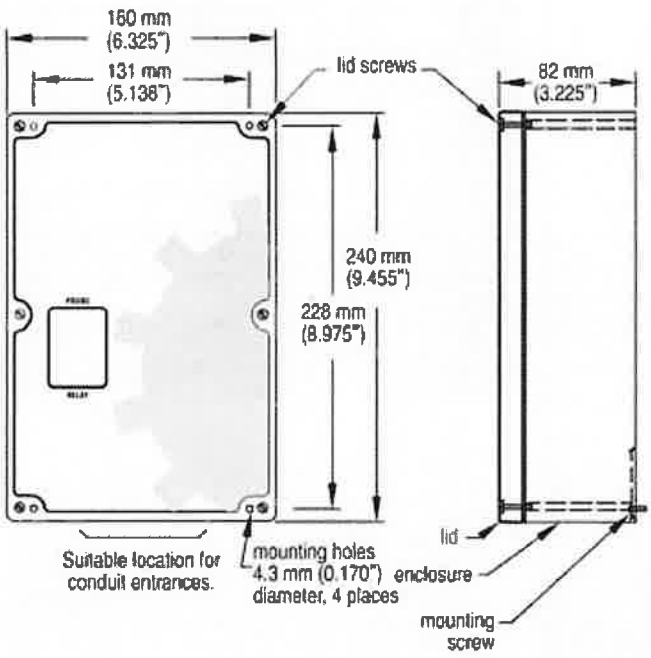
65-043-001

Ordering data	Order No.
MFA 4P Motion Failure Alarm Controller	A) 7MH7144 -
A highly sensitive single setpoint motion sensor alarm unit, used with MSP and XPP probes	
Enclosure	
NEMA 4X, polycarbonate enclosure	1
NEMA 4 painted mild steel enclosure	2
NEMA 4 stainless steel enclosure	3
Input Voltage	
100/115/200/230 V AC, 50/60 Hz, switch selectable	A
Speed detection version	
Standard, underspeed (U/S) or overspeed (O/S), switch selectable	A
Slow speed (S/S), U/S or O/S detection, switch selectable	B
Approvals	
CE, CSA$_{US/C}$, FM	2



Technical specifications

Mode of operation	
Measuring principle	Motion monitor and alarm
Typical application	Monitoring loss of motion in tail pulley, screw flights, bucket elevators
Features	• Switch selectable overspeed or underspeed detection • Setpoint adjustment 2 - 3000 PPM • Adjustable start-up time delay 0 - 60 seconds • Visual indication of probe operation and relay status
Output	2 relays working in unison, each providing 1 form C relay contacts (SPDT), rated 8 A @ 250 V AC resistive
Performance	
Repeatability	±1%
Dead band	±0.25%
Dynamic Range	0-7200 PPM
Ambient Temperature Range	-20 to +50 °C (-5 to +122 °F)
Design	
Enclosure rating	Type 4X/NEMA 4X/IP65 (standard and optional stainless steel) Type 4X/NEMA 4X/IP65 (optional mild steel)
Enclosure dimensions	160 mm x 240 mm x 82 mm (6.3" x 9.5" x 3.2")
Enclosure material	Polycarbonate (optional: mild steel or stainless steel)
Power Supply	100/115/200/230 V AC switch selectable, 50/60 Hz, 15 VA ±10% of rated voltage
Approvals	CE, CSA$_{US/C}$, FM



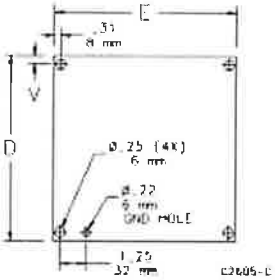
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Manuf.: . PNo: MILLTRONICS: MFA-4P (7MH71441AA2)	Rev: 0	Device Tag: ZSC	
	Date: 4/13/2018		
	By: TCC	Job Number: HBR7281	Page # 1/1

SUB-PANELS FOR ENCLOSURES

PENTAIR

SUB-PANEL CATALOG NUMBER	SUB-PANEL DIMENSIONS (IN.)
A-DPESS	D x E





11-035-126

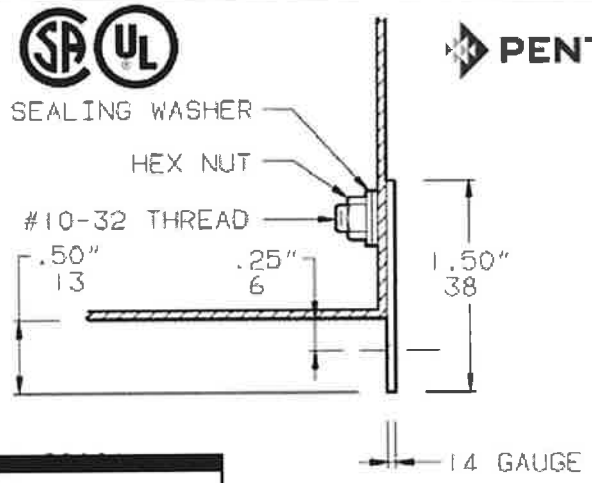
NOTE:

1. 6 Indicates 316 Stainless Steel.
2. AL Indicates Aluminum
3. G Indicates Conductive Steel

Catalog Number	Material	Panel Size D x E (in.)	Panel Size D x E (mm)	V (in.)	V (mm)
A6P4	Painted steel	4.88 x 2.88	124 x 73	0.31	8
A6P4G	Conductive steel	4.88 x 2.88	124 x 73	0.31	8
A6P4SS	Stainless Steel	4.88 x 2.88	124 x 73	0.31	8
A6P4AL	Aluminum	4.88 x 2.88	124 x 73	0.31	8
A6P6	Painted steel	4.88 x 4.88	124 x 124	0.31	8
A6P6G	Conductive steel	4.88 x 4.88	124 x 124	0.31	8
A6P6SS	Stainless Steel	4.88 x 4.88	124 x 124	0.31	8
A6P6AL	Aluminum	4.88 x 4.88	124 x 124	0.31	8
A8P6	Painted steel	6.75 x 4.88	171 x 124	0.25	6
A8P6G	Conductive steel	6.75 x 4.88	171 x 124	0.25	6
A8P6SS	Stainless Steel	6.75 x 4.88	171 x 124	0.25	6
A8P6AL	Aluminum	6.75 x 4.88	171 x 124	0.25	6
A8P8	Painted steel	6.75 x 6.88	171 x 175	0.25	6
A8P8AL	Aluminum	6.75 x 6.88	171 x 175	0.25	6
A10P8	Painted steel	8.75 x 6.88	222 x 175	0.25	6
A10P8G	Conductive steel	8.75 x 6.88	222 x 175	0.25	6
A10P8SS	Stainless Steel	8.75 x 6.88	222 x 175	0.25	6
A10P8AL	Aluminum	8.75 x 6.88	222 x 175	0.25	6
A10P10	Painted steel	8.75 x 8.88	222 x 226	0.25	6
A10P10G	Conductive steel	8.75 x 8.88	222 x 226	0.25	6
A10P10AL	Aluminum	8.75 x 8.88	222 x 226	0.25	6
A12P6	Painted steel	10.75 x 4.88	273 x 124	0.25	6
A12P6G	Conductive steel	10.75 x 4.88	273 x 124	0.25	6
A12P10	Painted steel	10.75 x 8.88	273 x 226	0.25	6
A12P10G	Conductive steel	10.75 x 8.88	273 x 226	0.25	6
A12P10SS	Stainless Steel	10.75 x 8.88	273 x 226	0.25	6
A12P10AL	Aluminum	10.75 x 8.88	273 x 226	0.25	6
A12P12	Painted steel	10.75 x 10.88	273 x 276	0.25	6
A12P12G	Conductive steel	10.75 x 10.88	273 x 276	0.25	6
A12P12SS	Stainless Steel	10.75 x 10.88	273 x 276	0.25	6
A14P8	Painted steel	12.75 x 6.88	324 x 175	0.25	6
A14P8G	Conductive steel	12.75 x 6.88	324 x 175	0.25	6
A14P12	Painted steel	12.75 x 10.88	324 x 276	0.25	6
A14P12G	Conductive steel	12.75 x 10.88	324 x 276	0.25	6
A14P12SS	Stainless Steel	12.75 x 10.88	324 x 276	0.25	6
A14P12AL	Aluminum	12.75 x 10.88	324 x 276	0.25	6
A16P10	Painted steel	14.75 x 8.88	375 x 226	0.25	6
A16P10G	Conductive steel	14.75 x 8.88	375 x 226	0.25	6
A16P14	Painted steel	14.75 x 12.88	375 x 327	0.25	6
A16P14G	Conductive steel	14.75 x 12.88	375 x 327	0.25	6
A16P14SS	Stainless Steel	14.75 x 12.88	375 x 327	0.25	6
A16P14AL	Aluminum	14.75 x 12.88	375 x 327	0.25	6
A18P16	Painted steel	16.75 x 14.88	425 x 378	0.25	6
A18P16G	Conductive steel	16.75 x 14.88	425 x 378	0.25	6
A18P16SS	Stainless Steel	16.75 x 14.88	425 x 378	0.25	6
A18P16AL	Aluminum	16.75 x 14.88	425 x 378	0.25	6

Mounting Bracket Kits

Mounting bracket kits DMFK1 and DMFK2 include two 14 gauge steel external mounting brackets and fasteners. Mounting bracket kit CMFK and CMFKSS each contain four 12 gauge steel or Type 304 stainless steel external mounting brackets and fasteners. Sealing washers are provided with each kit to maintain Type 4 or 12 rating after installation. Steel mounting brackets are zinc plated with clear chromate finish.



PENTAIR

11-035-176

Catalog Number	Description
† DMFK1	Mounting bracket kit
† DMFK2	Mounting bracket kit
† CMFK	Steel mounting bracket kit
†† CMFKSS	Stainless steel mounting bracket kit
†† CMTGFT	Composite mounting bracket kit



† Maintains UL/CSA Type 4 and Type 12.

†† Maintains UL/CSA Type 4 Type 4X, and Type 12.

Fiberglass Mounting Bracket Kit

Catalog Number	Bulletin Number
A50MFKR	A50Y

FIBERGLASS-HINGE COVERED JUNCTION BOX TYPE 4X JUNCTION BOXES

PENTAIR

11-035-273

ENCLOSURE CATALOG NUMBER	ENCLOSURE DIMENSIONS (IN.)	SUB-PANEL CATALOG NUMBER
A-ABCJFGQRPWR	A x B x C	A APB

NOTE: 1. PWR indicates with window cover.
2. R indicates with solid cover.



INDUSTRY STANDARDS

Mounting brackets required to meet UL/CSA external mounting requirements.

UL 508A Listed; Type 3, 3R, 4, 4X, 12, 13; File No. E61997
cUL Listed per CSA C22.2 No 94; Type 3, 3R, 4, 4X, 12, 13; File No. E61997
Enclosure flammability evaluated per UL 508A
Window flammability evaluated per UL 508A

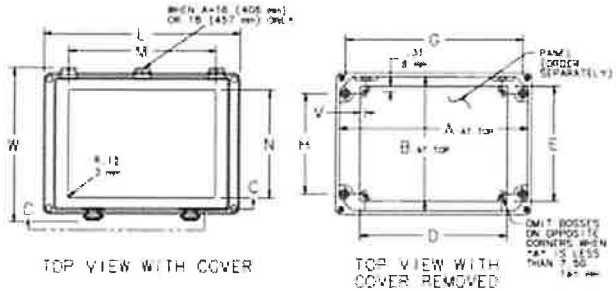
NEMA/EEMAC Type 3, 3R, 4, 4X, 12, 13
CSA File No. 42186: Type 3R, 4, 4X, 12
IEC 60529, IP66
Meets NEMA Type 3RX requirements

APPLICATION

Able to withstand harsh environments, these small enclosures feature a simple, traditional non-metallic design that is suitable for a broad range of applications.

SPECIFICATIONS

- Compression-molded fiberglass material has excellent temperature and chemical resistance qualities and exhibits outstanding physical properties
- Fiberglass material is easily punched, drilled, filed or sawed
- Seamless foam-in-place gasket assures water-tight and dust-tight seal
- Threaded internal bosses provided for mounting optional panels and terminal block kits
- Scratch-resistant polycarbonate windows are permanently bonded in place
- Screw-cover enclosures have easily removable covers attached to body with internal plated steel hinges. Cover securely fastens to the body with four captivated Type 316 stainless steel cover screws.
- Enclosures with quick-release latches have corrosion-resistant polyester hinges and polyester latches with a Type 316L stainless steel bail. Attached with Type 316 stainless steel screws. A Type 316L stainless steel padlock hasp is furnished with each enclosure.
- Sealing washers are furnished with enclosure



TOP VIEW WITH COVER

TOP VIEW WITH COVER REMOVED

FINISH

Fiberglass material is light-gray inside and out. Optional steel panels are painted white. Optional stainless steel, aluminum and composite panels are unpainted.

ACCESSORIES

See also Accessories.
H2OMIT® Vent Drains, Type 4X
HOL-SEALERS™ Non-Metallic Hole Seals
Panels for Junction Boxes

MODIFICATION AND CUSTOMIZATION

Hoffman excels at modifying and customizing products to your specifications. Contact your local Hoffman sales office or distributor for complete information.

BULLETIN: A50

Level Measurement
Continuous level measurement · Ultrasonic controllers
HydroRanger 200 HMI

SIEMENS

49-043-117



Technical specifications

Mode of Operation	
Measuring principle	Ultrasonic level measurement
Measuring range	0.3 ... 15 m (1 ... 50 ft), transducer dependent
Measuring points	1 or 2
Input	
Analog	0 ... 20 mA or 4 ... 20 mA, from alternate device, scalable (6 relay model)
Discrete	10 ... 50 V DC switching level Logical 0 ≤ 0.5 V DC Logical 1 = 10 ... 50 V DC max. 3 mA
Output	
EchoMax transducer	44 kHz
Ultrasonic transducer	Compatible transducers: ST-H and EchoMax series XPS-10, XPS-15/15F, and XRS-5
Relays[1]	Rating 5 A at 250 V AC, non-inductive
• Model with 6 relays	4 SPST Form A/2 SPDT Form
mA output	0 ... 20 mA or 4 ... 20 mA
• Max. load	750 Ω, isolated
• Resolution	0.1 % of range
Accuracy	
Error in measurement	0.25 % of range or 6 mm (0.24 inch), whichever is greater
Resolution	0.1 % of measuring range or 2 mm (0.08 inch), whichever is greater[2]
Temperature compensation	• -50 ... +150 °C (-58 ... +302 °F) • Integral temperature sensor in transducer • External TS-3 temperature sensor (optional) • Programmable fixed temperature values

Rated operating conditions	
Installation conditions	
• Location	Indoor / outdoor
• Installation category	II
• Pollution degree	4
Ambient conditions	
• Ambient temperature (enclosure)	-20 ... +50 °C (-4 ... +122 °F)
Design	
Weight	
• Wall mount	1.22 kg (2.68 lb)
• Panel mount	1.35 kg (2.97 lb)
Material (enclosure)	Polycarbonate
Degree of protection (enclosure)	
• Wall mount	IP65/Type 4X/NEMA 4X
• Panel mount	IP54/Type 3/NEMA 3
Cable	
• Transducer and mA output signal	2-core copper conductor, twisted, shielded, 300 Vrms, 0.82 mm² (18 AWG), Belden 8 760 or equivalent is acceptable
• Max. separation between transducer and transceiver	365 m (1 200 ft)
Displays and controls	60 x 40 mm (2.36 x 1.57 inch) LCD 240 x 160 pixels resolution
Power supply[3]	
AC version	100 ... 230 V AC ± 15 %, 50/60 Hz, 36 VA (17 W)
DC version	12 ... 30 V DC (20 W)
Certificates and approvals	• CE, RCM[4] • FM, CSA$_{US/C}$, UL listed • CSA$_{US/C}$ Class I, Div. 2, Groups A, B, C and D, Class II, Div. 2, Groups F and G, Class III (wall mount only) • MCERTS Class 2 approved for Open Channel Flow
Communication	• RS 232 with Modbus RTU or ASCII via RJ-11 connector • RS 485 with Modbus RTU or ASCII via terminal blocks • Optional: SmartLinx cards for - PROFIBUS DPV1 - DeviceNet

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Rev: 0
Date: 4/13/2018
By: TCC

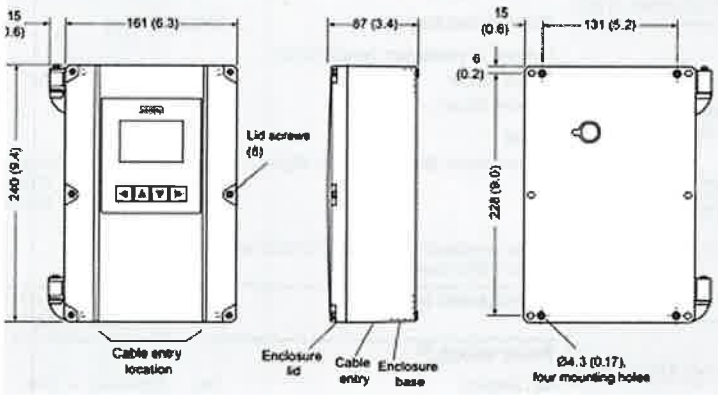
Device Tag: ULC
Job Number: HBR7281

Manuf.: . PNo: SIEMENS: 7ML5034-4AA01

Selection and Ordering data	Article No.
Siemens HydroRanger 200 HMI Ultrasonic level controller for up to six pumps that provides control, differential control and open channel flow monitoring. ↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.	↗ **7ML5034-** ■■■■■
Mounting, enclosure design	
4 button HMI, Wall mount, standard enclosure	4
4 button HMI, Wall mount, 4 entries, 4 M20 cable glands included	5
4 button HMI, Panel Mount	6
Input voltage	
100 ... 230 V AC	A
12 ... 30 V DC	B
Number of measurement points	
Single point model, 6 relays	A
Dual point model, 6 relays	B
Communication (SmartLinx)	
Without module	0
SmartLinx PROFIBUS DP V0 module	2
SmartLinx DeviceNet module	3
SmartLinx PROFIBUS DP V1 module	4
See SmartLinx product page 4/374 for more information	
Approvals	
General Purpose CE, FM, $CSA_{us/c}$, UL listed, RCM	1
CSA Class I, Div. 2, Groups A, B, C, and D; Class II, Div. 2, Groups F and G; Class III[1]	2

[1] Available with Mounting/Enclosure design options 4 or 5

Wall mount dimensions

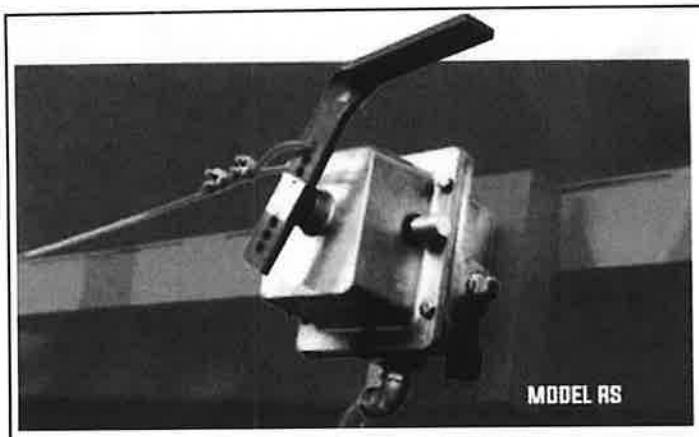


Selection and Ordering data	Order code
Further designs	
Please add "-Z" to Article No. and specify Order code(s).	
Stainless steel tag (69 x 50 mm (2.71 x 1.97 inch)]: Measuring-point number/identification (max. 27 characters), specify in plain text	**Y15**
Test Certificate: Manufacturer's test certificate M to DIN 55350, Part 18 and to ISO 9000	**C11**
Operating Instructions	**Article No.**
English	**A5E36261317**
German	**A5E36261391**
Note: The Operating Instructions should be ordered as a separate item on the order.	
All literature is available to download for free, in a range of languages, at http://www.siemens.com/processinstrumentation/documentation	
This device is shipped with the Siemens Level and Weighing manual DVD containing the ATEX Quick Start and Operating Instructions library.	
Other Operating Instructions	
SmartLinx PROFIBUS DPV1, English	**A5E36197302**
SmartLinx PROFIBUS DPV1, German	**A5E36197305**
SmartLinx PROFIBUS DP, English	**7ML1998-1AQ03**
SmartLinx PROFIBUS DP, German	**7ML1998-1AQ33**
SmartLinx DeviceNet, English	**7ML1998-1BH02**
Note: The appropriate SmartLinx Operating Instructions should be ordered as a separate line on the order	
All literature is available to download for free, in a range of languages, at http://www.siemens.com/processinstrumentation/documentation	
Accessories	
Tag, stainless steel, 12 x 45 mm (0.47 x 1.77 inch), one text line, suitable for enclosure	**7ML1930-1AC**
Sunshield kit, 304 stainless steel	**7ML1930-1GA**
USB to RS 232 adapter	**7ML1830-6AK**
RS 232 to RJ11 COMMS adapter	**7ML1830-1MC**
SITRANS RD100, loop powered display - see Chapter 7	**7ML5741-...**
SITRANS RD200, universal input display with Modbus conversion - see Chapter 7	**7ML5740-...**
SITRANS RD300, dual line display with totalizer and linearization curve and Modbus conversion - see Chapter 7	**7ML5744-...**
SITRANS RD500 web, universal remote monitoring solution for instrumentation - see Chapter 7	**7ML5750-...**
Spare parts	
Power Supply Board (100 ... 230 V AC)	**7ML1830-1MD**
Power Supply Board (12 ... 30 V DC)	**7ML1830-1ME**
Spare lid with HMI, MultiRanger 200 HMI/ HydroRanger 200 HMI, wall	**A5E35776738**
Spare lid with HMI, MultiRanger 200 HMI/ HydroRanger 200 HMI, panel	**A5E35776740**
SmartLinx PROFIBUS DP V1 module	**A5E35776741**

49-043-117

Conveyor Components Company

92-295-000



RS TECHNICAL INFORMATION

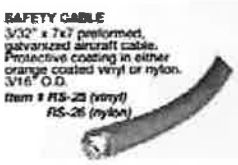
MODEL	DESCRIPTION
RS-1	One SP/DT microswitch, weatherproof
RS-1X	Explosion proof with one SP/DT microswitch, for NEMA 7 and 9
RS-2	Two SP/DT microswitches, weatherproof
RS-2L	Two SP/DT microswitches with external signal light, includes 120V lamp, weatherproof
RS-2X	Explosion proof with two SP/DT microswitches, for NEMA 7 and 9
RS-5	Two DP/DT microswitches, weatherproof
RS-5X	Explosion proof with two DP/DT microswitches, for NEMA 7 and 9

EXCLUSIVE FEATURES

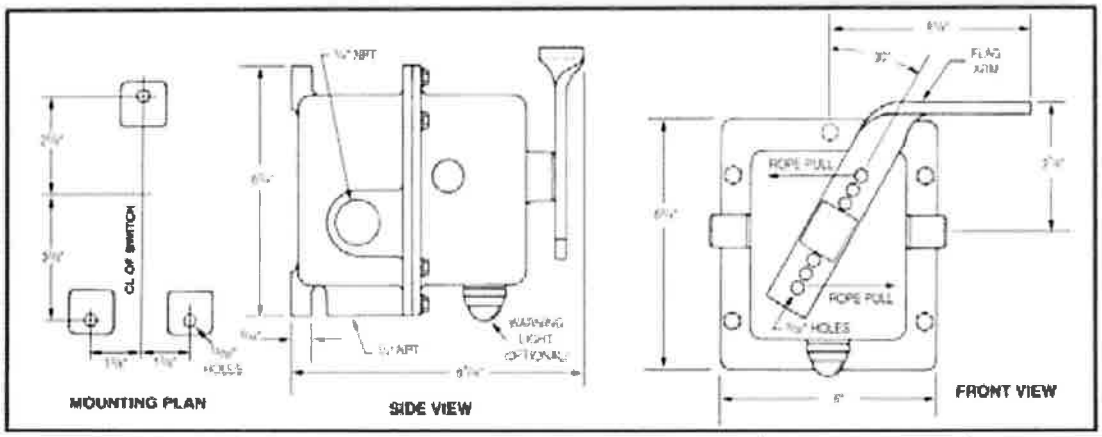
1. The Model RS is equipped with a positive safety lock. Having once been actuated, it cannot be accidentally reset causing dangerous equipment to restart. In order to reset the control, the actuation arm must be pushed in and turned. It takes no longer and it makes this a true "safety" control.
2. The Model RS is installed with cable extending in both directions from the actuating handle. There is one electrical connection inside. This simple arrangement eliminates the double electrical connections required in two ended units employing a separate microswitch for cable in each direction.
3. The actuation force required is simply adjusted in the field by a change in the position of the cable in holes provided in the actuation arm. One of our units will handle as much cable length as a double ended competitive unit and there is no longer a need to specify actuating force or right or left handed units.
4. The standard construction of the unit is a corrosion resistant aluminum housing complete with stainless steel hardware and red powder coated actuation handle. The actuation shaft is of stainless steel. Epoxy coating is also available if required.
5. The Model RS controls are listed by UL, Inc. and CSA Group. The general purpose models are listed for non-hazardous atmospheres. Explosion proof models are listed for use in hazardous atmospheres as defined by the National Electric Code handbook and the National Electrical Manufacturers Association Standards for NEMA type 7 and 9 hazardous locations. Specifically, they are listed for Class I, Div 1, Groups C and D; and Class II, Div. 1, Groups E, F and G.
6. Model RS offers the lowest cost per foot of protection because it incorporates fewer switches and less wiring is required. Cable may be extended in either or both directions with no changes required in the internal mechanism of the unit and the wiring is still of a simple uncomplicated nature.
7. The unit is available with a warning light that may be wired to indicate actuation. This permits easy identification of actuated units in areas where visual identification is difficult.


CABLE SUPPORT EYE BOLT
1/2" x 6" plated 2-1/2" long N.C. thread, 1" eye, two nuts and one lockwasher.
Item # RS-27


CABLE END FITTING
Secures protective cable to switch hand and supports.
Item # RS-26


SAFETY CABLE
3/32" x 7x7 preformed, galvanized aircraft cable. Protective coating in either orange coated vinyl or nylon. 3/16" O.D.
Item # RS-23 (vinyl)
RS-26 (nylon)


CONDUIT PLUG
3/4" metal, socket head conduit plug.
Item # RS-29



ELEMECH INC.
630-499-7080 · www.elemechinc.com

Rev: 0	Device Tag: PC1
Date: 4/13/2018	
By: TCC	Job Number: HBR7281
Manuf:. PNo: CONTROL COMPONENTS COMPANY: RS-1X	Page # 1/1

ENM-10 Level regulator

FLYGT

12-216-003

Technical data

Liquid temperature:	min. 0°C (32°F) max. 60°C (140°F)
Liquid density:	min. 0.65 g/cm^3 max. 1.5 g/cm^3
Degree of protection:	IP68, 20 m (65 ft)
Interrupting capacity of micro switch:	AC, resistive load, 250V 10A AC, inductive load, 250V 3A cos ϕ = 0.5 DC, 30V 5A
With gold plated micro switch:	same as above, except: DC, 24V 10mA

Note that local regulations may limit the voltage.

Materials

Body:	Body:
Bending relief:	EPDM rubber
Cable:	special compound PVC or NBR/PVC nitrile/PVC rubber

Weight: approx. 2 kg (4.5 lb) for a standard density regulator with 20 m cable.

Approvals: CE, CSA, SEMKO, NEMKO, DEMKO

LVD approval according to EN61058

CSA approval: Cert no. 1330172

Cl.I Zone 0, Gr. IIC;

CL.I Div.1 Gr A, B, C&D;

Cl.II Gr. E, F&G;

Cl.III when installed to the certified Intrinsically Safe relay, Ex ia, rated for the locations per submitter controll drawing and installation manual.

Intrincically safe circuits are required for the automatic control system. · Use a EX-safety barrier (e.g. Prod. no. 84 01 07).



W24-2Exi
Photoelectric sensors for explosive atmospheres

SICK
Sensor Intelligence.

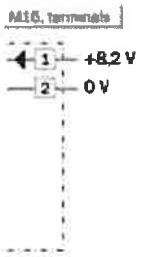
67-324-007

Technical data	WT24-2	X200
Scanning distance, typ. max.	40 ... 2,000 mm [1]	
Operating distance	100 ... 2,000 mm [1]	
Adjustment of operating distance	Potentiometer	
Light source [2], light type	LED, infrared light	
Light spot diameter	Approx. 50 mm at 2,000 mm	
Supply voltage V_S [3]	5 ... 15.5 V DC	
Residual ripple [4]	0.4 V_{PP}	
EC-type examination certificate	PTB 03 ATEX 2105	
Input voltage U_i max. [5]	15.5 V	
Input current I_i max. [5]	53 mA	
Input power P_i max. [5]	100 mW	
Internal capacity C_i max. [5]	80 nF	
Internal inductivity L_i max. [5]	≈ 0 µH (negligible small)	
Switching output/current consumption	Control current dependent on switching [6]	
	Object is detected ≥ 2,2 mA	
	Object is not detected ≤ 1 mA	
Switching mode	Light-switching	
Response time [7]	≤ 10 ms	
Max. switching frequency [8]	50 Hz	
Connection types	M16, terminal connection	
	Plug 4-pin, M12	
Protection class [9]	⧈	
Circuit protection [10]	A, C	
Enclosure rating	IP 67	
Ambient temperature T_A	Operation: –20 °C ... +60 °C	
	Storage: –25 °C ... +70 °C	
Weight	Approx. 330 g	
Housing material	Zinc die-cast housing	



Connection types
WT24-2X200





CE Ex ⧈

ELEMECH INC.
630-499-7080 · www.elemechinc.com

Rev: 0	Device Tag: PHOTO
Date: 4/13/2018	
Manuf:. PNo: SICK: 1041910 (WT24-2X200)	By: TCC
	Job Number: HBR7281
	Page # 1/1

Replacement Lamps

Allen-Bradley

Pilot Lights, Illuminated Push Buttons, Illuminated Push-Pull, Illuminated Push-Pull/Twist to Release, and Illuminated Selector Switches

32-005-***

Lamp	Type	Current, Typical	Lamp Voltage	ANSI No.	Catalog Voltage Code		Cat. No.
Incandescent	Full Voltage Transformer	150 mA/250 mA	6.3V AC	755/1866	6, 16, 26, 36, 46, 56, 76	*	**800T-N65**
	Full Voltage	80 mA	14V AC/DC	756	12	*	800T-N141
		70 mA	24V AC/DC	757	24	*	**800T-N157**
		50 mA	48V AC/DC	1835	48	*	800T-N365
	Full Voltage Resistor	22 mA	120V AC/DC	949	10, 11	*	**800T-N169**
	Flashing	150 mA	6V AC/DC	267	6	*	**800T-N212**
	Dual Input Diode	57 mA	24V AC/DC	24 MB	24	*	800T-N180
		21 mA	120V AC	90 MB	16	*	800T-N261
Neon	—	2 mA	120V AC/DC	82A	10, 20		**609-N9**

Lamp	Type	Current, Typical*	Lamp Voltage	Leakage Current	Code	Cat. No.*
LED‡	Universal	13 mA @ 24V DC 8.5 mA @ 120V AC‡	3V§	3 mA	2	800T-N376x
	Transformer	60	6V	14 mA	16, 26, 46, 56	800T-N377x

* Item is sold in multiples of 5. Order quantity of 5 to receive package of 5 pieces.

* To complete the cat. no. replace the **x** with the first letter of the desired color: **G**reen, **R**ed, or **W**hite.

‡ Typical current consumption values indicated are relative to the input of the power module.

§ Lamp is intended for use with power module Cat. No. 800TC-N374 which has an input voltage rating of 12 ...130V AC/DC.

Legacy LED Lamps♣

Lamp	Type	Current, Typical►	Lamp Voltage	Leakage Current	Catalog Voltage Code		Cat. No.※
LED✣	Full Voltage	13 mA/22 mA	12V AC/DC	3 mA	12		800T-N362x
		20 mA/21 mA	24V AC/DC	3 mA	24		800T-N319x
		12 mA/17 mA	32V AC/DC	3 mA	32		800T-N363x
		9 mA/14 mA	48V AC/DC	3 mA	48		800T-N364x
		3.3 mA/6 mA	120V AC	—	10		800T-N320x
		4.5 mA/6.2 mA	130V AC/DC	3 mA	13		800T-N321x
	Transformer	50 mA	6V AC	14 mA	6, 16, 26, 36, 46, 56, 76		800T-N318x
	Flashing	18 mA	24V AC/DC	—	N/A	+	800T-N319Fx

♣ In full voltage applications, these lamps are intended to be used with power module Cat. No. 800T-N330.

✣ All LEDs except 120V have an internal shunt resistor for use with solid-state outputs. LEDs will not illuminate below listed leakage current.

► Typical current draw varies with LED color. The first mA value is for a green or blue LED and the second mA value is for a red or amber LED.

※ To complete the cat. no. replace the **x** with the first letter of the desired color: **A**mber, **G**reen, **R**ed, **B**lue, or **W**hite. White LEDs only available in 6V, 24V, 120V, and 130V.

+ Flashing rate is 2 Hz.

Cluster Pilot Lights

Lamp	Type	Current, Typical	Lamp Voltage	ANSI No.	Cat. No.•
Incandescent	Full Voltage Transformer	195 mA	6V AC/DC	381	**800T-N258**
	Full Voltage	73 mA	12V AC/DC	382	800T-N259
		37 mA	24V AC/DC	387	**800T-N260**

Lamp	Type	Current, Typical	Lamp Voltage	Polarity		Cat. No.▲
LED	Full Voltage Transformer	45 mA	6V AC/DC	Positive		800T-N340x
	Full Voltage	36 mA	12V AC/DC	Positive		800T-N341x
		14 mA	28V AC/DC	Bi-Polar	11	**800T-N90x**

• Item is sold in multiples of 5. Order quantity of 5 to receive package of 5 pieces.

▲ To complete the cat. no., replace the **x** with the first letter of the desired color: **A**mber, **G**reen, or **R**ed only.

11 For use with 24V AC/DC rated devices.

ELEMECH INC.
630-499-7080 · www.elemechinc.com

Rev: 0	Device Tag: SPARE
Date: 4/13/2018	
By: TCC	Job Number: HBR7281
Manuf:. PNo: ALLEN-BRADLEY: 800T-N65	Page # 1/1

Continuous level measurement - Ultrasonic transducers

ST-H



Benefits

- Can be mounted on a 2" (50.8 mm) standpipe
- Immune to corrosive and harsh environments
- Integral temperature sensor

Application

The narrow design of the ST-H allows the transducer to be mounted on a 2" (50.8 mm) standpipe. When mounted correctly, it is completely protected from the process and can even be used in harsh, corrosive environments.

During operation, the ultrasonic transducer emits acoustic pulses in a narrow beam perpendicular to the transducer face. The level transceiver measures the propagation time between pulse emission and reception of the echo to calculate the distance from the transducer to the material. Variations in sound velocity due to changes in temperature within the permissible range are automatically compensated by the integral temperature sensor.

- Key Applications: chemical storage, liquid tanks

Technical specifications

Mode of operation	
Measuring principle	Ultrasonic transducer
Input	
Measuring range	0.3 ... 10 m (1 ... 33 ft)
Output	
Frequency	44 kHz
Beam angle	12°
Accuracy	
Temperature compensation	Compensated by integral temperature sensor
Rated operating conditions	
Pressure	Normal atmospheric pressure
Ambient conditions	
• Ambient temperature	-20 ... +60 °C (-5 ... +140 °F) (ATEX approved model) -40 ... +73 °C (-40 ... +163 °F) (CSA/FM approved model)
Design	
Weight [1]	1.4 kg (3 lbs)
Material (enclosure)	Base and lid made of ETFE or PVDF (epoxy fitted joint)[2]
Process connection	2" NPT [(Taper), ANSI/ASME B1.20.1], R 2" [(BSPT), EN 10226] or G 2" [(BSPP), EN ISO 228-1]
Degree of protection	IP68
Cable connection	2-core shielded/twisted, 0.519 mm² (20 AWG), PVC sheath
Cable (max. length)	365 m (1200 ft) with RG 62 A/U coaxial cable
Options	
Flange adapter	3" Universal (fits DN 65, PN 10 and 3" ASME)
Submergence coupling	For maintaining high level readings while the transducer is submerged
Certificates and approvals	CE[3], CSA Class I, II, III, Div. 1, Gr. A, B, C, D, E, F, G T3 (ETFE only), FM Class I, II, Div. 1, Gr. C, D, E, F, G T4A, ATEX II 2G EEx m IIC T5, C-TICK, INMETRO: Br-Ex m II T5

[1] Approximate shipping weight of transducer with standard cable length
[2] When measuring chemicals, check compatibility of ETFE or PVDF and epoxy, or mount joint external to process.
[3] EMC certificate available on request

Level Measurement
Continuous level measurement - Ultrasonic transducers

49-043-009

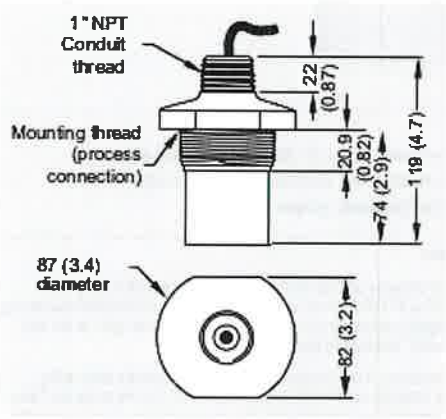
ST-H

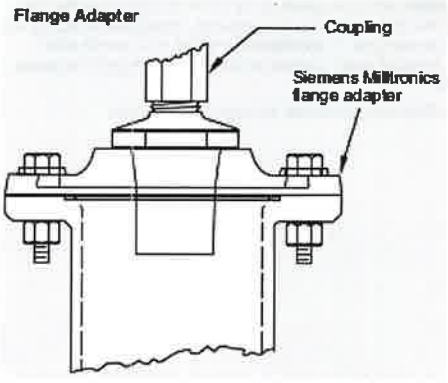
Selection and Ordering data		Order No.
Echomax® ST-H ultrasonic transducer	C)	**7ML1100-**
Level measurement in chemical storage and liquid tanks. The narrow design of the ST-H allows the transducer to be mounted on a 2" standpipe. Measuring range: min. 0.3 m (1 ft), max. 10 m (33 ft).		■■A■0
Process connection		
ETFE, 2" NPT [(Taper), ANSI/ASME B1.20.1]		0
ETFE, R 2" [(BSPT), EN 10226]		1
ETFE, G 2" [(BSPP), EN ISO 228-1]		2
PVDF copolymer, 2" NPT [(Taper), ANSI/ASME B1.20.1]		3
PVDF copolymer, R 2" [(BSPT), EN 10226]		4
PVDF copolymer, G 2" [(BSPP), EN ISO 228-1]		5
Cable length		
5 m (16.40 ft)		A
10 m (32.81 ft)		B
30 m (98.43 ft)		C
50 m (164.04 ft)		D
100 m (328.08 ft)		E
Approvals		
FM Class I, II, Div. 1, C-TICK		2
ATEX II 2G, CSA, C-TICK, INMETRO [1]		3
ATEX II 2G, C-TICK, INMETRO [2]		4
Operating Instructions		
Quick Start Manual, multi-language	C)	**7ML1998-5QK82**
Applications Guidelines, multi-language	C)	**7ML1998-5HV81**

Note: The Applications Guidelines should be ordered as a separate line item on the order.

This device is shipped with the Siemens Milltronics manual CD containing the complete ATEX Quick Start and Operating Instructions library.

[1] Available with Process connection options 0 to 2 only
[2] Available with Process connection options 3 to 5 only
C) Subject to export regulations AL: N, ECCN: EAR99





Selection and Ordering data	Order code
Further designs	
Please add "-Z" to Order No. and specify Order code(s).	
Acrylic coated, stainless steel tag [13 x 45 mm (0.5 x 1.75")]: Measuring-point number/identification (max. 16 characters) specify in plain text	**Y17**

Accessories	Order No.
Universal box bracket, mounting kit	**7ML1830-1BK**
3" ASME, DN 65 PN 10, JIS 10K 3B ETFE flange adapter for 2" NPT	**7ML1830-1BT**
3" ASME, DN 65 PN 10, JIS 10K 3B ETFE flange adapter for 2" BSPT	**7ML1830-1BU**
Easy Aimer 2, NPT with ¾" x 1" PVC coupling	**7ML1830-1AQ**
Easy Aimer 2, aluminum with M20 adapter and 1" and 1½" BSPT aluminum couplings	**7ML1830-1AX**
Easy Aimer 304, with stainless steel coupling	**7ML1830-1AU**
Easy Aimer 304, with M20 adapter and 1" and 1½" BSPT 304 SS couplings	**7ML1830-1GN**

MILLTRONICS
PETERBOROUGH, ONTARIO, CANADA

65-043-002

Probes



Standard Milltronics MSP-12
- Heavy-duty general purpose motion probe
- Long lasting phenolic body with internal amplifier
- Convenient mounting flange and locknut for fast installation and setup
- Temperature rating: -40 to 60 °C (-40 to 140 °F)
- Enclosure rating: Type/NEMA 4X, 6, IP67



High temperature Milltronics MSP-3
- Heavy-duty, high temperature aluminum probe designed to withstand operating temperatures to 260 °C (500 °F)
- Cast aluminum probe with convenient mounting flange and locknut
- 1.5 m (5 ft) of high temperature PTFE cable provided. Up to 30 m (100 ft) may be used.
- Amplifier remote mounted in enclosure 140 x 140 x 100 mm (5.5 x 5.5 x 4"), available in cast aluminum (½" NPT conduit entry), painted steel (Type/NEMA 4, IP65 rating), or stainless steel (Type/NEMA 4X, IP65 rating)
- Amplifier temperature rating -40 to 60 °C (-40 to 140 °F)
- Enclosure rating: Type/NEMA 4X, 6, IP67

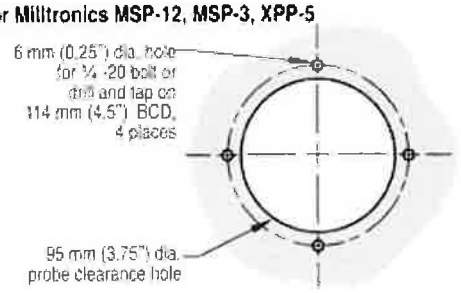


Stainless high temperature Milltronics MSP-9
- Heavy-duty, high temperature 304 stainless steel probe
- Special construction allows operation of probe in environment up to 260 °C (500 °F)
- 1.5 m (5 ft) special high temperature PTFE cable provided. Up to 30 m (100 ft) may be used.
- Amplifier remote mounted in enclosure 140 x 140 x 100 mm (5.5 x 5.5 x 4"), available in cast aluminum (½" NPT conduit entry), painted steel (Type/NEMA 4, IP65 rating), or stainless steel (Type/NEMA 4X, IP65 rating)
- Enclosure rating: Type/NEMA 4X, 6, IP67
- Amplifier temperature rating -40 to 60 °C (-40 to 140 °F)

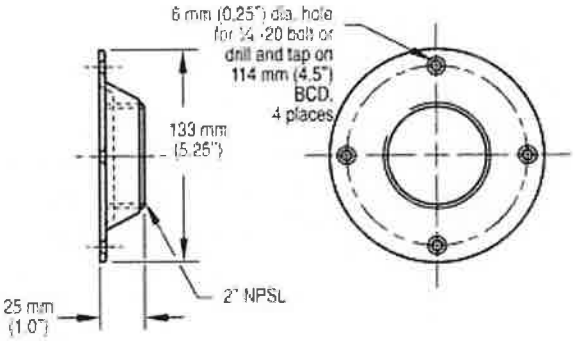


Milltronics XPP-5
- CSA hazardous approval (Class I, Div. 1, Groups A, B, C & D; Class II, Div. 1, Groups E, F & G; Class III)
- Phenolic / aluminum body that is fully potted
- Convenient mounting flange and locknut
- 3/4" NPT male hub connection
- Operating temp. from -40 to 60 °C (-40 to 140 °F)
- Enclosure rating: Type/NEMA 4X, 6, IP67

Mounting for Milltronics MSP-12, MSP-3, XPP-5



Note: For dimensional and/or mounting details for MSP-9 and MSP-1, see instruction manual.



Ordering data	Order No.
Milltronics Motion Sensing Probes	A) 7MH7145 -
A series of motion sensing probes used with the MFA 4p. Milltronics MSP-1: miniature motion sensing probe Milltronics MSP-3: heavy-duty, high temperature aluminum Milltronics MSP-9: heavy-duty, high temperature stainless steel Milltronics MSP-12: heavy-duty, general purpose Milltronics XPP-5: hazardous rate Note: Milltronics MSP-1, MSP-3, and MSP-9 probes require the use of Milltronics RMA (amplifier)	0
Model	
MSP-1 with 1.8m (6 ft.) of cable	A
MSP-3, 1/2" NPT conduit entry with 1.5 m (5 ft.) high temperature cable	B
MSP-9 with 1.5 m (5 ft.) high temperature cable	D
MSP-12, 1/2" NPT conduit entry	E
XPP-5, with 1.5 m cable, (CSA Class I, Gr. A,B,C & D; Class II Gr. E,F & G)	G
XPP-5, with 10 m cable, (CSA Class I, Gr. A,B,C & D; Class II Gr. E,F & G)	H
XPP-5, with 15 m cable, (CSA Class I, Gr. A,B,C & D; Class II Gr. E,F & G)	J
Approvals	
CE	A

C SP US

TAB 3

HUBER TECHNOLOGY
WASTE WATER Solutions

Operating Instructions

Huber Multi-Rake Bar Screen RakeMax®



HUBER TECHNOLOGY, Inc.

9735 NorthCross Center Court STE A
Huntersville, NC 28078

Original operating instructions
HHUSA Version 02/13



NOTICE

This manual is part of the machine and must be available for the operators any time.
The safety instructions must be observed.
In case of selling the machine the manual must be included.

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1 Product Specification

1.1 Intended use

The Huber Multi-Rake Bar Screen RakeMax® is intended to separate screenings, settling and floating material.

For solids separation the machine is **applied**:
- in wastewater treatment plants (municipal and industrial)
- for industrial process and partial flows

The intended use also includes:
- Observance of the start-up, operation and maintenance conditions as set out in these operating instructions
- Taking foreseeable malpractice into account
- Operation by skilled workers only (who are familiar with the correct procedures and know the dangers)

⚠ WARNING

The machine is intended exclusively for the above specified use.
Any additional use or rebuilding of the equipment without prior written approval by the manufacturer does not comply with the intended use.
The manufacturer will not assume liability for consequential damage. The operator alone will bear the risk.
Do not start up the machine before there has been ensured that all safety devices are completely mounted and operable, and that the plant into which the machine may be incorporated complies with the rules.

The machine is suitable to be used in Class 1 Division 1 areas.

1.2 Definition of terms for machine components

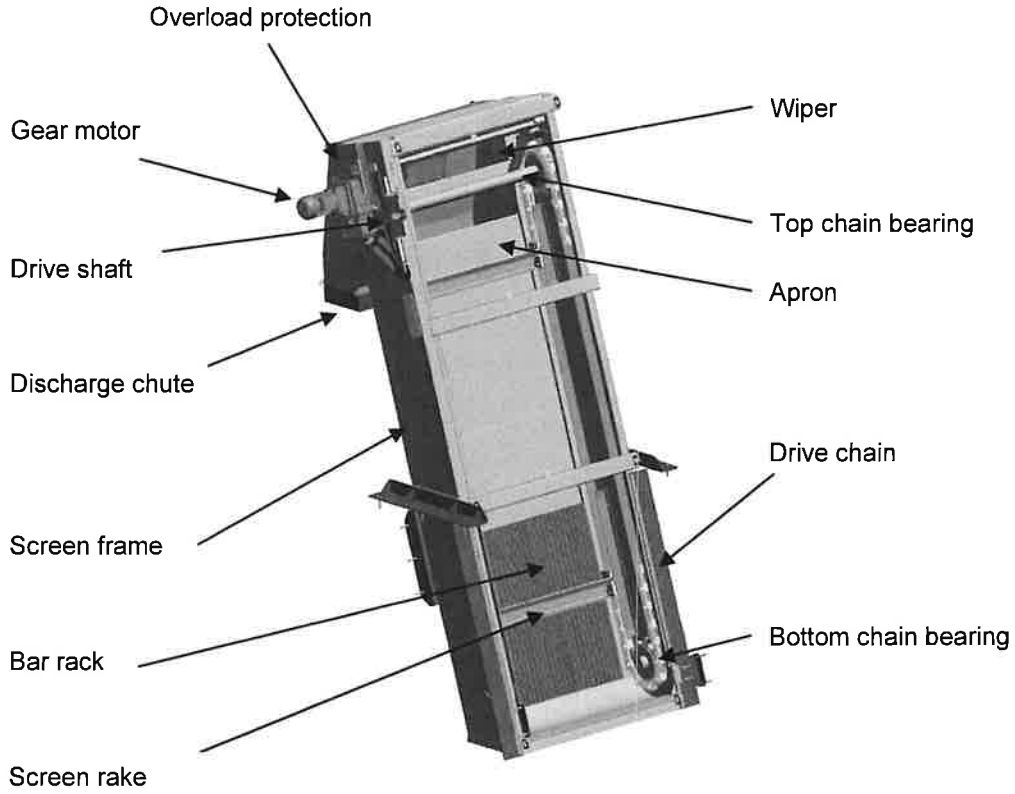
Definition of terms:
The Huber RakeMax is used to clean stationary bar racks.

The screen consists of the following components:
- Stationary bar rack with apron and discharge chute
- Two drive chains with screen rakes
- Upper chain bearing with sprockets, drive with overload protection and drive shaft
- Bottom chain bearing with sprockets
- Screen frame for channel installation

The Huber RakeMax® screen consists in a stationary bar rack mounted between the two screen frames. The bar rack is normally installed at an angle of 70 - 85°. The bar rack consists of individual flat bars and is cleaned by the rake when necessary. The screen rakes are fixed to the peripheral chains which can be re-tensioned via a special chain tensioning unit. The number of screen rakes depends on the amount of screenings and the specific application. The chains are driven by two sprockets mounted on the drive shaft.

Screenings are transported upwards along the apron which comes after the bar rack. A hinged wiper pushes the screenings from the rake shelf over the discharge chute into a skip or conveyor.

The following drawing gives an overview of the individual machine parts.



1.3 Functional description (See TAB 2 for Project Specific Sequence)

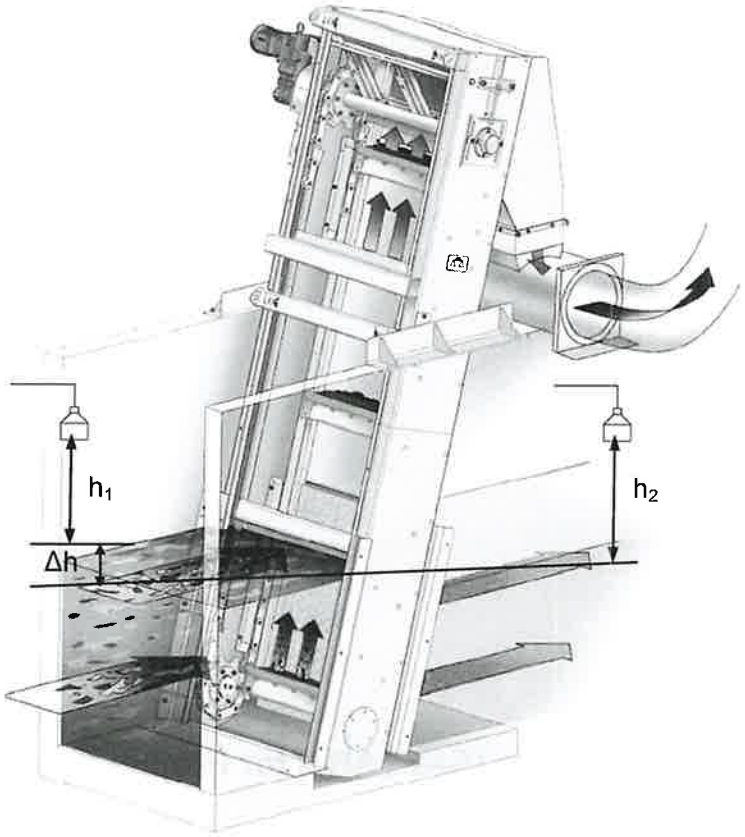
The Huber RakeMax® screen is installed into the channel at an angle of 85° *(optional 70-85°).* While the wastewater passes through the bar rack, solids are retained in the rack. The retained solids blind the screen basket surface, causing thus an additional filter effect. The screen drive starts at a defined difference in height. While the cleaning rakes, which are driven by the peripheral chains, travel upwards they transport the screenings upwards along the apron which comes after the bar rack. A hinged wiper pushes the screenings from the rake shelf over the discharge chute into a skip or conveyor, or for example into a wash press.

1.4 Functional description of components

1.4.1 Level control system (See TAB 2 for Project Specific Level Controls Type & Function)

Since the level control system is part of the electrical switchboard and control panel, it is only part of Huber supply if the machine is ordered complete with the electrical control panel. Further information regarding the level control system can be found in the control panel section of this manual.

Huber's standard level control system is a dual point ultrasonic level controller e.g. Siemens HydroRanger 200. Please check the manufacturer's operating instructions for detailed information.



When material builds up on the screen, a level differential (Δh) is created, and the water level is higher in front of the screen (h_1) than behind it (h_2). When this differential reaches the programmed setpoint, the HydroRanger 200 activates a relay to start the screen. The differential level settings have to be adjusted to local site conditions. Please also refer to the installation drawing for maximum permissible water levels and maximum differential pressures for your application.

In general if the set differential level is smaller the machine starts earlier and the running hours increase.

2 Safety

2.1 General safety instructions

⚠ DANGER

„DANGER" indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

„WARNING" indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

„CAUTION" indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE

„NOTICE" indicates a property damage message. Follow notices to avoid material damage!

These operating instructions have to remain attached to the machine. It must be made sure that the operating instructions are ready to hand any time for any person that has to perform work on the machine. In addition to these operating instructions, instructions in the sense of the labor protection law and ordinance regulating the use of tools have to be available.
As these operating instructions contain fundamental instructions to be observed when installing, operating and servicing the machine, the responsible staff must read the instructions prior to machine installation and start-up. The operating instructions must at any time be available ready to hand at the installation place of the machine/plant. Not only the general safety instructions contained in this chapter have to be observed but also the special safety instructions added under the main items.

2.1.1 Operator's duty of care

The plant has been constructed and manufactured taking into consideration a risk analysis and after careful selection of the applicable harmonized standards and other technical specifications. The machine complies with the state-of-the-art technology and offers a maximum amount of safety.

To achieve such safety in practical operation, it is however necessary to take any measures required therefore. It is the operator's duty of care to plan these measures and control their implementation.

The operator must especially ensure that

- The machine is applied according to its intended use (see chapter *Product Specification*)
- The machine is operated only in a perfect ready-to-operate condition and especially the safety devices are regularly controlled.
- Protective gear for the operating, maintenance and repair personnel is available and used.
- These operating instructions are permanently available on site complete and in a legible condition.
- Only sufficiently qualified and authorized personnel are in charge of machine operation, maintenance and repair.
- Such personnel receive regular briefing concerning all questions of safety and environmental protection and know these operating instructions, especially the safety instructions contained.
- Any safety and warning symbols attached to the machine remain there in a legible condition.

2.1.2 Definition of safety symbols



⚠ WARNING

Occupational safety symbol
This symbol will accompany all safety instructions that are associated with risks to life and/or limb. Follow these instructions and proceed carefully! At the same time, follow all applicable laws, general safety and accident prevention regulations.

3



⚠ WARNING

Electric current warning
This symbol warns of electric current. Prior to performing any work, switch off mains isolator and make sure that the system is off-circuit.
At the same time, follow all applicable laws, general safety and accident prevention regulations.

4



⚠ WARNING

Be careful not to get caught when starting up, servicing or repairing the machine!

5

NOTICE

This symbol is found where special attention is required to ensure compliance with instructions concerning correct operating sequences to prevent damage to the machine or its function.

Instructions directly attached to the machine, e.g.
- Instructions and warning signs
- Labels for liquid connections
- Arrow showing the direction of rotation

must be strictly followed and kept in absolutely legible condition.
Signs or labels that have become illegible must be replaced immediately.

2.1.3 Qualification and training of personnel

Only well-trained and briefed persons who know these operating instructions and act according to these instructions are authorized to operate the machine. The individual areas of responsibility of operating staff must be defined clearly. The area of authority, responsibility and control of the personnel must be precisely regulated by the operator. The operator must further ensure that the personnel have fully understood these operating instructions.

Personnel being trained must in the beginning work under the supervision of an experienced person. The completed successful training and briefing must be confirmed in writing.

Any electrical control and safety devices must generally be operated by instructed and authorized persons only.

Any person performing work on the machine must read these operating instructions and confirm by signature that the operating instructions have been understood.

2.1.4 Safety instructions for maintenance, inspection, installation

Any maintenance work must be carried out by qualified staff only.

Any inspection and installation work must be carried out by authorized and qualified staff only.

Work on the plant may only be carried out after the plant has been isolated.

Enclosed rooms of wastewater treatment plants that must be entered for service and maintenance have to be aerated in a way that prevents a dangerous explosive atmosphere, lack of oxygen and presence of harmful concentrations of gas or vapor.

⚠ WARNING

Secure the machine against unexpected start in case of open access to the screenings discharge resp. secure the access to this danger area before changing the screenings container or doing maintenance work or disassembling on a downstream machine.



⚠ WARNING

Shutdown procedure: Switch off mains isolator and lock it.
Each person who is commissioned to perform maintenance work on the machine must have his own padlock. Starting the machine is only possible when all padlocks on the mains isolator have been removed.

Do not immediately re-start the machine, if the reason why it has stopped is unclear. Somebody could have stopped the machine in order to make a manual adjustment and may have forgotten to secure it against starting. The unexpected start could result in serious injury of personnel.

It is in your own interest to clean the machine prior to working on it to prevent the danger of infections.

⚠ CAUTION

Always protect yourself by means of waterproof protective gear, boots, gloves, and, if possible, also by face protection during cleaning of the machine - especially if a high pressure cleaner is being used – to avoid being hit by waste water, organic material, etc.

Re-attach all safety equipment, covers, grates completely to their original place and assure that they are properly and completely reattached.

Use only tools and means that are expressly intended for such work.

Before starting the machine again, check the items mentioned in chapter *Start-up*.

2.1.5 Other dangers

Other dangers are potential, non-apparent dangers.

Despite all precautions taken, there are other dangers, such as:

- To be caught by unintentional movements of the machine
- To slip on wet or dirty ground
- Danger of falling in front of or onto the machine during maintenance work
- Malfunctioning control
- Allergies and irritations caused by contact with waste water or screenings
- Infections caused by bacteria or pollution
- Explosions or fire caused by gas or fumes
- Increased water passage after heavy rainfall for example

2.1.6 Unauthorized rebuilding and production of spare parts

Alterations or changes to the machine:

For safety reasons, it is not permitted to make unauthorized alterations or changes to the machine. This applies also to welding work on bearing components.

Any intended modifications, alterations or changes require the prior written consent of Huber Technology.

Use only original spare parts, original wearing parts and original accessories as these are especially designed for the machine. Components purchased from other sources give no guarantee that they have been designed and manufactured to suit the specific operating and safety requirements.
Components purchased from other sources give no guarantee that they have been designed and manufactured to suit the specific operating and safety requirements.

2.2 Machine identification

Any specifications made in these operating instructions apply to only the type of machine that is named on the title page.
The identification plate is attached to the screenings discharge and specifies the following:

- Name and address of supplier
- Serial name and type, optionally serial number
- Year of manufacture

Always forward the machine type, year of manufacture and order number when inquiring or ordering spare parts to ensure perfect and prompt processing or your queries and orders.

2.3 Incorporated safety systems

The incorporated safety systems are subject to regular checkups.

Mains isolator
The mains isolator is located on the control panel and disconnects/connects the machine from/with the mains supply.

Padlock the mains isolator after switch-off prior to performing service or repair work.

Emergency cutoff circuit
The machine is included in an emergency cutoff circuit.
The emergency cutoff switch is located on the control panel and/ or local control station.
Whenever the emergency cutoff switch is operated, the machine or complete plant including incorporated units will be set into a safe operating state.

Motor temperature control
The machine is equipped with a thermostat for motor temperature control with overload protection. The motor of the machine is switched off in the event of too much heat built-up. The overcurrent safety device using a thermal delay must be set to disrupt the dri ve motor from the power system within the delay $t_{E..}$

Plant control
Internal plant control includes a 4-conductor feed system, 3 phase, with separate earth line with GREEN line coating.
Additionally earth the machine casing for potential equalization



⚠ WARNING

Control panels can only be opened by using a special key. The special key may only be handed to an authorized person. Take care that doors of control panels are only opened by skilled staff for maintenance work and fault detection, otherwise the doors must stay locked!

NOTICE

These operating instructions are part of the machine and have to be available for the operating staff at any time.
The safety instructions contained must be observed.
It is strictly prohibited to override any safety instructions or change the mode of action of safety instructions.

2.4 Safety measures

It is the operator's responsibility to instruct his operating and servicing staff concerning:

- Protective devices on the machine,
- Control of observance of safety measures.

This copy of operating instructions has to be stored to be at hand when needed in the future. Observe the intervals for inspection and control measures! In these operating instructions, the work is described so that it can be understood

- **by an instructed person** (referring to chapter *Operation and operation modes*
- by skilled staff (referring to chapters *Transport, Installation, Maintenance, Trouble Shooting and Repair*).

The chapters ***Transport, Installation, Maintenance, Trouble Shooting and Repair*** are intended **for skilled staff only**. Any work described under these chapters must be performed by skilled staff only.

Instructed person
An instructed person is a person that has been instructed by a skilled person, and trained if necessary, about the assigned jobs and possible risks arising from improper performance and informed about necessary protective devices and protective measures.

Skilled persons
Skilled persons are persons that are able to evaluate assigned jobs and recognize possible risks, due to their professional skills, expertise and experience and knowledge of corresponding standards.

2.5 Operator's duty of care

The operator has to obtain the local operating license and observe the respective requirements. In addition, the operator has to observe the local laws concerning

- Safety of personnel (accident prevention regulations)
- Safety of work equipment (protective gear and maintenance)
- Product disposal (Waste Management Law)
- Material disposal (Waste Management Law)
- Cleaning (cleaning agent and disposal)
- Environmental compliance

Connections:
The operator has to ensure before start-up of the machine, if installation and start-up are performed by the operator himself, to comply with local standards (such as for electrical connection for instance).

NOTICE

Lighting
The operator has to provide sufficient and equal lighting in all areas of the plant. The recommended illumination level is 300 lux (value for maintenance).

3 Handling and Transporting

Observe the following points to avoid damage to the machine or persons when handling the equipment:

- Only qualified persons are permitted to perform transport work, observing the safety instructions.
- Lifting and righting of the equipment must be done only by the lifting eyes provided.
- Use only the lifting devices specified hereunder to transport the machine.
- Read also the chapter *General Safety Instructions*.

3.1 Dimensions and weight

The machine length and arrangement are adjusted to suit specific site requirements (available space, channel depth, discharge height).

The dimensions are specified in the project-specific installation drawing attached to these installation instructions.

The weight of the screen depends on the machine size and length. The weights are specified in the installation drawings in TAB 8.

The machines are packed on palettes for trucking, and in sea-water-proof boxes for sea transport.

3.2 Permitted transport devices and auxiliaries

⚠ CAUTION

Have transport and unloading done by experienced experts only.

Fork lift or building machine of sufficient lifting capacity to handle the weight and size of the equipment, to be operated by qualified personnel only. Rope slings or straps of required load bearing capacity. Prior to unloading, remove the small parts supplied with the machine, such as supports, from the transport rack.



⚠ WARNING

Attachment: Hook shackle, load hook etc. into the lifting eyes on the frame. Fixing points are marked with the symbol LIFT HERE (as illustrated here). The ropes of the lifting device must hang freely and must not be attached more than 60° from the vertical. The machine must hang horizontally during unloading.

Inspect all materials for damage before and during unloading. Any transport damage found should be noted on the bill of lading and the forwarder and manufacturer/supplier notified immediately.

NOTICE

Make sure the delivery is complete by carefully checking all received materials against the bill of delivery.

3.3 Storage

When selecting the storage place take care that the components cannot be damaged by vehicles or careless working. Make sure the components cannot get dirty due to splashes of concrete or mortar and protect the machine against spark fountains from angle grinders etc. Cover the motor (in order to avoid ingress of water) on machines stored outdoors, but do not wrap it. Never expose the control panel to rain (temperature down to 23°F / - 5°C is permissible).

If the screen is stored longer than 3 months or not started up immediately after installation, the standard stainless steel chains (version 2) must be sprayed with oil monthly to avoid corrosion.

3.4 Transport to the installation place

As there are different situations and possibilities at the individual sites, we cannot give exact installation instructions. This work must be carried out by qualified fitters.

You always need lifting equipment for transporting the machine from the intermediate storage place to the installation place because of the machine weight.

As lifting equipment up to the building are used: caterpillars, power shovel, cranes etc. dependent on the access ways. Lifting equipment mostly used in a building is: Polyester slings, tripods, chain tackle block, fork lift, transport rollers, tackles.

⚠ CAUTION
Wear safety shoes with steel caps to prevent injuries.



⚠ WARNING
Always stand clear off a suspended load!

Unpacking:
Do not loosen the clamping bands or steel ropes before the machine is right in its installation place.

4 Installation

Observe the following safety instructions when installing the machine to avoid critical injuries, damage to the machine and other damage.

- Only qualified persons are permitted to perform installation work, observing the safety instructions.
- Check the machine for transport damage prior to starting with any installation work.
- Make sure that only authorized persons have access to the working area and that installation work does not endanger any other persons.
- When laying machine connections, make sure that no one can trip over laid cables, hoses, pipelines, etc.
- Observe the prescribed bending radii when laying cables/hoses/pipelines.
- Observe the instructions for operating media, lubricants, auxiliary material used.
- Read also the chapter General Safety Instructions.

4.1 Acceptable environmental conditions

The machine is manufactured for installation in a building as specified by the customer.



⚠ CAUTION

Stainless steel parts can get very hot in case of heavy solar radiation, danger of burning.

Frost protection:
Machines without a casing must not be operated in winter due to the danger of freezing. Appropriate measures must be taken (e.g. complete emptying) to ensure that the machine cannot freeze.

Protection against dust and water:
As the atmosphere at the installation place is permanently humid, the equipment is designed to resist these conditions. All components in contact with water and solids are made of stainless steel which is insusceptible to moisture and wetness.

The gear motors are made for IP 65 and are therefore protected against permeation of dust and spray water from any direction.

Protection against explosion:

Gear motor:	Class 1 Division 1
Proximity switch	Class 1 Division 1

Lighting
The lighting must make safe working on each part of the plant possible without any risk.

NOTICE

Lighting
The operator has to provide sufficient and equal lighting in all areas of the plant. The recommended illumination level is 300 lux (value for maintenance).

4.2 Site requirements

Cover all channel sections which do not need to be accessible for machine installation and fix a railing along open channel sections.
There must be enough space available around the machine for repair and maintenance work.

Required minimum **distance** to the machine or railing: 3.3 ft (1 m) (lateral, in front of and behind the machine)

Emergency bypass
An emergency bypass is absolutely necessary for one-line plants, such as for the event of a power failure or fault.
The complete hydraulic conditions of the sewage treatment works must be taken into account for dimensioning of the emergency bypass. It is important that the emergency bypass overflow weir lies approx. 2 inches (50 mm) below max. water level (see installation drawing) to protect the screen.

Stop logs or penstocks must be positioned in front of and behind the machine to enable shut-off of the machine for repair. No cross section or penstock must however be positioned in the installation area of the screen.

Make sure the door/gate in the building offers sufficient space to pass the machine. It is recommended to attach a suitable mounting support to the ceiling, in the direction of the machine's axis.

Static dimensioning of the points where the machine is supported by legs on the channel bottom and under the rising pipe on the building bottom or top of the channel must be carried out according to the weights specified in the manufacturer's data sheet.

4.3 General instructions for installation

Installation must be carried out in accordance with these instructions. If installation is not performed by Huber Technology, Huber Technology cannot accept responsibility for incorrect offloading or installation.
Installation must be performed by qualified and experienced personnel.

Prior to installation:
- Completely read these instructions. They contain important information how to prevent damage caused by lack of knowledge.
- Approach roads must be provided so that the machine can be installed either by means of a crane in case of outdoor installation or by a lifting truck and rollers as well as by lifting chain block or hoist in case of installation in a building.
- Electrical power must be provided to be available on site at the installation date.

Preliminary work:
- If a channel cover is to be installed, mount the frame and exactly measure the cover dimensions (see installation drawing).
- If it is an installation in a building, make sure a mounting support is fitted centrally above the machine.
- In the installation area of the screen, cross girders, penstocks or other are not allowed.
- There has to be an emergency by-pass in front of the machine. Take the overflow weir height from the installation drawing.

Preparatory work:
- Check all assembly and fixing material making sure it is complete.
- Prepare all cables according to the cable list (see wiring diagram in control section) and all necessary small components (e.g. level transducers and controller).

- Prepare lifting device that is able to lift the load during installation.
- Clean the channel / installation place with a broom before installation in order to prevent injuries caused by slipping.

4.4 Assembly and installation

4.4.1 Mechanical installation

General instructions:

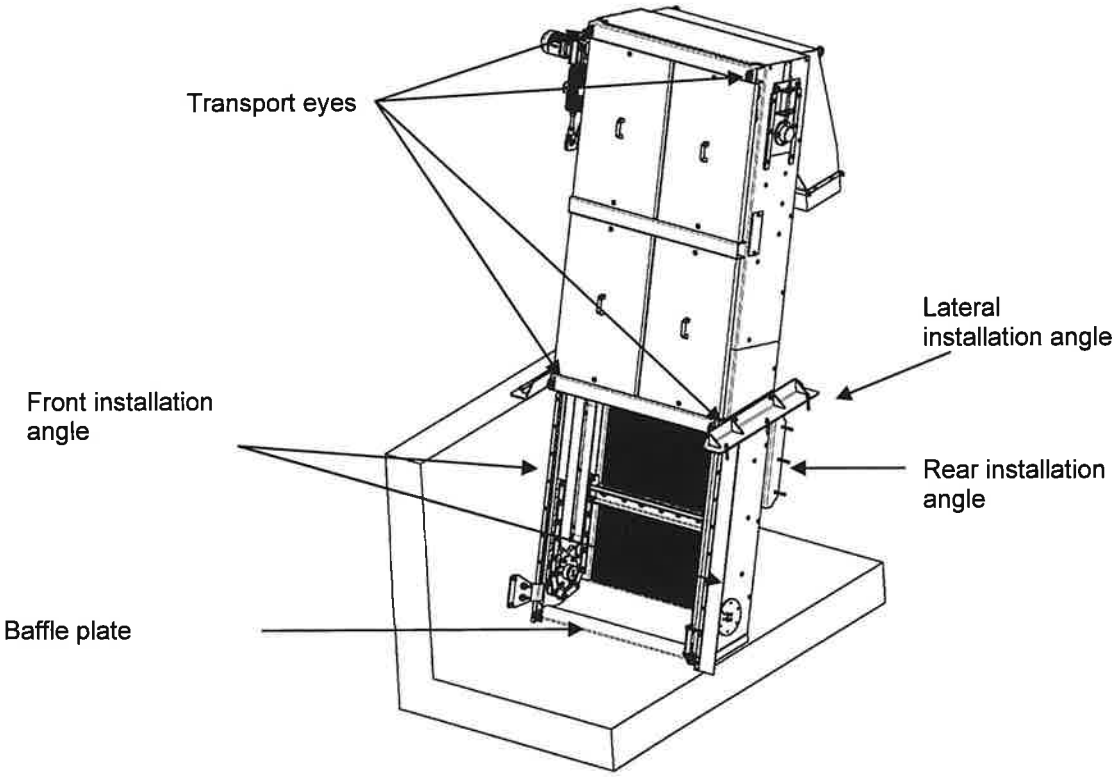
- Fix lifting devices (2 chain hoists or similar) to the prepared installation supports over the channel. If necessary, prepare points of suspension with required load bearing capacity and arrange in such a way that the plant can hang above the installation area without manual moving.
- Secure safety load hooks on transport eyes or rope straps to the machine and the lifting device.

NOTICE

Blow the holes for the stainless steel plugs under pressure after drilling (using bellows, air pump, etc.) to ensure a professional durable adhesive joint.

Use grease for all unlockable screws, thus providing a durable mobility of thread.

Installation proposal:

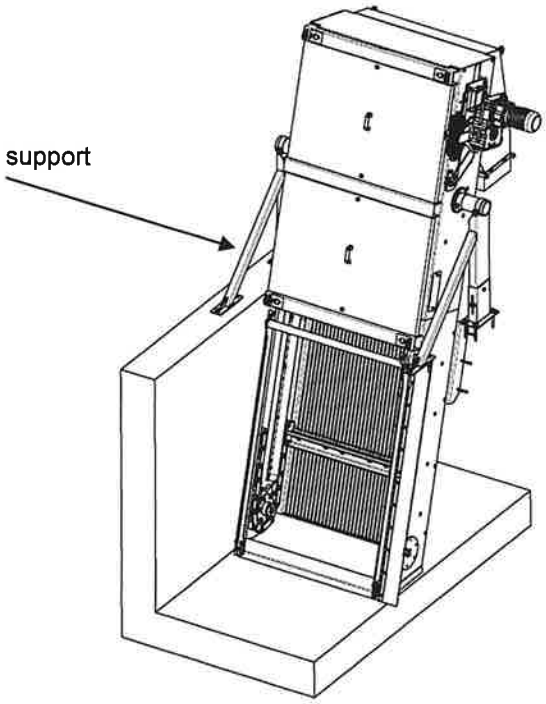


How to proceed with the non-pivotable screen version:

- Mount the rear angles to the channel walls as shown in the installation drawing.
- Lift the machine on the lifting eyes and lower it slowly from its horizontal position into the installation position as specified in the installation drawing.
- Place the machine down into the channel. The correct lower landing point can be taken from the installation drawing.
- Additionally secure the screen, which rests on the pre-assembled mounting angles, on the upper lifting eyes.
- Mount the front installation angles to the channel walls (plain support plate on screen frame). A rubber strip seals the gap between the screen frame and channel walls.
- Mount the lateral installation angles at the upper side of the channel.
- Weld these installation angles to the screen frame to fix the screen.
- Remove the lifting device from the upper lifting eyes.
- Finally fix the discharge box using the tap holes on the screen frame.

Pivotable screen version:

Another installation possibility is to install the screen pivotable. This alternative is applied if due to the channel depth or discharge height pivoting of the screen is required. In such a case the pivot axis is supported on mounting angles that have to be bolted on the upper channel side.



4.4.2 Electrical installation

Electrical installation to be carried out by qualified electricians only.

General:
The following instructions are offered for guidance if installation is not included in Huber Technology's supply contract.
If installation is not included in the supply contract, Huber Technology cannot accept responsibility for incorrect installation.

Wiring:



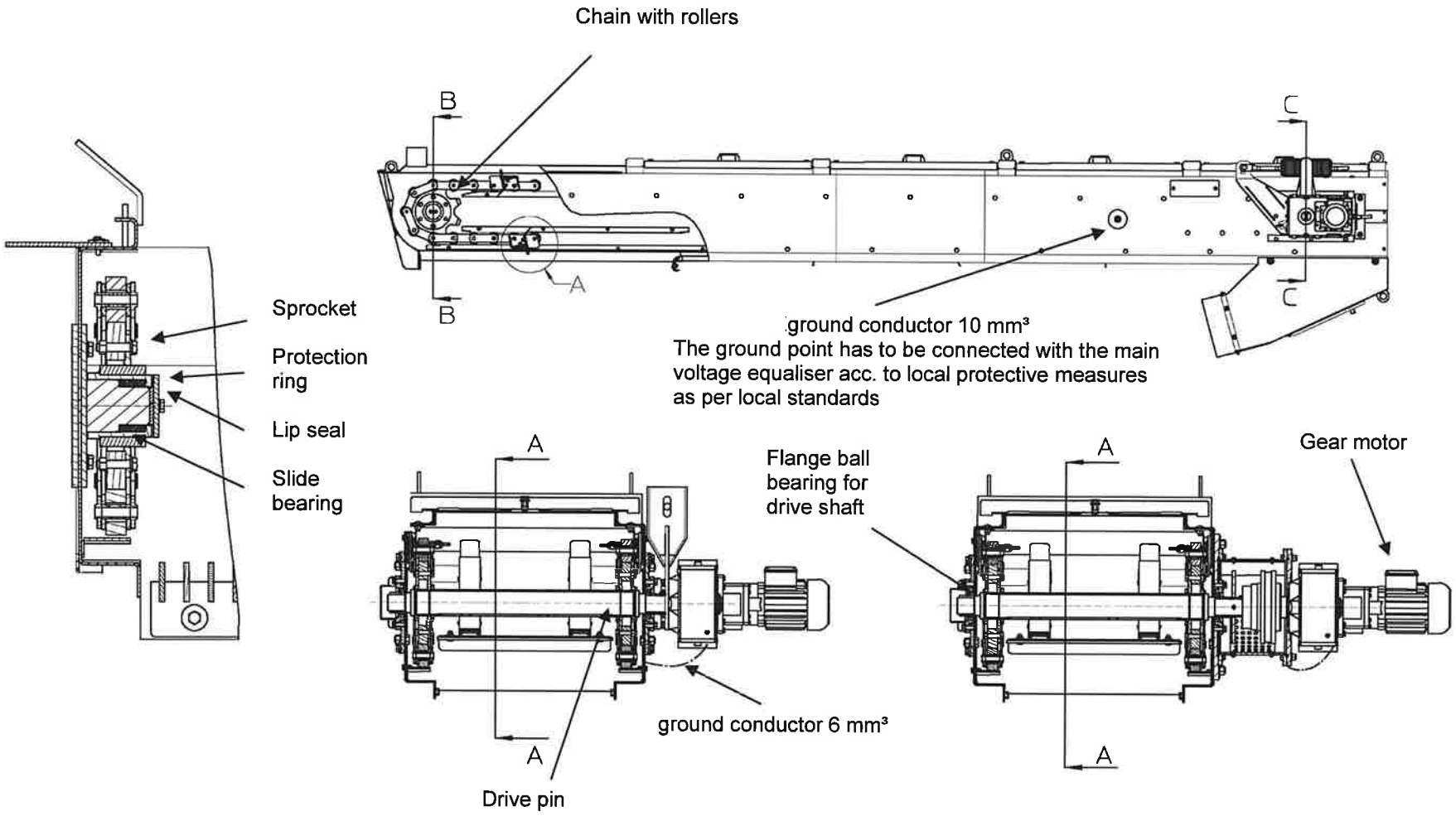
⚠ WARNING

Make sure that power supply is disconnected!
Secure this condition by appropriate measures!

- Prepare ground connection to the plant prior to beginning any other work, and ground the gear motor. The protection system of the terminal sockets must correspond to the protection system in which the plant has been installed. Fix the control panel with bolts in the intended position.
- Fix the adjacent control box with dowels next to / onto the machine.
- Prepare all cables between the machine, control panel and local control station and connect the plant to the power supply according to the specifications in the wiring diagram.

If there is a differential water level control system ensure that the ultrasonic level transmitters are mounted correctly. Please refer to the manufacturer's installation instructions for further information.

Prior to first start resp. prior to recommissioning (e.g. after changing the power supply) check the rotation direction of the motors!


Chain with rollers
B
C
A
B
C
Sprocket
Protection ring
Lip seal
Slide bearing
ground conductor 10 mm³
The ground point has to be connected with the main voltage equaliser acc. to local protective measures as per local standards
A
Flange ball bearing for drive shaft
A
Gear motor
ground conductor 6 mm³
A
A
Drive pin

5 Start-up

Observe the following safety instructions for machine start-up to avoid damage to the machine or injuries.

- Only qualified persons are permitted to perform start-up work, observing the safety instructions.
- Check before the first start-up that all tools and foreign objects have been removed.
- Activate all safety devices and emergency cutoff switches before start-up.
- Check that the proximity switch is in perfect condition. The distance between the proximity switch and impulse transmitter must be approx. 5/64" (2 mm).
- Check chain tension according to instructions given in chapter "Maintenance and repair".
- Read also the chapter *General Safety Instructions*.

5.1 Customer-supplied connections

All customer-supplied connections must be installed on the marked positions, or at least as close as possible, according to the manufacturer's instructions respectively installation drawing.

5.1.1 Electrical connection

The electrical connections must be laid to the installation place of the control panel.

Please refer to wiring diagram in control section for further information.

5.2 Checks prior to initial start-up

Prior to start-up:

Make yourself familiar with the

- operation and control elements of the machine
- machine equipment
- operation principle of the machine
- immediate environment of the machine
- safety devices of the machine
- measures to be taken in case of emergency

NOTICE

Check that the max. admissible water levels are observed by suitable measures. The admissible levels respectively pressure losses can be found in the data sheet or installation drawing.
In case pumps are installed behind the screens, their control must be included in the screen controls. This makes sure that the capacity is reduced when the max. admissible water level is reached, or the pump gets switched off completely.

Perform the following work prior to any start-up:

- Check and make sure that all safety device are attached and in a ready-to-operate condition.
- Check the machine for visible damage and eliminate any damage found immediately or report them to the supervisory staff, as machine operation is only permitted if the machine is in a perfect condition.
- Check and make sure that authorized persons only have access to the operation area of the machine and no other persons are endangered by starting the machine.
- Remove any objects or other material from the operation area of the machine, which is not needed for machine operation.

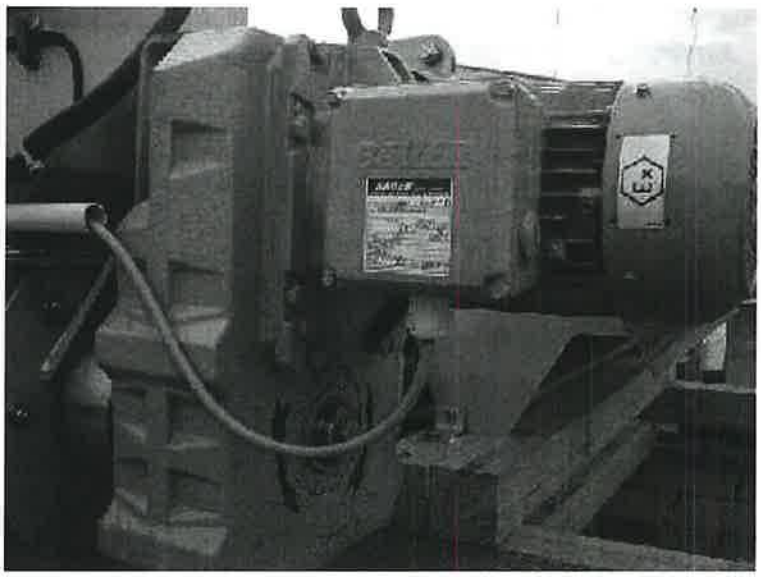
- Remove all foreign objects from the channel that might cause operational troubles (such as pieces of wood, stones, iron, etc.). Remove also ice if this has formed due to low temperature.

The screen was lubricated in the factory before dispatch as specified in the provided lubricant table. Check all lubrication points and re-lubricate them, if necessary, as described in chapter *Maintenance*.

The following needs to be checked prior to starting the screen:
- Check the adjustment of the rake towards the bar rack and apron.
- The rake tines must mesh with the rack bars without contact.
- Avoid contact between the rake tines and apron.
- The optimal distance between the tine points and the apron is 5/64-7/64" (2-3 mm).
- Check the function of the proximity switches for torque control (and optionally screen home position).

Let the screen perform several full removal cycles and observe thoroughly if all screen functions are OK.

Check that the screw-type cable fitting fits tight and re-tighten the screw, if necessary, to prevent ingress of water into the motor. (See below picture of the screw-type cable fitting.)



6 Operation

Observe the following instructions when operating the machine to avoid damage to the machine or injuries.

- Never use the machine for any other purpose than the intended use!
- Inform yourself about the correct behavior in case of a fault prior to switching the machine on.
- Check prior to switching the machine on that the following units are in a ready-to-operate condition:
    - Protective devices
    - Emergency cutoff switch

Read also the chapter General Safety Instructions.

6.1 Control philosophy (See TAB 2 for Project Specific Controls)

The electrical control regulates all automated functions of the machine both in automatic and hand mode. After switching the mains isolator on, the plant works in automatic mode. The control panel must be installed outside the screening room in a non-hazardous environment.

Read this chapter carefully if you have the electrical control panel supplied by a third company. The panel must be completely wired in order to connect the machine. The wiring diagram should lie inside the panel.

6.1.1 Control panel design and equipment

The equipment in detail is specified in the material list of the attached wiring diagram.

NOTICE

Do not re-start the machine after an overload protection relay has tripped before the cause for tripping has been found and eliminated. See also indications in text display!

6.1.2 Standard design

The standard control panel comprises a stainless steel NEMA 4X enclosure housing mains, fuses, switches, controls and indicators. The control panel incorporates an Allen Bradley MicroLogix PLC for sequence control. A Panel View operator interface is used to display system status and to facilitate changing operating parameters.

Switch possibilities on control display

Operation and fault signals are indicated on the text display. After the plant has been switched on it is in AUTO mode. The operating keys of the text display, or local control station, allow different manual operation modes. For further details, see control panel section of the manual.

6.2 Operation possibilities

6.2.1 Operation by means of adjacent control switch

The control units are displaced from the main control panel into an adjacent control box (local control station) if the main control panel is not positioned within close distance to the machine. The machine can for example be installed in a classified area and operated via a NEMA 7 local control station while the main control panel is installed in a room without classification.

Equipment:

- Emergency stop pushbutton
- Selector switch (HOA) for screen
- Rotation selector switch (FOR) for screen

Arrangement:

Directly adjacent to the machine, installation options:

- On standard upright dowelled to the floor
- Clamp-mounted on the screen frame

Selector switch (HOA) positions:

Position	Action	Condition
AUTO	Machine is running	When level control or timer actuate
HAND	Machine runs forwards	As long as the rotation selector switch remains in this position

Rotation direction selector switch (FOR) positions on local control station for manual operation (HAND):

Position	Action	Condition
FORWARD	Screen runs forwards	When switch is in "HAND" position
REVERSE	Screen reverses	When lswitch is in "HAND" position

Screen drive requires a VFD or soft starter.

Please refer to control drawings for device settings and sequence of operation.

6.2.2 Time dependent automatic start control

If the inflow rate is low, screenings may accumulate in front of the screen if the screen is not activated by differential level. To prevent accumulation of screenings, the screen is programmed to start automatically after a selectable standstill time. The screen will run for a selectable run-on time.

7 Troubleshooting and Repair

Symptom	Possible cause	Repair
Screen does not run although the tripped lamp is off.	Mains isolator is in OFF position.	Switch mains isolator ON.
	Selector switch is in "0" position.	Turn selector switch to HAND or AUTO
	Control fuse has melted.	Replace fuse.
	PLC-CPU is set to STOP.	Switch to RUN.
	No signal from ultrasonic level transducer	Check transducer.
Fault lamp is lit. Or the fault is indicated in the text display.	Motor overload has tripped.	a) Switch off mains isolator b) Check if: • Big solids block the rake • The rake is jammed in the bar rack c) Run the rake upwards/back to eliminate the cause for the trouble. d) Switch on motor protection switch and operate reset key. e) Switch on mains isolator.
	Limit switch of overload protection has tripped.	a) , b) , c) Ditto
	Phase breakdown	Check fuses in control panel. Check preceding fuses.
Continuous operation in AUTO mode	Level control is permanently activating because: Level transducer is blocked.	Check for obstructions in transducer acoustic beam.
Time-dependent control does not work.	Time has not been set in text display or on timer.	Set a time.
	Timer is defective.	Repair the timer.

8 Maintenance and Repair

⚠ CAUTION

Enclosed rooms of wastewater treatment plants that must be entered for service and maintenance have to be aerated in a way that prevents a dangerous explosive atmosphere, lack of oxygen and presence of harmful concentrations of gas or vapor.

⚠ CAUTION

The chapter maintenance and repair is intended for skilled staff only.
Any maintenance or repair work must be performed by skilled staff only.
Skilled staff has to be equipped with personal protective gear (such as gloves, etc.).

Skilled persons
Skilled persons are persons that are able to evaluate assigned jobs and recognize possible risks, due to their professional skills, expertise and experience and knowledge of corresponding standards.
Regular cleaning and plant maintenance is required to ensure trouble-free plant operation.



⚠ CAUTION

Always wear protective glasses and rubber gloves if harmful materials have been processed by the machine.

The machine is subject to vibrations during operation, which may cause screw and clamp connections to get loose. To prevent damage, regularly check the machine.

⚠ CAUTION

It is essential to proceed as described under 2.1.4 when shutting down the machine prior to performing maintenance, repair or cleaning work. Use only tools and means that are expressly intended for such work.

Observe the following instructions when performing maintenance or repair work on the machine to avoid damage to the machine or injuries.

- Prior to performing any repair work, shut off a wide area around the machine.
- Switch off all voltage sources and secure the voltage sources to prevent they are unintentionally switched on again.
- Never use any other than the specified operating media.
- Never use any other than the spare parts specified in our spare parts lists.
- Read also the chapter *General Safety Instructions*.

8.1 Cleaning and inspection schedule

NOTICE

Check the potential equalisation regularly, as described in chapter 2.3, Incorporated safety systems!

Weekly:
- Clean and inspect level sensors.
- Clean and inspect bar rack, rakes, apron and wiper.
- Check for loose rake bolts on chain.

Monthly:
- Check adjustment of rake towards bar rack and apron.

Quarterly:
- Check chain tension

⚠ CAUTION

Never use a high pressure unit to clean electrical plant equipment!

8.2 Maintenance

8.2.1 Inspection of screwed connections

Check all screwed connections regularly, at least at the time of annual inspection, if they are tight. Replace all self-locking nuts that were unlocked for the purpose of maintenance or repair, otherwise used nuts may get loose and cause damage.

8.2.2 Rake maintenance

Monthly check the adjustment of the rake towards the bar rack and apron and make corrections, if necessary. The rake tines must mesh with the rack bars and slide along the apron both without direct contact. Check also the wiper function if screenings are completely removed from the rake.

8.2.3 Maintenance of drive motor

Operating media and lubricant replacement

The screen is equipped with a gear motor, the technical data and required lubricant amounts of which can be taken from the attached motor data sheet. The required lubricant amount is additionally specified on the identification plate. If two amounts are specified, the first refers to the main gearing while the second refers to the intermediate gearing.

Separate operating instructions for the gear motor are attached in TAB 4. They include a list of permissible types of lubricant.

One recommended lubricant is Kluberoil G-4-220-US (Huber Technology article # SP-KLG4220).

Under normal operational conditions it is recommended to replace the lubricant after approx. 15,000 operation hours. Independent of the operation time, lubricant replacement is recommended after 2-3 years at the latest.

8.2.4 Maintenance schedule

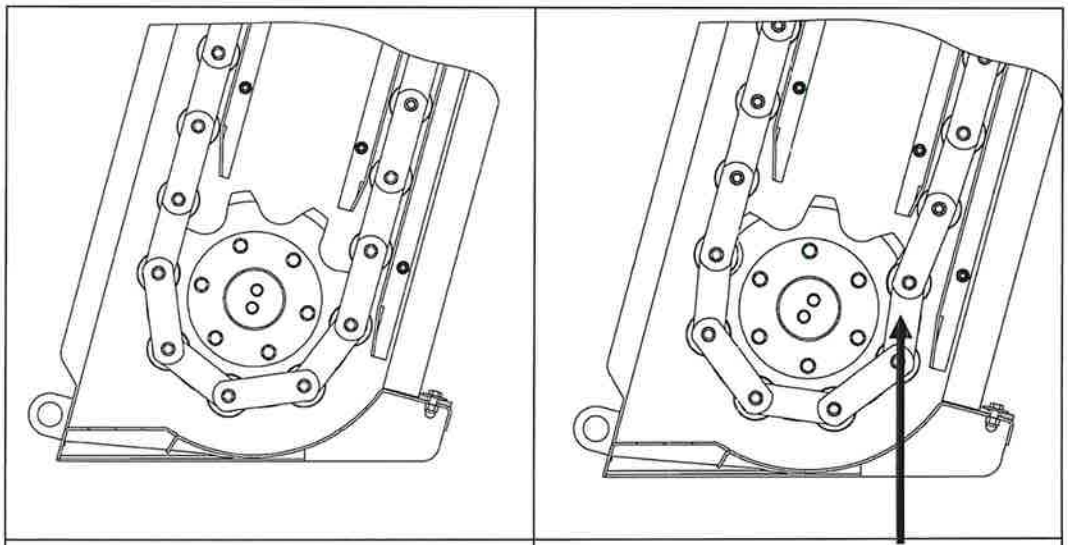
The screen is designed to minimize maintenance even under difficult operation conditions.

Individual units for which no specification is provided are lubricated for life.

Do not replace mineral by synthetic lubricants as synthetic lubricants may affect sealings and surface protections.

8.2.5 Chain tension

In our factory the chain is tightened in a way that the chain bears on the rear chain track. If the chain is tightened too much, it moves away from the chain track towards the sprocket.

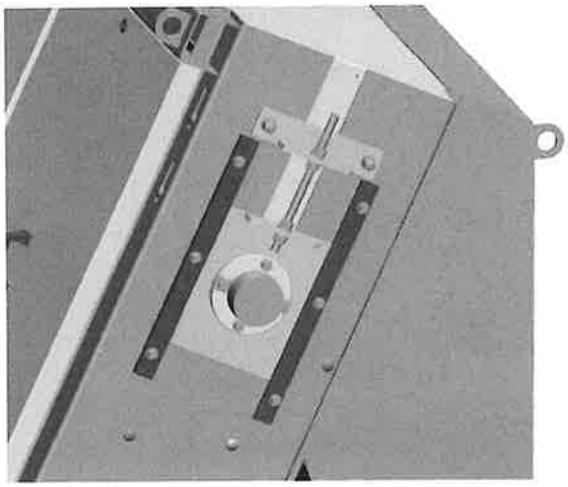


Correct chain tension	Wrong chain tension

Check the chain tension for the first time after 10 - 15 running hours. We recommend operating the screen after start-up in dry running mode for 10 - 15 hours and then check the chain tension.

As the chain may elongate during operation, chain tension has to be checked quarterly, if necessary the chain has to be tightened. For tightening release the screws of the chain tension

device on both sides of the screen frame. Retighten the nuts on the threaded rods on both sides; make sure that the chain still bears on the rear chain track.



NOTICE

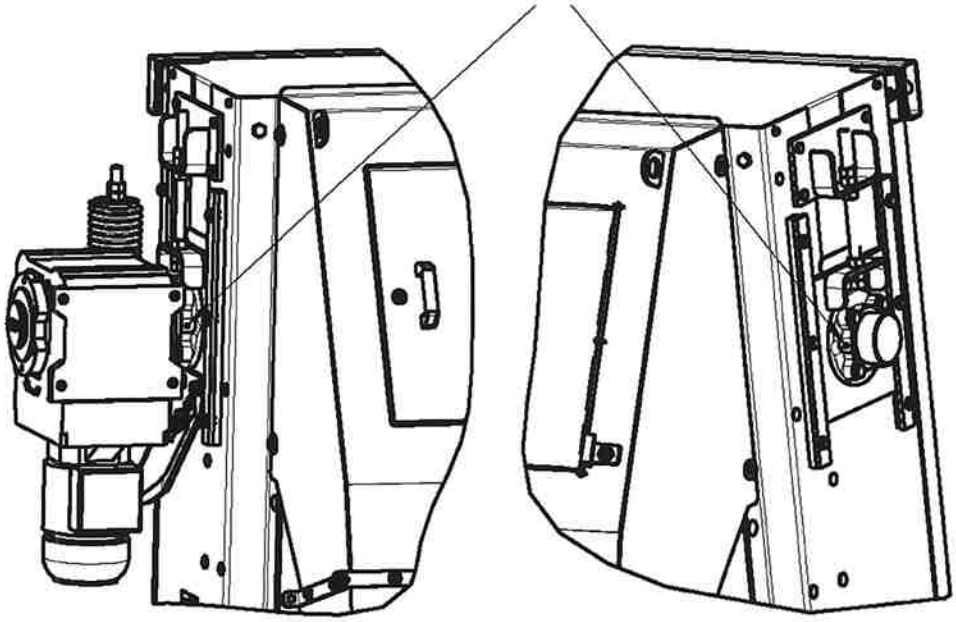
Tighten the chain in small steps!

Do never tighten the chain too much!

8.2.6 Greasing of the top bearing (at HF-version also middle bearing)

The machines have a lubrication system for the top bearings. The lubrication is carried out by grease nipples which are shown on the following sketch.

Grease nipples



Every 50 operation hours these bearings have to be lubricated with 5 strokes of the grease gun The standard lubricant is STABYL EOS E2 by Fuchs Lubritech (Huber Technology article # SP-V0919-001, 400g cartridge), which is biologically degradable.

8.3 Spare parts, components subject to wear

Long life and corrosion resistance against all municipal and most industrial sorts of wastewater as all components which are in contact with water are completely made of stainless steel, acid-treated in a pickling bath and passivated.

a) Wear parts
Our guarantee does not include wearing parts that are subject to natural wear during operation. Wear parts are defined as parts that show increased wear due to their function, the degree of wear depending on operational conditions, running hours and plant maintenance.

Main wear parts of the plant:
Chain
Bottom chain bearing
Wiper plate
Screen rake

b) Spare parts
For other spare parts such as gear motor, solenoid valve, etc. see TAB 8.

Whenever you order spare parts please specify:
Machine type
Size
Order number = machine number
Year of manufacture
Operational voltage of the corresponding electrical component
Order no. from the spare part list (appendix)
Required quantity
Delivery address

8.4 Regular tests of machines

The regular tests for maintenance of the plant's nominal condition shall include after every 4500 operation hours, at least however after 3 years, checkup of the components listed below. Replace the components, if they show signs of an unacceptable operating condition.

Operation hours	Interval	Subject	Recommended method
4500	3 years	Operating condition: Bottom chain bearing	Check for play (using a lever) Uniform screen run
4500	3 years	Operating condition: Drive shaft	Check flange bearings for wear



⚠ CAUTION

There is a danger of burning in the area of the drive motors

NOTICE

Additionally observe the separate operating instructions for electro motors, drives and bearings for maintenance.



⚠ CAUTION

Repair or extensive maintenance work on machines in a hazardous area (ex protection) should be performed in a separate room on the dismounted machine.

9 Shutdown

Observe the following safety instructions for machine shutdowns to avoid damage to the machine, injuries or environmental damage.

- Qualified staff only is authorized to carry out shutdowns.
- Contact the manufacturer for questions concerning disposal of the machine.
- Take care of environmentally-friendly disposal of operating media, lubricants and auxiliary material (e.g. gearbox oil). Observe the regulations for eco-friendly waste disposal!
- Lifting and righting of the equipment must be done only by the lifting eyes provided.
- Use only the lifting devices specified hereunder to transport the machine.
- Read also the chapter *Transport*.
- Read also the chapter *General Safety Instructions*.

9.1 Temporary shutdown

- Clean the screen with a high-pressure unit prior to a longer shutdown.
- If the machine is installed outdoors the motor should be covered (in order to avoid ingress of water) but not wrapped.
- It is recommended to change the gearbox oil prior to start-up after a several-year shutdown. Further conservation is not necessary.

9.2 Final shutdown / disposal

Qualified staff only is authorized to perform electrical and mechanical shutdowns.
Prior to a final shutdown, follow the instructions for a temporary shutdown and the following additional instructions:

- Drain the gearbox oil. Disposal of gearbox oil: Observe the regulations for eco-friendly waste disposal!

10 Additional Information

If you require more information, please write or phone. We will do our best to support you.

Our US headquarters:

Huber Technology, Inc.
9735 NorthCross Center Court STE A
Huntersville, NC 28078

Phone: 1-704-949-1010
Fax: 1-704-949-1020
E-mail: huber@hhusa.net

Our customer service:

Phone: 1-877-US HUBER
E-mail: service@hhusa.net
parts@hhusa.net

We will help you to quickly find the right specialist to answer your questions.

Or visit our website http://www.huber-technology.com providing up-to-date information concerning our Business Unit Service.

Our service comprises **preventive maintenance, routine servicing, and short-term repair**. Our service hotline is available **24 hours a day, 7 days a week.**

Our qualified team offers a customer-oriented and reliable service. This service includes:

- **Installation supervision and start-up service**
- **Operator training**
- **Inspection and preventive maintenance**
- **Fine tuning of equipment for optimum performance**
- **Trouble shooting**
- **Routine and emergency repair**
- **Spare parts**

These additional services guarantee reliable plant operation, which is an important aspect for both municipal and industrial applications, and will help you to meet the requirements within your area of responsibility.

HUBER Technology, Inc.

11 Technical Specifications (2x) Multi-Rake Bar Screens RakeMax Size: 8320x975x6 mm

DIMENSIONS & WEIGHT	See next page and drawings in TAB 8
MAX FLOW	32.5 MGD per Screen
RAKING INTERVALS	7 sec RAKING SPEED 39 ft/min
SPARE PARTS	See TAB 8
BAR PROFILE TYPE	Material AISI 304L SST. Tear drop profile.
OPENINGS FOR DEWATERING	6 mm= .25"
FRAME MATERIAL	Material AISI 304L SST. See next page for more details.
CHAINS AND ROLLERS	See chain specification page on the next pages for details.
SURFACE TREATMENT	All stainless steel components are submerged in an acid pickling bath to passivate all surfaces. The gearmotor drive is painted with: Abrasive blast clean 35 µm special self-etching primary coat red-brown (RAL 3009) 40 µm one-component waterborn refinishing paint (RAL 7031) 40 µm high solid two-component polyurethan sky blue (RAL 5015) minimum thickness for complete geared motor 115 um
DRIVE MECHANISM	Three-phase Danfoss Bauer beveled gearbox, mounted on the drive shaft of the screen. Baldor VFD drive motor directly mounted on the gearbox Outgoing RPM of gearmotor is 9.6 at 60 Hz

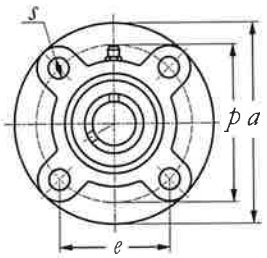
HUBER TECHNOLOGY
WASTE WATER Solutions

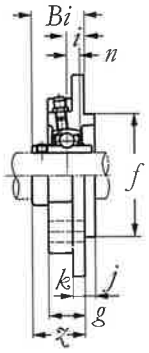
Standard Specification Detail for Rakemax® Multi-Rake Bar Screen

1) Nominal screen length and width (mm):	8320 x 975
2) Nominal opening between screening bars (mm):	6
3) Effective free open area for water flow (%):	42.9
4) Maximum flow rate through screen (MGD):	32.5
5) Inclination of screen (deg.):	85
6) Maximum water level in front of screen (ft):	6.0
7) Maximum headloss at peak flow assuming 30% blinding (in):	11
8) Minimum material thickness of 60 deg discharge chute (in):	.16
9) Tear drop profile width & tail width & length (in):	.31 x .20 x 2.36
10) Thickness of curved base plate at lower ends of bars (in):	.16
11) Bar length (ft):	8.2
12) Thickness of dead plate between side frames (in):	.16
13) Maximum distance between rakes teeth over the dead plate (in):	.08
14) Thickness of side frame with 4 axial edges (in):	.16
15) Minimum width of side frame (in):	23
16) Thickness of cross beam U-channel connecting the side frames (in):	4.25 x 2 x .16
17) Thickness of SST removable covers stiffened with 4 edges (in):	.06
18) Thickness of neoprene seal between frame & channel wall (in):	.16
19) Thickness of L-profile roller tracks bolted to each side of frame (in):	.16
20) Number of SST endless drive chains:	2
21) Guaranteed chain breaking strength (Tons): - Tested Value	13.5 – 20.5
22) Minimum drive chain pitch (in):	5

23) Minimum diameter & width of polymide chain rollers (in):	2.75 x 1.25
24) Number of upper SST two piece sprockets. Number of lower SST one piece sprockets. All sprockets shall be flanged to a shaft or bearing:	2 2
25) Minimum diameter & thickness & pitch of each sprocket (in):	13 x 1.12 x 5
26) Lower slide ceramic bearing in SST casing. White cast iron shaft & silicium carbide slide bushings length & minimum internal diameter (in):	2 x 2.32
27) Upper flange bearing in paint coated cast iron minimum diameter (in):	2.36
28) Minimum thickness of rake bars (in):	.31
29) Minimum thickness of rake bar cross section U-channel profile (in):	4.13 x 2.36
30) Minimum thickness & depth of rake blades bolted to rake bars (in):	.31 x 6.69
31) Minimum thickness of pivoting cleaning scraper at discharge (in):	.16
32) Minimum thickness of SST U-channel profile (in):	1.53 x 2.68
33) Minimum thickness of adjustable polyethylene wiper (in):	.39
34) Minimum length of SST scraper arms connecting scraper to frame (in):	20
35) Minimum thickness of SST scraper arms (in):	.16
36) Minimum thickness of SST U-channel profile cross section (in):	2.68 x 2.32
37) Number of neoprene shock absorber elements for scraper arm rest position:	2
38) minimum thickness & diameter of SST drive shaft (in):	.20 x 3.15

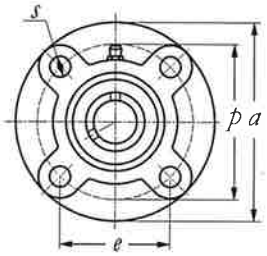
STANDARD DUTY FLANGED CARTRIDGE UNITS CAST HOUSING
SET SCREWS TYPE

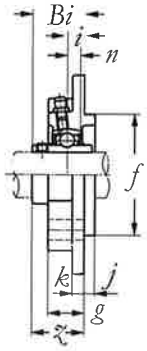




Shaft dia. mm / inch	Unit number	Nominal dimensions mm inch a	p	e	i	s	j	k	g	f	z	Bi	n	Bolt size mm / inch	Bearing number	Housing number	Mass of unit Kg
12	UCFC 201	100	78	55.1	10	12	5	6	20.5	62	28.3	31.0	12.7	M10	UC 201	FC 204	0.73
1/2	UCFC 201-8	3-15/16	3-5/64	2-11/64	25/64	15/32	13/64	15/64	13/16	2-7/16	1-7/64	1.2205	0.5000	3/8	UC 201-8	FC 204	0.73
15	UCFC 202	100	78	55.1	10	12	5	6	20.5	62	28.3	31.0	12.7	M10	UC 202	FC 204	0.72
9/16	UCFC 202-9	3-15/16	3-5/64	2-11/64	25/64	15/32	13/64	15/64	13/16	2-7/16	1-7/64	1.2205	0.5000	3/8	UC 202-9	FC 204	0.72
5/8	UCFC 202-10														UC 202-10		0.72
17	UCFC 203	100	78	55.1	10	12	5	6	20.5	62	28.3	31.0	12.7	M10	UC 203	FC 204	0.71
11/16	UCFC 203-11	3-15/16	3-5/64	2-11/64	25/64	15/32	13/64	15/64	13/16	2-7/16	1-7/64	1.2205	0.5000	3/8	UC 203-11	FC 204	0.71
20	UCFC 204	100	78	55.1	10	12	5	6	20.5	62	28.3	31.0	12.7	M10	UC 204	FC 204	0.69
3/4	UCFC 204-12	3-15/16	3-5/64	2-11/64	25/64	15/32	13/64	15/64	13/16	2-7/16	1-7/64	1.2205	0.5000	3/8	UC 204-12	FC 204	0.70
25	UCFC 205	115	90	63.6	10	12	6	7	21.0	70	29.7	34.0	14.3	M10	UC 205	FC 205	0.99
13/16	UCFC 205-13														UC 205-13		1.03
7/8	UCFC 205-14														UC 205-14		1.01
15/16	UCFC 205-15	4-17/32	3-35/64	2-1/2	25/64	15/32	15/64	9/32	53/64	2-3/4	1-11/64	1.3386	0.5630	3/8	UC 205-15	FC 205	1.00
1	UCFC 205-16														UC 205-16		0.98
30	UCFC 206	125	100	70.7	10	12	8	8	23.0	80	32.2	38.1	15.9	M10	UC 206	FC 206	1.25
1-1/16	UCFC 206-17														UC 206-17		1.29
1-1/8	UCFC 206-18														UC 206-18		1.27
1-3/16	UCFC 206-19	4-59/64	3-15/16	2-25/32	25/64	15/32	5/16	5/16	29/32	3-5/32	1-17/64	1.5000	0.6260	3/8	UC 206-19	FC 206	1.24
1-1/4	UCFC 206-20														UC 206-20		1.23
35	UCFC 207	135	110	77.8	11	14	8	9	26.0	90	36.4	42.9	17.5	M12	UC 207	FC 207	1.64
1-1/4	UCFC 207-20														UC 207-20		1.70
1-5/16	UCFC 207-21														UC 207-21		1.68
1-3/8	UCFC 207-22	5-5/16	4-21/64	3-1/16	7/16	35/64	5/16	23/64	1-1/64	3-35/64	1-7/16	1.6890	0.6890	7/16	UC 207-22	FC 207	1.65
1-7/16	UCFC 207-23														UC 207-23		1.62
40	UCFC 208	145	120	84.8	11	14	10	9	26.0	100	41.2	49.2	19.0	M12	UC 208	FC 208	2.01
1-1/2	UCFC 208-24	5-45/64	4-23/32	3-11/32	7/16	35/64	25/64	23/64	1-1/64	3-15/16	1-5/8	1.9370	0.7480	7/16	UC 208-24	FC 208	2.05
45	UCFC 209	160	132	93.3	10	16	12	10	26.0	105	40.2	49.2	19.0	M14	UC 209	FC 209	2.57
1-5/8	UCFC 209-26														UC 209-26		2.67
1-11/16	UCFC 209-27	6-19/64	5-13/64	3-43/64	25/64	5/8	15/32	25/64	1-1/64	4-9/64	1-37/64	1.9370	0.7480	1/2	UC 209-27	FC 209	2.63
1-3/4	UCFC 209-28														UC 209-28		2.59
50	UCFC 210	165	138	97.6	10	16	12	14	28.0	110	42.6	51.6	19.0	M14	UC 210	FC 210	2.85
1-7/8	UCFC 210-30														UC 210-30		2.92
1-15/16	UCFC 210-31	6-1/2	5-7/16	3-27/32	25/64	5/8	15/32	35/64	1-7/64	4-21/64	1-43/64	2.0315	0.7480	1/2	UC 210-31	FC 210	2.87
2	UCFC 210-32														UC 210-32		2.83

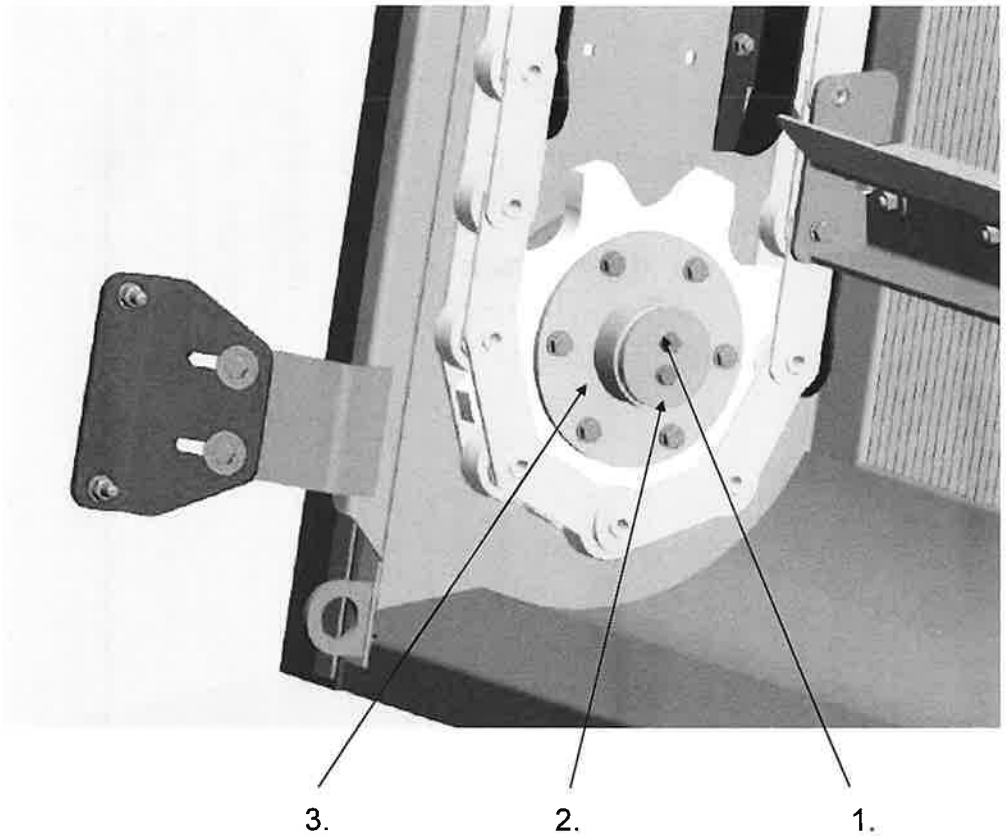
STANDARD DUTY FLANGED CARTRIDGE UNITS CAST HOUSING
SET SCREWS TYPE

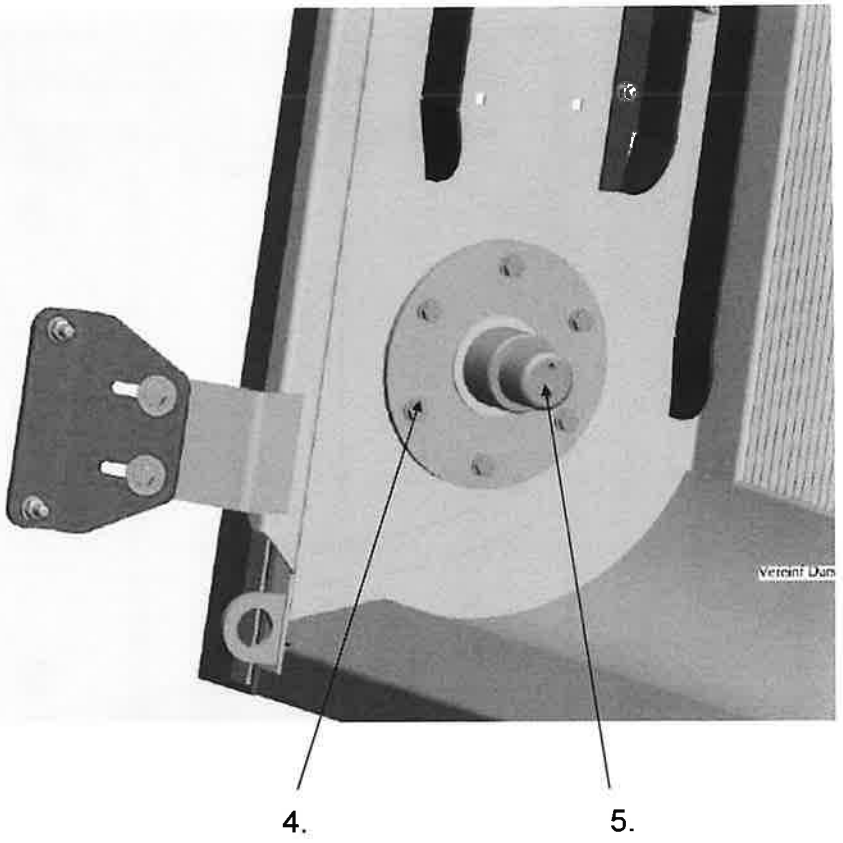




Shaft dia. mm / inch	Unit number	Nominal dimensions mm inch a	p	e	i	s	j	k	g	f	z	Bi	n	Bolt size mm / inch	Bearing number	Housing number	Mass of unit Kg
55	UCFC 211	185	150	106.1	13	19	12	13	30.0	125	46.4	55.6	22.2	M16	UC 211	FC 211	3.92
2	UCFC 211-32														UC 211-32		4.07
2-1/16	UCFC 211-33														UC 211-33		4.02
2-1/8	UCFC 211-34	7-9/32	5-29/32	4-11/64	3/64	3/4	15/32	3/64	1-3/16	4-59/64	1-53/64	2.1890	0.8740	5/8	UC 211-34	FC 211	3.97
2-3/16	UCFC 211-35														UC 211-35		3.90
60	UCFC 212	195	160	113.1	17	19	12	15	36.0	135	56.7	65.1	25.4	M16	UC 212	FC 212	5.03
2-1/4	UCFC 212-36														UC 212-36		5.17
2-5/16	UCFC 212-37														UC 212-37		5.10
2-3/8	UCFC 212-38	7-43/64	6-19/64	4-29/64	43/64	3/4	15/32	19/32	1-27/64	5-5/16	2-15/64	2.5630	1.0000	5/8	UC 212-38	FC 212	5.01
2-7/16	UCFC 212-39														UC 212-39		4.95
65	UCFC 213	205	170	120.2	16	19	14	15	35.0	145	55.7	65.1	25.4	M16	UC 213	FC 213	5.52
2-1/2	UCFC 213-40														UC 213-40		5.60
2-9/16	UCFC 213-41	8-5/64	6-11/16	4-47/64	5/8	3/4	35/64	19/32	1-3/8	5-45/64	2-3/16	2.5630	1.0000	5/8	UC 213-41	FC 213	5.44
70	UCFC 214	215	177	125.1	17	19	14	16	38.0	150	61.4	74.6	30.2	M16	UC 214	FC 214	6.55
2-5/8	UCFC 214-42														UC 214-42		6.58
2-11/16	UCFC 214-43														UC 214-43		6.57
2-3/4	UCFC 214-44	8-15/32	6-31/32	4-59/64	43/64	3/4	35/64	5/8	1-1/2	5-29/32	2-27/64	2.9370	1.1890	5/8	UC 214-44	FC 214	6.56
75	UCFC 215	220	184	130.1	18	19	16	17	39.0	160	62.5	77.8	33.3	M16	UC 215	FC 215	7.01
2-13/16	UCFC 215-45														UC 215-45		7.10
2-7/8	UCFC 215-46														UC 215-46		7.06
2-15/16	UCFC 215-47	8-21/32	7-1/4	5-1/8	45/64	3/4	5/8	43/64	1-17/32	6-19/64	2-29/64	3.0630	1.3110	5/8	UC 215-47	FC 215	7.04
3	UCFC 215-48														UC 215-48		6.93
80	UCFC 216	240	200	141.4	18	23	16	18	42.0	170	67.3	82.6	33.3	M20	UC 216	FC 216	8.94
3-1/16	UCFC 216-49														UC 216-49		9.03
3-1/8	UCFC 216-50														UC 216-50		8.99
3-3/16	UCFC 216-51	9-29/64	7-7/8	5-9/16	45/64	29/32	5/8	45/64	1-21/32	6-11/16	2-21/32	3.2520	1.3110	3/4	UC 216-51	FC 216	8.86
85	UCFC 217	250	208	147.1	18	23	18	20	45.0	180	69.6	85.7	34.1	M20	UC 217	FC 217	10.68
3-1/4	UCFC 217-52														UC 217-52		10.90
3-5/16	UCFC 217-53														UC 217-53		10.76
3-7/16	UCFC 217-55	9-27/32	8-3/16	5-51/64	45/64	29/32	45/64	25/32	1-49/64	7-3/32	2-47/64	3.3740	1.3425	3/4	UC 217-55	FC 217	10.51
90	UCFC 218	265	220	155.5	22	23	18	20	50.0	190	78.3	96.0	39.7	M20	UC 218	FC 218	12.95
3-1/2	UCFC 218-56	10-7/16	8-21/32	6-1/8	55/64	29/32	45/64	25/32	1-31/32	7-31/64	3-5/64	3.7800	1.5630	3/4	UC 218-56	FC 218	13.06

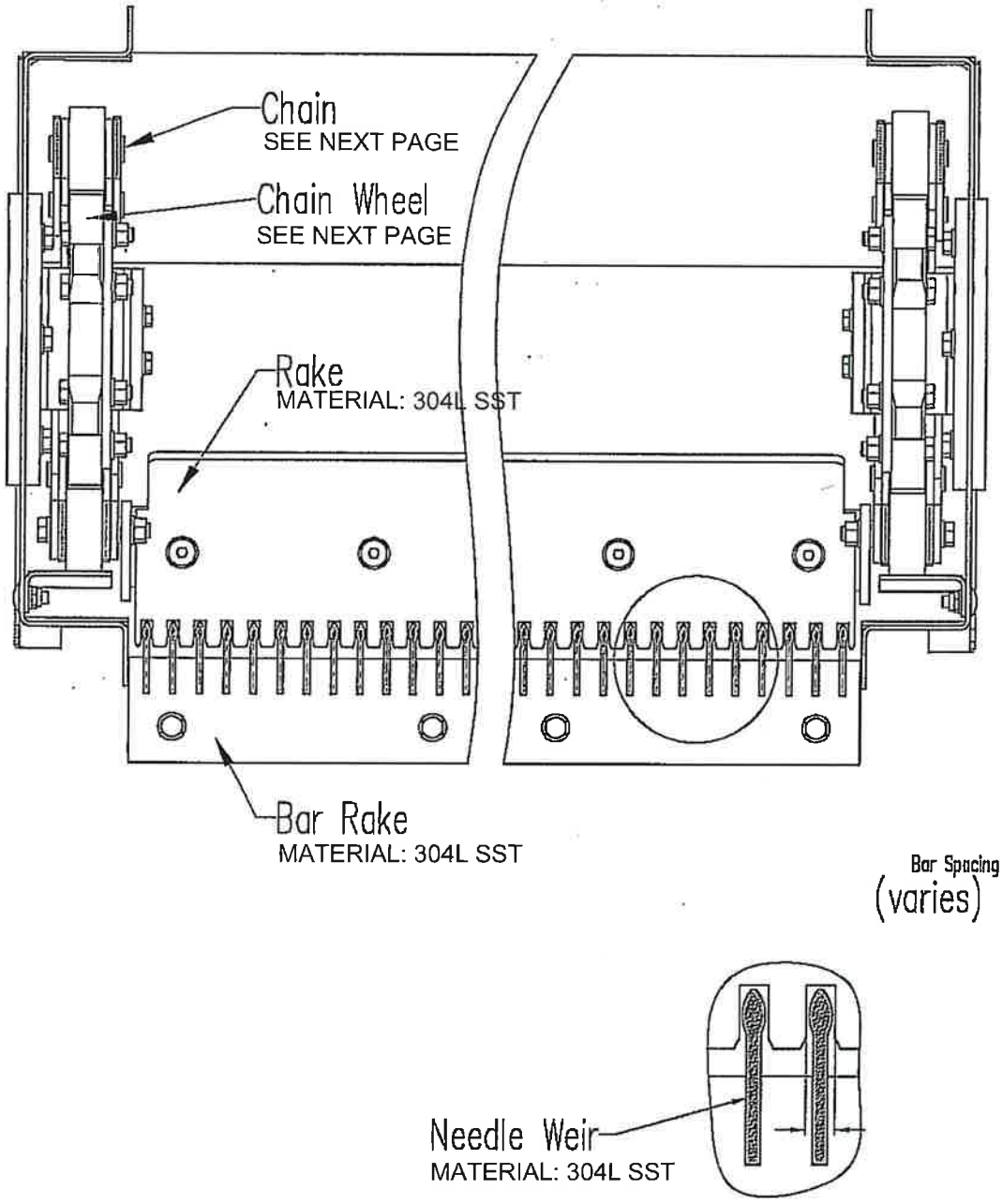
RakeMax® Multi-Rake Bar Screen
Bottom chain bearing





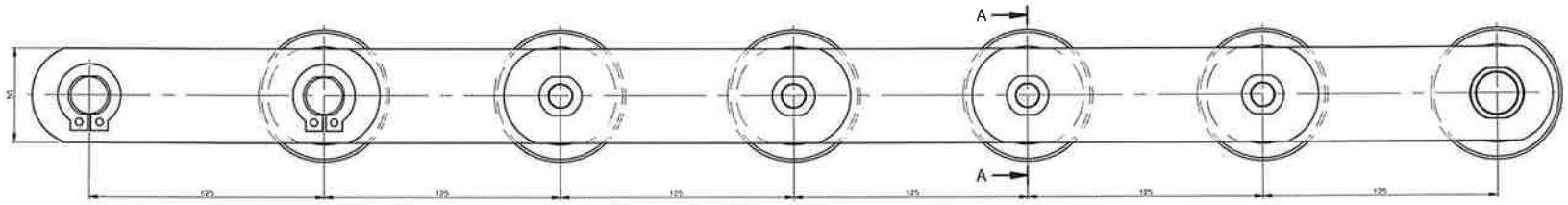
Dismantle in the following order:

1. screw and washer
2. disc
3. ceramic bearing with sprocket wheel
4. screw and washer
5. journal pin

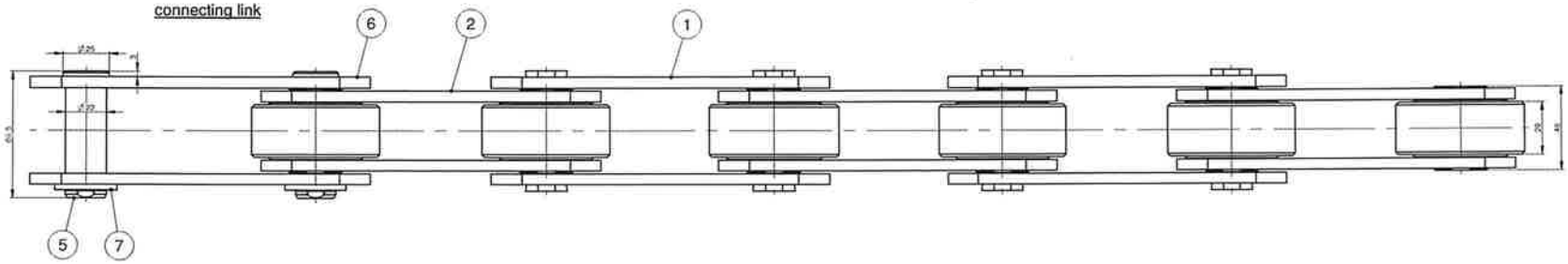


HUBER TECHNOLOGY

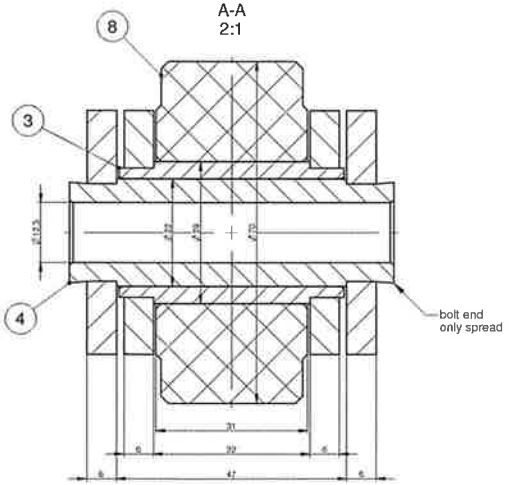
RakeMax Teardrop Design	
Lexington, KS	Scale: NTS
Project No.	Drawing No. teardrop_design_HHUSA.dwg

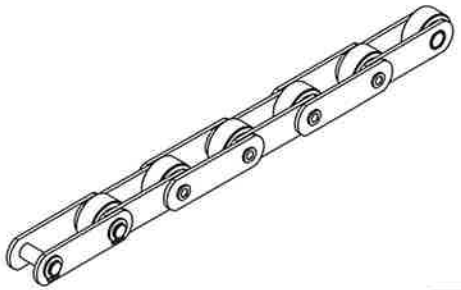


connecting link



A-A
2:1





calc. breaking strength : 120 kN

weight : approx. 9 kg/m

pos	designation	width	size	weight	ou.-Ø	in.-Ø	teeth	part	ref. No.	material + base sizes	weight
8	roller	31			70	29,2		8	E-1957.2	P460	0,74 kg
7	circlip #WN0622							7	128632	X2CrNiMoF 12 2 (1.4406)	0,03 kg
1	outer link plate	50	6	185		22,1		6	129623	X2CrNiMoF 12 2 (1.4406)	0,38 kg
2	circlip head pin			69,5	22			5	129610	X20Cr13 (1.4057)	0,41 kg
4	hollow pin			98	22	12,3		4	128607	X20Cr13 (1.4057)	0,53 kg
3	bush			40	29	22,15		3	128605	X20Cr13 (1.4057)	0,58 kg
6	inner link plate	50	6	185		29		2	128230	X2CrNiMoF 12 2 (1.4406)	2,12 kg
5	outer link plate	50	6	185		22		1	128229	X2CrNiMoF 12 2 (1.4406)	1,85 kg

state	date	name	Copyright reserved to DIN34 / ISO16016	KettenWulf KettenWulf Betriebs GmbH Zum Hohenstein 15 D-59868 Eslohe-Kükelheim
drawn	26.11.2009	Krombach		
approved	27.01.2014	Stange		
release	27.01.2014	Stange	CAD status checked	

change nr	description	CAD drawing number	index
replaced by	**hollow pin chain** RakeMax Version 2	128631	e
		scale	
		1:6;1:1,25;1:5	

index	information	date	name
e	182546	24.01.2014	Gasser
d	137279	27.09.2010	Schulz
c	5821	20.05.2010	Ruether

fit dimension	deviation

Hydraulic Calculation for RakeMax: 8320/975/6

Date: 3/15/2018

Project: EHWWS

Given data:

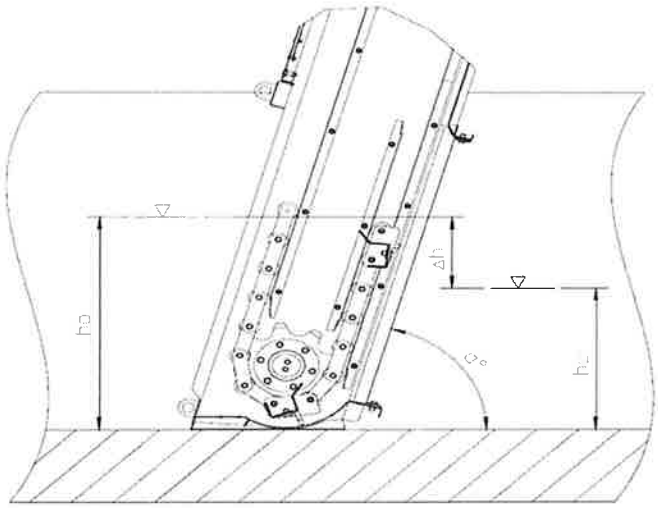
Flow rate (Peak)	Q	32.5	MGD
Channel width	w channel	48.0	inch
Selected screen width	ws	38.4	inch
Water level behind screen	hu	61.5	inch
Flow velocity in channel	vg	2.45	ft/sec

Specific screen data:

Bar spacing	e	1/4	inch
Bar thickness	s	23/73	* inch
Bar geometry coefficient	b	0.84	* [-]
Installation angle	a	85	[°]

Calculation basis:

Free surface factor	ao = e/(s+e)	42.9	[%]
Flow velocity between slots	vr = Q/(ws*ho*ao*(1-b))*sin(alpha)		
Blinding factor z	z = e - ynet*(e+s)		
Relative flow area	y net = e/(s+e)-b*e/(s+e)		
Headloss	delta h = beta*((s+z)/(e-z))^4/3*sin(alpha)* vo^2/2*g		
Upstream head	ho = hu + delta h		
Velocity in the screen	vo = Q/(ws*ho)		



Calculated data:

Blinding b	Headloss (delta h)	Upstream head ho	Flow velocity between slots vr
[%]	inch	inch	ft/sec
0	2	64	6.88
10	5	66	7.36
20	8	69	7.91
30	11	73	8.60
35	15	77	8.81
40	19	80	9.08
50	*24*	*85*	*10.28*

TAB 4

HUBER Technology, Inc. • Huntersville, NC

Motor Data Sheet (2x) HUBER Multi-Rake Bar Screen RakeMax Size: 8320x975x6 mm

Gearbox Manufacture:	Danfoss-Bauer, Somerset, NJ
Motor Manufacture:	Baldor, Fort Smith, AR
Enclosure:	XPFC
Explosion Proof Rating:	Class 1, Division 1, Group D
Gearbox:	BK60ZX-74VHW-C self locking
Motor:	IDXM7542T, VFD, Continuous, Thermostats
Horsepower (HP):	3.0
Motor Speed (RPM):	1755
Output Shaft Speed (RPM):	9.6
Nominal Torque Output Shaft (lbf-in):	19,030
NEMA Nominal Efficiency (%):	89.5 Premium Efficient
Gear Ratio:	183.2
Hertz/Phase/Voltage:	60/3/230/460 (Y)
Full Current Load (A):	8.2/4.1
Frame Size:	NEMA182TC, C-Flange
Service Factor:	1.00
Maximum Ambient Temperature:	40°C
Winding Material:	Copper
Frame Material:	Cast Iron
Insulation Class:	H
NEMA Design Code:	B
Color:	sky blue (RAL 5015)

GEARBOX APPENDIX INFORMATION

TYPE: DANFOSS-BAUER BK60

BAUER

ET-BK 60

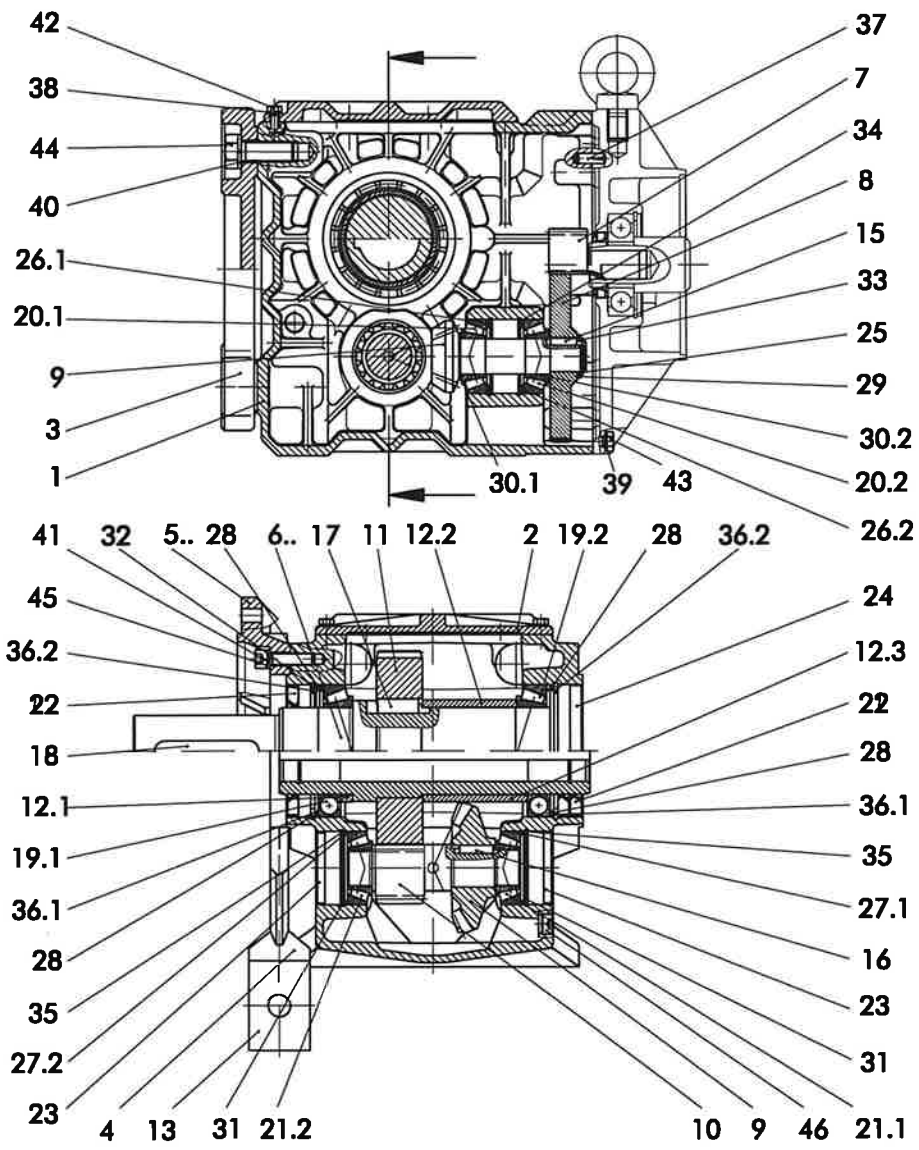
Parts list
and sectional drawing

Gear unit type

Part No.	Order No.	Quantity		Designation
47	–			Lubricant
46	2503018	1		Cover screw
45	2503026	0/6		Fillister head screw with flange or torque arm
44	2507552	0/4		Hexagon bolt with foot plate
43	1001078	8		Hexagon bolt
42	1316656	8		Hexagon bolt
41	1011634	0/6		Spring washer with flange or torque arm
40	1439022	0/4		Spring washer with foot plate
39	1010441	8		Spring washer
38	1010492	8		Spring washer
37	2506670	2		Dowel pin
36.2	2508737	0/2		Retainer ring with reinforced bearings
36.1	1000349	0/2		Retainer ring with normal bearings
35	1248901	2		Retainer ring
34	1248901	2		Retainer ring
33	2511061	1		Retainer ring
32	*	1		Tuning package with reinforced bearings
31	*	2		Tuning package
30.2	*	1		Tuning package
30.1	*	1		Tuning package



A 5-B/98-ET-BK 60 Printed in Germany



Right to change the design reserved.

Gear unit type

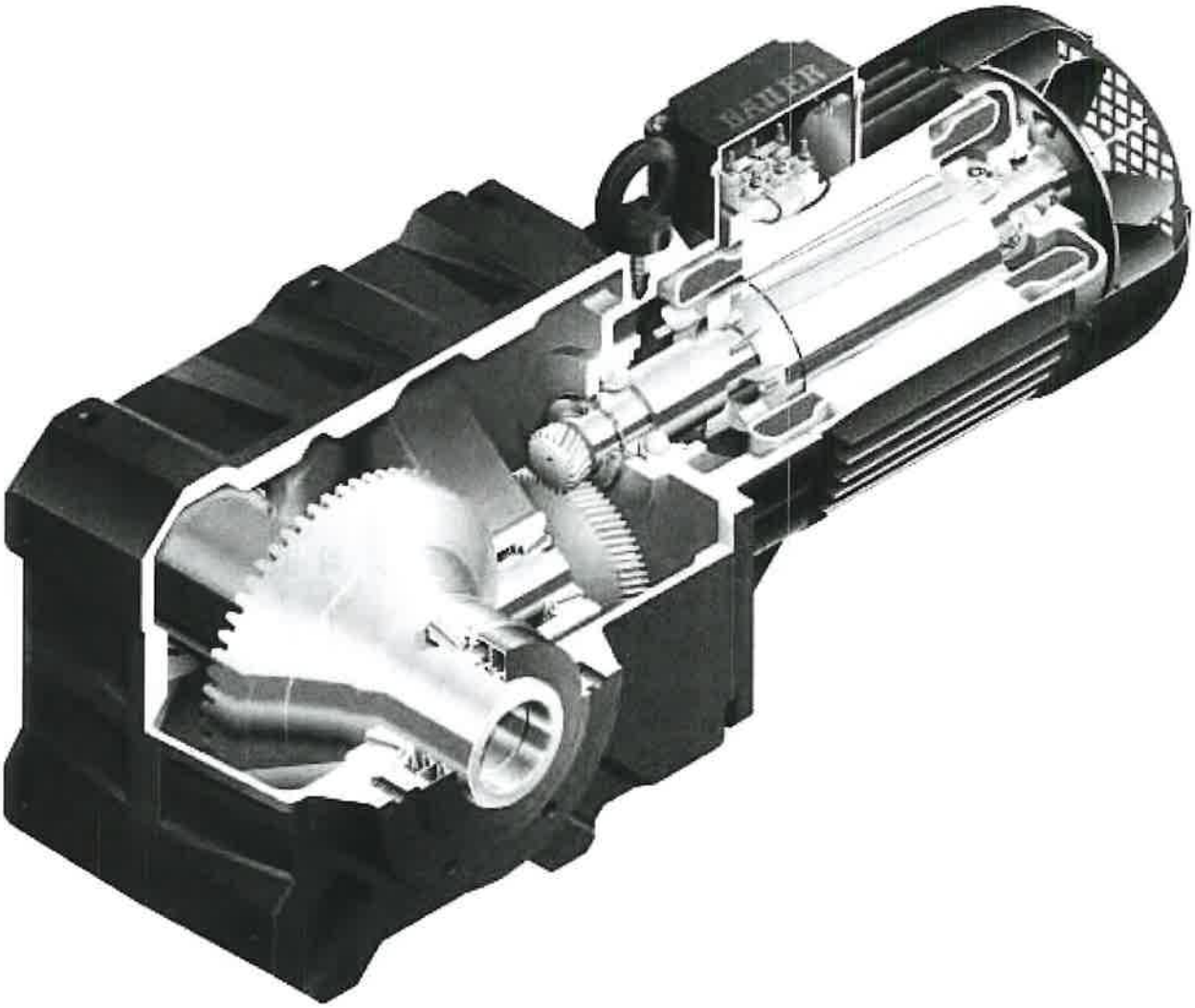
ET-BK 60

Part No.	Order No.	Quantity	Designation
29	*	1	Tuning package
28	2508729	2/4	Supporting plate 4 off with reinforced bearings
27.2	2508711	1	Supporting plate
27.1	2510944	1	Supporting plate T3 measure
26.2	2508711	1	Supporting plate
26.1	2520591	1	Supporting plate T1 measure
25	1451995	1	Supporting plate
24	1448382	0/1	Sealing cover with solid shaft on one side
23	2507561	2	Sealing cover
22	2502879	1/2/4	Shaft seal
21.2	2508443	1	Tapered roller bearing
21.1	2510529	1	Tapered roller bearing L3V measure
20.2	2508443	1	Tapered roller bearing
20.1	2520559	1	Tapered roller bearing L1 measure
19.2	1402471	0/2	Tapered roller bearing with reinforced bearings
19.1	1028821	0/2	Ball bearing with normal bearings
18	1000594	0/1/2	Key with solid shaft
17	2507226	1	Key
16	2507587	1	Key
15	2507218	1	Key
14			
13	1387499	0/2	Rubber buffer with torque arm
12.3	2507617	0/1	Spacer with normal bearings
12.2	2507609	0/1	Spacer with reinforced bearings
12.1	2507595	0/1	Spacer with normal bearings
11	*	1	Gear
10	*	1	Pinion shaft
9	*	1	Bevel gear set
8	*	1	Gear
7	*	1	Pinion
6.5	2507528	0/1	Hollow shaft for SSV
6.4	2507510	0/1	Hollow shaft with keyway
6.3	2507501	0/1	Solid output shaft, both sides
6.2	2519739	0/1	Solid output shaft H
6.1	2507498	0/1	Solid output shaft V
5.2	2507285	0/1	Flange Ø 350
5.1	2503867	0/1	Flange Ø 300
4	2503891	0/1	Torque restraining arm
3	2508745	0/1	Foot plate
2	2507536	1	System cover
1	*	1	Attachment housing

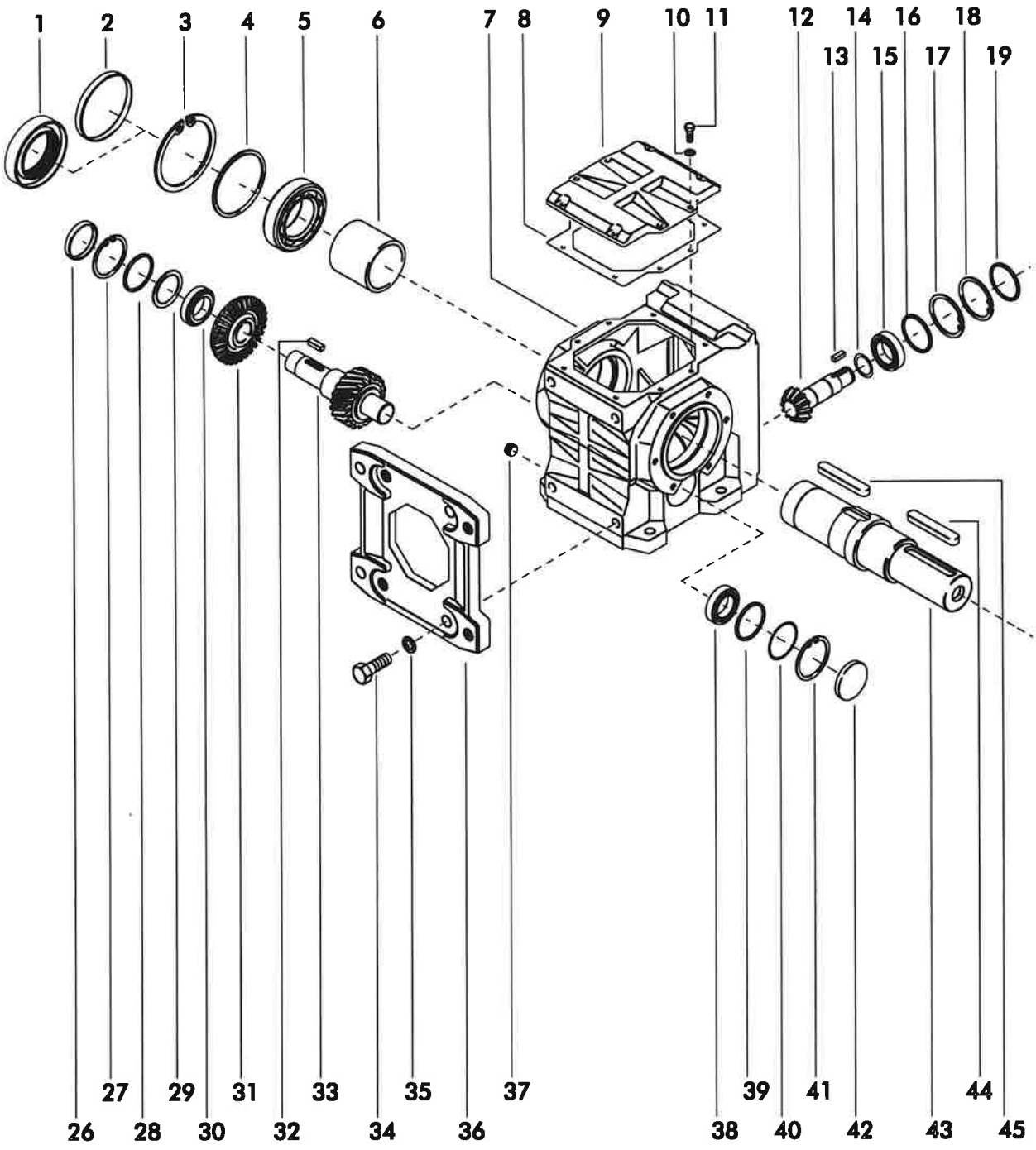
* ATTENTION
Please clearly state serial number when ordering these spare parts.

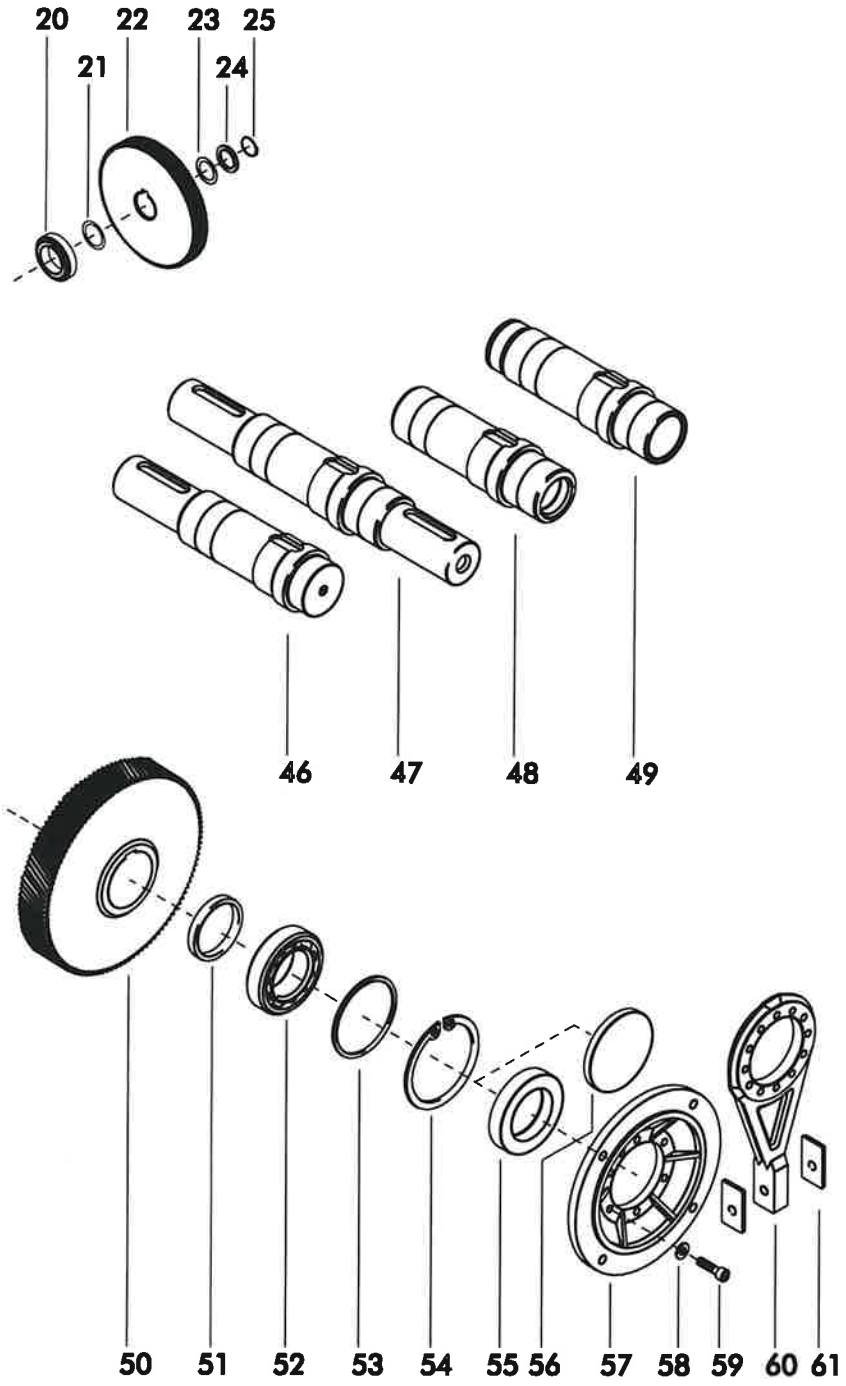
5 BK series bevel geared motors

5.1 Section through a BAUER bevel geared motor



5.2.2 Explosion diagram of 3-stage bevel gears BK60

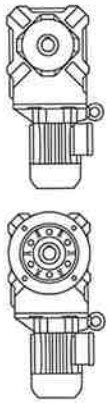




Part	Designation
1	Shaft seal
2	Sealing cover
3	Retainer ring
4	Support washer
5	Roller bearing
6	Spacer
7	Attachment housing
8	Liquid seal
9	System cover
10	Spring washer
11	Hexagon bolt
12	Conical pinion
13	Key
14	Tuning package
15	Roller bearing
16	Support washer
17	Retainer ring
18	Retainer ring
19	Support washer
20	Roller bearing
21	Tuning package
22	Gear
23	Tuning package
24	Tuning package
25	Retainer ring
26	Sealing cover
27	Retainer ring
28	Tuning package
29	Support washer
30	Roller bearing
31	Bevel gear
32	Key
33	Pinion shaft
34	Hexagon bolt
35	Spring washer
36	Foot plate
37	Cover screw
38	Roller bearing
39	Support washer
40	Tuning package
41	Retainer ring
42	Sealing cover
43	Solid output shaft V
44	Key
45	Key
46	Solid output shaft H
47	Solid output shaft, both sides
48	Hollow shaft with keyway
49	Hollow shaft for shrink disk
50	Gear
51	Spacer
52	Roller bearing
53	Support washer
54	Retainer ring
55	Shaft seal
56	Sealing cover
57	Flange
58	Spring washer
59	Allen screw
60	Torque restraining arm
61	Rubber puffer

Standard fitting position for bevel geared motors

The following standard fitting positions are defined for BAUER bevel geared motors.



H3

Standard lubricant quantities for bevel gears

Lubricant quantity in l or kg

Gear type	H1	H2	H3	H4	V1	V2
BK10	0.83	0.83	0.92	1.65	0.92	0.92
BK20	1.5	1.5	1.6	2.8	1.65	1.65
BK30	2.2	2.2	2.3	4.2	2.4	2.4
BK40	3.5	3.5	3.5	6.7	3.7	3.7
BK50	5.8	5.8	5.8	11.0	6.0	6.0
BK60	6.0	8.7	6.9	11.7	8.6	8.6
BK70	10.2	15.0	11.5	21.2	13.5	14.5
BK80	18.0	25.5	19.0	37.0	23.5	25.5
BK90	33.0	48.0	36.0	70.7	45.0	48.0

Lubricant quantities and lubricant types should be compared with the rating plate.

5.5 Removing and fitting bevel gears

5.5.1 Dismantling the gear stage

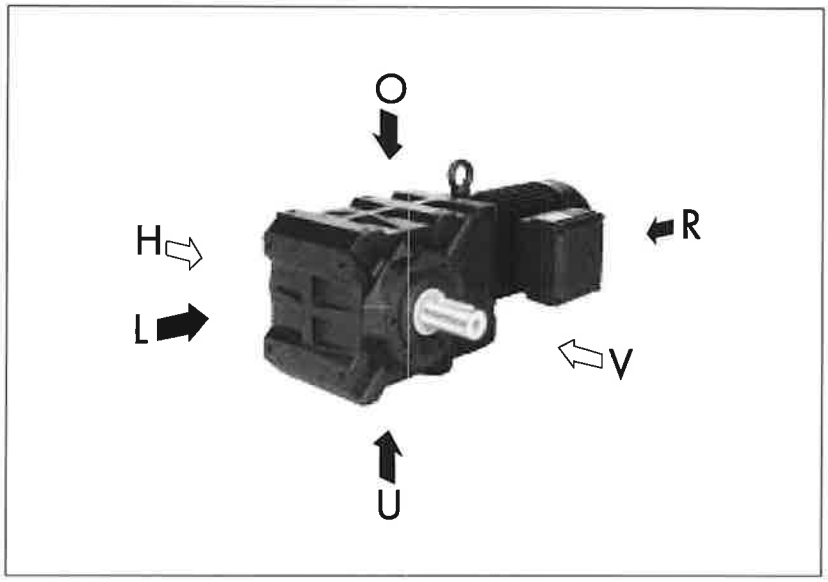
Remove wheel 2 after draining the lubricant and removing the motor stage. Then remove the radial shaft seal and the sealing cap on the output shaft, the circlips and supporting ring with matching packet.

To press out the output shaft move it together with the bevel wheel in the direction of gear side V until they touch a stop that can be felt. The bevel gear stage teeth are then disengaged.

In this position support the bevel gear with appropriately prepared elements against the gear housing so that no harmful pressure can act on the bevel pinion when pressing out the output shaft.

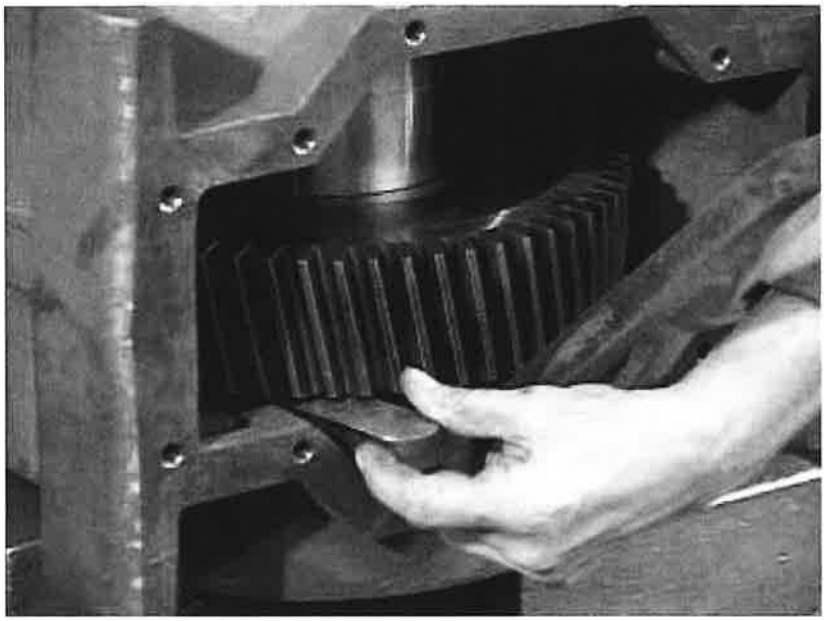
Press out the output shaft in the direction of gear side H.

Then remove the bevel pinion shaft together with bearing.



Note:
The bevel gears are 3-stage from size BK60.

Before removing the bevel gear stage dismantle the output shaft. To do this, support the end wheel using suitable stops against the gear housing. Then press out the output shaft in the direction of gear side V.



To remove the bevel gear remove the sealing caps, circlips and support disks. Now move the pinion shaft together with bevel wheel in the direction of gear side H as far as the stop so that the teeth are disengaged. After removing the feather key from wheel 2, carefully push the bevel pinion into the gear as far as it will go. After pulling the pinion shaft back remove the outer bearing and the circlips for both pinion shaft bearings. then pull the pinion shaft out together with the inner bearing.

Now push pinion shaft 2 with bevel wheel back again and tilt the complete pinion shaft out of the bearing and remove it through the assembly opening.

5.5.2 Fitting the gear stage

It is important for the gear stage to be fitted so that it can function correctly, which involves trouble-free running of the bevel gear stage (tooth edge play, appearance of the bearing surface after bedding in) in particular. This is only guaranteed once the bevel gear stage has been matched precisely in relation to its position in the gear housing with the aid of adjusting washers.

If the position of the bevel gear or of the bevel pinion in the gear alters due to new components (see matching diagram), then re-matching and therefore a fresh definition of the actual dimensions for the matching packets is required.

These can be calculated with the aid of equations in accordance with matching plan BK-AR1 for BK10 to BK50 and BK-AR2 for BK60 to BK90. The nominal dimensional variations required for the calculation are shown in the measuring points listed in the matching plan.

Note:
The bevel gear stage must be replaced as a unit due to paired wheel sets.

The pinions can be fitted more easily if they are heated and cooled alternately.

Now fit the bevel pinion again as the first step in accordance with the corresponding matching plan. To do this, pre-assemble the inner bearing without the outer bearing ring but together with the computed matching packet on the pinion shaft.

Important: The matching packet must be pressed in between the pinion shaft shoulder the inner bearing ring so that there is no play

Now place the outer ring for bearing 1 in the housing as well as the supporting rings and the circlips.

Fit the outer bearing ring for bearing 2 and insert the pre-assembled pinion shaft into the bearing from the inside, then push on the heated inner ring for bearing L2 (approx. 150°C) so that there is no play.

By rotating the pinion shaft several times make sure that the rollers abut the bevel roller bearings to achieve play-free running of the pinion shaft.

Fit the bevel gear in accordance with the matching plan. Again, make sure that there is no play after fitting as described for the bevel pinion.

Important: The torsional backlash must be between 0.05 mm and 0.25 mm as a minimum.

Now fit the output shaft in the case of the 3-stage gear sizes.

Fit the output shaft bearing with supporting ring and circlip on gear side H and then inert spacer sleeve and heated end wheel and fit the output shaft. It is advisable to heat the inner ring for the fitted bearing beforehand.

Finally, fit the front bearing with supporting ring and circlip.

If the output shaft bearing is reinforced adjust the bevel roller bearings with the matching packets so that there is no play.

Note:

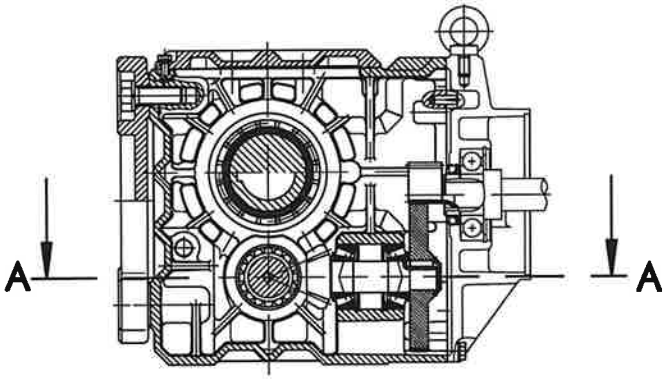
Coat the shaft sealing rings and sealing caps on the outer jacket with a slip additive to make fitting easier.

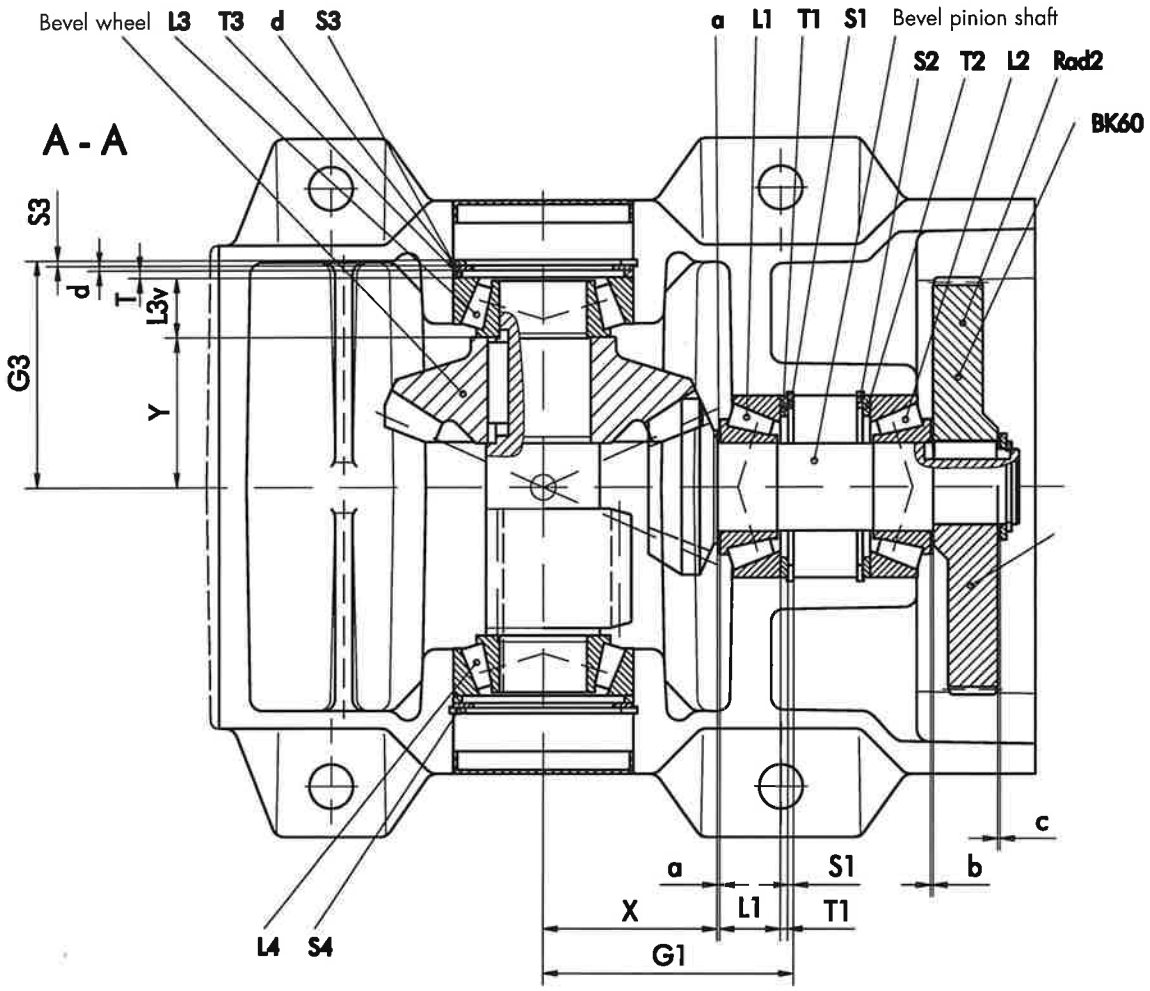
In the case of a double shaft seal both sealing rings should be fitted together in one unit. Grease the sealing lips before fitting.

It is advisable to heat wheel 2 to about 160°C to make fitting easier.

As a matter of principle: Cool the output shaft and pinion shaft to make fitting easier.

5.5.4 Matching and fitting three-stage bevel gears BK60





Measure points:

G1 measured at housing

G3 measured at housing

L1 measured at bearing

L3v measured at bearing

S1 Nominal thickness circlip

S3 Nominal thickness circlip

T1 measured at supporting ring

T3 measured at supporting ring

X nominal dimension ± inscribed deviation at bevel pinion shaft

Y nominal dimension ± inscribed deviation at bevel wheel

Assembly instructions for bevel pinion:

1.) Fit circlip S1, supporting ring T1 and outer ring bearing L1 in the housing.

2.) Coord. dimension a = G1 – (X + L1 + T1 + S1)

3.) Draw matching packet a and inner ring baering L1 onto bevel pinion shaft; fit in housing.

4.) Fir circlip S2, supporting ring T2 and bearing L2 so that there is no play.

5.) Select thickness of matching packet so that enclosure is flush with shaft shoulder.

6.) Insert key. draw wheel 2 up as far as top on shaft shoulder and matching packet b.

7.) Fill space between wheel 2 and circlip with matching washers and supporting ring.

Attention: Fit supporting ring against circlip!

Nominal Dimensions

BK	60	70	80	90
G1	100.1	126.1	156.35	191.35
G3	90.75	103.25	127	150
L1	24.25	24.75	35	41
L3v	24.25	27.25	35	41
S1	2.2	2.7	2.7	3.7
S3	2.2	2.7	2.7	3.7
T1	3	3.5	3.5	3.5
T3	3	3.5	3.5	3.5
X	69.5	94	114	142
Y	59.5	68	84	100
a		1.15		
b	1.5	1.5	1.5	1.5
c	1	1	1.2	1.2
d		1.8		

Assembly instructions for bevel wheel:

8.) Shaft sealing ring(s), circlip S3, matching packet d, supporting ring T3 and bearing L3 in this sequence fit in.

Attention: The 1mm thick matching washer must fit against the circlip!

Coord. dimension:
Matching dimension d = G3 – (Y + L3v + T3 + S3)

9.) Insert bevel wheel in housing and place on fitted parts.

10.) Fit pinion shaft (R5) and bearing L4 so that there is no play.

11.) Fill space between bearing L4 and circlip S4 with matching washer and supporting ring.

Attention: Fit supporting ring against bearing L4!
1mm thick matching washer must fit against circlip!

5.6 Assembly advice for shaft-mounted execution with hollow shaft and keyway

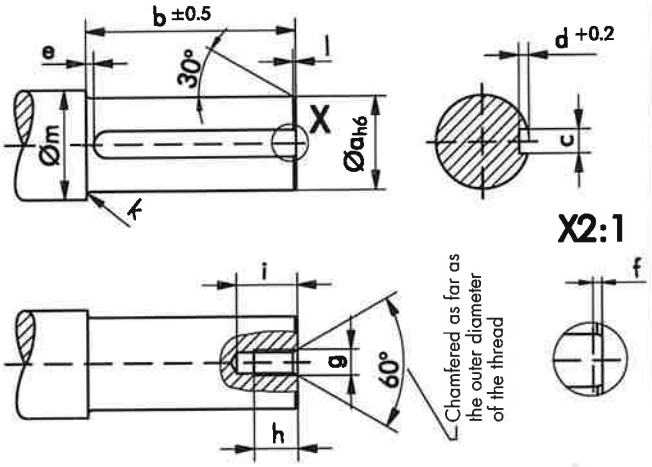
Assembly: Screw the threaded bolt into the face thread of the shaft to be driven. Press the shaft-mounted gear onto the shaft with the aid of the nut via the thrust piece and the circlip.

Retaining: Rotate the thrust piece and draw it with the fixing screw against the circlip.

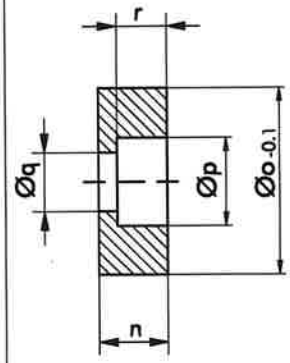
Dismantling: Place the thrust piece between shaft face and circlip. The press-off screw presses against the shaft face and draws off the shaft-mounted gear.

The parts are not supplied.

Item 1 Shaft journal

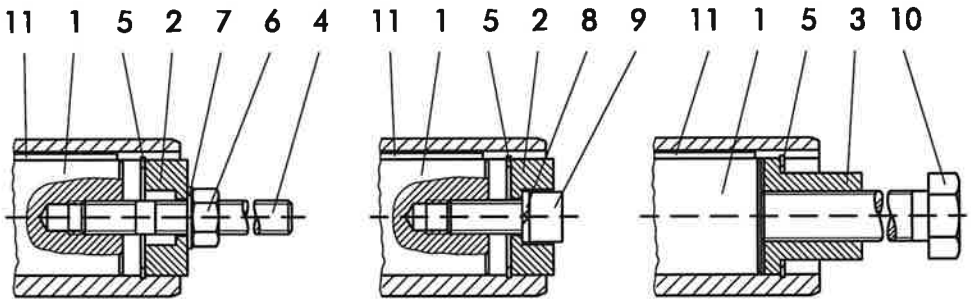


Item 2 Washer



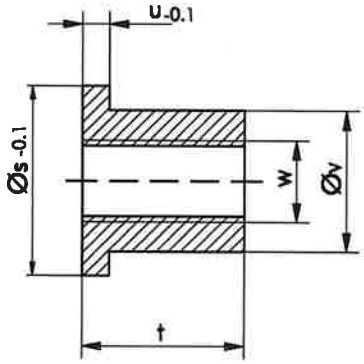
x Edges broken
Material: C45 DIN17200

Type	Dimensions																
	Item 1 Shaft journal												Item 2 Washer				
	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r
BK10	25	148	8	4	5	2	M8	18	24	2,5	1,5	33	13,5	24,8	15	9	8,5
BK20	30	170	8	4	5	2	M10	20	26	3	1,5	38	15	29,8	18	11	10
BK30	35	201	10	5	5	2	M10	20	26	3	1,5	43	16	34,8	18	11	10
BK40	40	235	12	5	5	2	M12	22	29	3	2	48	18	39,8	20	13,5	12
BK50	50	254	14	5,5	6	3	M16	30	37	3,5	2	58	21	49,8	26	17,5	15
BK60	60	273	18	7	6	3	M20	38	46	3,5	2	68	24	59,8	33	22	18
BK70	80	316	22	9	8	4	M20	38	46	4	2	90	27	79,8	33	22	20
BK80	100	360	28	10	8	5	M24	45	54	4	3	110	32	99,8	40	26	25
BK90	120	432	32	11	8	6	M24	45	54	4,5	3	130	35	119,8	40	26	28

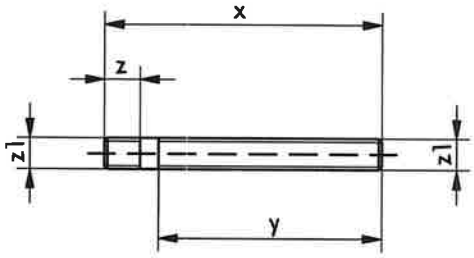


Assembly Holding Dismantling

Item 3 Sleeve



Item 4 Threaded bolt



Material: steel, tensile strength ≥ 1000 N/mm²
Thread rolled

x
Edges broken
Material: C45 DIN17200

Type	Dimensions									Circlip DIN 472	Nut DIN 934-8	Washer DIN 125-St	Spring washer DIN 7980	Cylinder screw DIN 912-8.8	Hexagon screw DIN 933-8.8	Key DIN 6885 Width x Hight x length
	Item 3, Sleeve					Item 4, Threaded bolt										
	s	t	u	v	w	x	y	z	z1	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11
BK10	24,8	24	5	16	M12	200	170	20	M8	25x1,2	M8	8,4	8	M8x30	M12x190	AB 8x7x141
BK20	29,8	28	5	20	M14	230	195	23	M10	30x1,2	M10	10,5	10	M10x30	M14x210	AB 8x7x163
BK30	34,8	28	5	23	M14	260	220	23	M10	35x1,5	M10	10,5	10	M10x35	M14x240	AB 10x8x194
BK40	39,8	40	6	31	M20	300	260	28	M12	40x1,75	M12	13	12	M12x35	M20x290	AB 12x8x228
BK50	49,8	48	6	36	M24	340	290	37	M16	50x2,0	M16	17	16	M16x40	M24x320	AB 14x9x245
BK60	59,8	60	6	44	M30	370	310	45	M20	60x2,0	M20	21	20	M20x50	M30x350	AB 18x11x264
BK70	79,8	60	8	55	M30	420	360	45	M20	80x2,5	M20	21	20	M20x50	M30x400	AB 22x14x304
BK80	99,8	72	10	75	M36	480	410	55	M24	100x3,0	M24	25	24	M24x60	M36x450	AB 28x16x347
BK90	119,8	72	10	80	M36	560	480	55	M24	120x4,0	M24	25	24	M24x60	M36x520	AB 32x18x418

ADDITIONAL GEARBOX LUBRICATION INFORMATION

TYPE: DANFOSS-BAUER BK60

Maintenance and Service Procedures for Danfoss-Bauer NEMA C-Face Gear Motors

A. Gearbox Lubrication

All Danfoss Bauer gearmotors come shipped from the factory with the correct type and quantity of lubricant installed. The lubricant recommended service interval is 2 years or 15,000 hours, which ever occurs first. The lubricant change procedure is very simple usually taking no more than 10 minutes. Lubricant types can be found on the motor tag and attached documentation. Lubricant change procedures are as follows:

1. Locate the lowest plug on the gearbox, this will be your drain plug.
2. Place a drain pan under the drain plug and remove the drain plug with a metric allen key of the correct size to speed draining remove the uppermost plug on the gearbox.
3. Reinstall the drain plug
4. Locate the recommended oil type and quantity in nametag or motor data sheet.
5. Install the recommended quantity and type of oil. Reinstall the uppermost plug.

Caution As the number one oil related problem of Danfoss Bauer Gearmotors is overfilling, it is recommended that the only time the oil plugs be touched is when the oil is changed.

1. Many people ask why there is no sight glass, dipstick, or level plugs on Danfoss Bauer Gearboxes, the reason for this is simple, they are not needed:
2. Danfoss Bauer gearmotors are designed to be mounted in many different positions. As such there would need to be many different level devices on each gearbox. This would increase the cost, the chance for leaks and the chance for overfilling due to confusion.
3. It is much easier to visually inspect the gearmotor for signs of leaks than to check an oil level device. Gearmotors do not consume oil, so unless there is a leak the oil level will remain constant.
4. Because gear motors are stationary devices, any substantial leakage will be detected long before there could be an oil related failure.

F. BK Series Gearbox Rebuild

The rebuild procedures are fairly simple and usually take less then 3 hours. The procedure begins after the coupling housing is removed from the gearbox housing. The procedure is as follows:

1. Drain gearbox lubricant See A. above.
2. Remove bolts from gearbox to coupling housing flange.
3. Using a sharp chisel split the clutch housing to gearbox connection.
4. Remove the clutch housing from the gearbox.
5. Remove the shrink disk from the output shaft.
6. Remove the retaining ring from the top of the secondary gear shaft.
7. Using a 2 jaw gear puller remove primary driven gear from secondary pinion.
8. Remove shaft seals from both sides of the output shaft.
9. Remove retaining rings and support spacers and shim washers from both sides of the gearbox be sure to mark them so as to be sure to reinstall them in the correct positions later..
10. Using a soft mallet tap the output shaft toward the output side of the gearbox this will remove any loading from the bevel pinion during disassembly.
11. Support bevel output gear with key stock cut to length, heat output gear and press output shaft out of the gearbox from opposite the shrink disk side.
12. Remove output bevel gear from the gearbox housing

13. Drive the intermediate bevel pinion toward the inside of the gearbox to disengage it from the tapered roller bearing.
14. Remove the output, bearings from the gearbox.
15. Remove intermediate gear, bearings, spacers and shim washers from the gearbox journal be sure to mark all shims to ensure proper positioning during reassembly.
16. Inspect all parts to be reused for excessive wear. The bearings and output seals must be replaced during a rebuild.
17. Heat the output gear to 150 C and freeze output shaft and intermediate bevel pinion to facilitate assembly.
18. Install retaining rings, spacers and bearings into the intermediate journal making sure that the parts are installed in the correct positions.
19. Drive bevel pinion into intermediate bearings, install spacers and key.
20. Heat primary driven gear to 100 deg. C and install on secondary pinion gear while supporting the pinion. It is very important that when completed the intermediate gears will spin freely with no more than .3 mm of axial play.
21. Install retaining ring to secure primary driven gear.
22. Insert front output bearing, spacers and retaining ring into the gearbox journal.
23. Insert and align output gear into gearbox.
24. Press output shaft from shrink disk side into bearing & gear until shaft seats in gear.
25. Allow assembly to cool.
26. Install shrink disk side bearing spacers and retaining ring into the gearbox journal.
27. Pack the seal lips with grease and Coat the exterior of the output seals with sealant and press them into the gearbox assembly.
28. To retain enclosure integrity, sealant must be used on the mating surfaces. We recommend using Loctite® 515 or equivalent.

Lubricant grades

Gear oils CLP 220 to DIN 51502 or DIN 51517 or in special cases particularly soft and long-fibre greases GLP 00f with good EP characteristics are suitable for lubricating the gear unit. The lubricant should be suitable for low-friction and almost wear-free continuous operation. The damage stage in the FZG test to DIN 51354 should be above stage
12 and specific wear should be below 0.27 mg/kWh. The lubricant must not foam, should offer protection against corrosion and should not attack the internal paintwork, the roller bearings and gearwheels or
the gasket.

Different grades of lubricant should not be mixed as this would impair the lubricating properties. A long operating period can only be ensured by using the lubricants listed below or proven equivalent lubricants. The original lubricant can also be supplied from the works in small packs of 5 and 10 kg (11 and 22 lbs) respectively.

Please refer to MB 89.. (available upon request) in case the geared motors shall be encased prior to usage for a longer period of time.

Wear-protecting EP gear oils in accordance with the following table have proved to be particularly successful:

Producer	Gear units type series **BG, BF, BK60 – BK90** Mineral oil CLP 220
BP	Energol GR-XP 220
CASTROL	Alpha SP 220 or Hypoy EP 90
ELF	Reductelf SP 220
ESSO	Spartan EP 220 or GP 90
FINA	Giran 220
FUCHS	Renolin CLPF 220 Super or Renolin CLP 220
KLÜBER	Klüberoil GEM 1-220
MOBIL	Mobilgear 630
SHELL	Omala Oil 220
TOTAL	Carter EP 220

Attention:

Synthetic gearbox oils with Polygycol basis (e.g. PGLP...) must be kept separate from mineral oils and disposed of as Special Waste.

Unless the ambient temperature is below approximately –10° C (14° F) the viscosity grade VG 220 (SAE 90) and AGMA 5 EP in North America to international viscosity classification at 40° C (100° F) ISO 3448 and DIN 51519 is recommended.

For lower ambient temperatures oils of lower viscosity grade and correspondingly improved starting characteristics should be used, for example ISO VG 46 (SAE 75). These grades may in fact even be necessary in the temperature range around freezing point if the initial break-away torque of a drive is reduced to give a smooth start or if the motor has a comparatively low output. For ambient temperatures ranging continuously above +30° C (86° F) oils of ISO VG 680 (SAE 140) or AGMA 8 EP should be used.

Lubricant quantities

The optimum amount of lubricant for the specified design/mounting position is stated on the motor rating plate (symbol). It should be noted that, depending on the gearbox layout, the gearwheels and roller bearings at the top must also be reliably lubricated. In special cases the oil level gauge should be observed. For other layouts enquiries can be made in the works about the required amount of lubricant.

Lubricating the roller bearings

The maintenance intervals for roller bearings vary according to the operational speed, ambient temperature, load etc.

The roller bearings fitted in the gear unit are charged at the works with roller bearing grease and during operation they are lubricated by the gearbox lubricant.

Roller bearings in the gear unit which have been thoroughly cleaned or replaced during overhauls must be lubricated with an ageing-resistant, anti-corrosion lithium roller bearing grease of high working stability and of consistency No. 2 or No. 3.

Approximately half the free space between the rolling members should be filled with grease. Excess greasing increases the bearing temperature and should therefore be avoided.

9.1.6.7 AGMA Classification

Service factors and AGMA classes are comparable in the following way:

AGMA class	I	II	III
required Service Factor	1.0	1.4	2.0

9.1.6.8 Guide for the classification of typical gear motor applications

AGMA Classes and service factors by application

Application	Hrs. per day	
	3-10	24
PRINTING PRESSES	I	II
PULLERS		
Barge Haul	II	III
PUMPS		
Centrifugal	I	II
Proportioning	II	II
Single Acting 3 or more Cylinders	II	II
Double Acting 2 or more Cylinders	II	II
Single Acting 1 or 2 Cylinders*		
Double Acting Single - Cylinder		
Rotary - Gear Type	I	II
Lobe, vane	I	II
RUBBER INDUSTRY		
Mixer	III	III
Rubber Calender	II	II
Rubber Mill (2 or more)	II	II
Sheeter	II	II
Tire Building Machines	II*	II
Tire Tube Press Openers	I	I
Tubers and Strainers	II	II
SEWAGE DISPOSAL EQUIPMENT		
Bar Gereens	II	
Chemical Feeders	I	II
Collectors Circuline or Straightline	I	II
Dewatering Screens	II	II
Grit Collectors	I	II
Scrum Breakers	II	II
Slow or Rapid Mixers	II	II
Sludge Collectors	I	II
Thickeners	II	II
Vacuum Filters	II	II

MOTOR APPENDIX INFORMATION

TYPE: BALDOR 3.0 HP

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Product Information Packet

IDXM7542T

3HP,1755RPM,3PH,60HZ,182TC,0632M,XPFC,F1

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Part Detail							
Revision:	J	**Status:**	PRD/A	**Change #:**		**Proprietary:**	No
Type:	AC	**Prod. Type:**	0632M	**Elec. Spec:**	06WGX181	**CD Diagram:**	CD0005
Enclosure:	XPFC	**Mfg Plant:**		**Mech. Spec:**	06J010	**Layout:**	06LYJ010
Frame:	182TC	**Mounting:**	F1	**Poles:**	04	**Created Date:**	12-21-2011
Base:	RG	**Rotation:**	R	**Insulation:**	H	**Eff. Date:**	12-23-2015
Leads:	9#16					**Replaced By:**	
Literature:		**Elec. Diagram:**					

Nameplate NP0890XPSLEV							
NO.		CC	010A				
S/N		TEMP CODE	T2B				
SPEC.	06J010X181G2	INV.TYPE	PWM				
CAT.NO.	IDXM7542T	C HP FR	60	C HP TO	90		
HP	3	CT HZ FROM	6	CT HZ TO	60		
VOLTS	230/460	VT HZ FROM	6	VT HZ TO	60		
AMPS	8.2/4.1	MAG CUR	4.2/2.1				
RPM	1755	MX RPM	2700				
HZ	60	PH	3	CL	F	NOM.EFF.	89.5
SER.F.	1.00	DES	B	SL HZ	1.5	WK2	0.3
FRAME	182TC	RATING	40C AMB-CONT				
	75C RISE						

Parts List		
Part Number	**Description**	**Quantity**
SA236472	SA 06J010X181G2	1.000 EA
RA223419	RA 06J010X181G2	1.000 EA
36FN3000C01SP	EXFN, PLASTIC, 5.25 OD, .912 ID	1.000 EA
HW3201A05	3/8-16 EYEBOLT	1.000 EA
07CB1000A02	CONDUIT BOX, MODEL 306,EXP. PROOF	1.000 EA
10XN2520A12	O1/4-20X 3/4 HEX HEAD CAP	4.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	4.000 EA
WD1000B17	T&B CX35TN TERMINAL	1.000 EA
11XW1032G06	10-32 X .38, TAPTITE II, HEX WSHR SLTD U	1.000 EA
HW4500A19	1/4-28X1/4 SLOTTED PLUG F/S	2.000 EA
06EP1706A01	SPECIAL FRONT ENDPLATE X06M - TEFC	1.000 EA
10XN3118K20	5/16-18 X 1 1/4 GRADE 5 STEEL ZC PLATED	4.000 EA
HW1001A31	LOCKWASHER 5/16, ZINC PLT.591 OD, .319 I	4.000 EA
HW5100A05	WVY WSHR F/205 & 304 BRGS	1.000 EA
06EP1707A01	STD XP PU EP 182-4TC 206 BRG 306M	1.000 EA
51XN1032A20	10-32 X 1 1/4 HX WS SL SR	2.000 EA
HW4001A01	1/4 HX SOC PIPE PLG (F/S) ALLOY STEEL W/	2.000 EA
60XN1032A07	10-32 X 1/2 TRUSS HEAD, TORX SERRATED ZN	2.000 EA
10XN3118K20	5/16-18 X 1 1/4 GRADE 5 STEEL ZC PLATED	4.000 EA
HW1001A31	LOCKWASHER 5/16, ZINC PLT.591 OD, .319 I	4.000 EA
06FH1003A01	FAN COVER, CAST X-PROOF--MACHINING	1.000 EA
51XN1032A14	10-32 X 0.875 HX WS SL SR	4.000 EA
07CB1500A01	CONDUIT BOX LID MACH	1.000 EA
10XN2520A16	1/4-20 X 1 HEX HEAD CAP SCR, ZINC PLATED	4.000 EA

Parts List (continued)

Part Number	Description	Quantity
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	4.000 EA
HW2501E16	3KEY, 1/4 SQ X 1.750	1.000 EA
HA7000A02	KEY RETAINER RING, 1 1/8 DIA, 1 3/8 DIA	1.000 EA
LB1081F	ALUM XP CAUTION LABEL (FS PLANT ONLY-	1.000 EA
LB1115N	LABEL,LIFTING DEVICE (ON ROLLS)	1.000 EA
85XU0407S04	4X1/4 U DRIVE PIN STAINLESS	6.000 EA
MJ1000A02	GREASE, POLYREX EM EXXON (USe 4824-15A)	0.050 LB
51XB1214A16	12-14X1.00 HXWSSLD SERTYB	1.000 EA
MG1025G29	DK CHARCOAL 789.229 - 4824-3CEH	0.028 GA
LB1119N	WARNING LABEL	1.000 EA
LC0145B01	CONNECTION LABEL	1.000 EA
NP0890XPSLEV	SS XP INV UL CSA-EEV CC CL-I GP-D	1.000 EA
G0PA1000	PKG GRP, PRINT PK1026A06	1.000 EA
MN416A01	TAG-INSTAL-MAINT no wire (1400/bx) 11/14	1.000 EA

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AC Induction Motor Performance Data

Record # 36483

Typical performance - not guaranteed values

Winding: 06WGX181	**Type:** 0632M	**Enclosure:** TEBC

Nameplate Data				General Characteristics at 460 V, 60 Hz: High Volt Connection	
Rated Output (HP)	3			Full Load Torque	9.06 LB-FT
Volts	230/460			Start Configuration	DOL
Full Load Amps	8.2/4.1			Break Down Torque	33.1 LB-FT
R.P.M.	1755			Pull-Up Torque	18.2 LB-FT
Hz	60	Phase	3	Locked-rotor Torque	20.4 LB-FT
NEMA Design Code	B	KVA Code	J	Starting Current	29.8 Amps
Service Factor	1			No-load Current	2.14 Amps
NEMA Nom. Eff.	89.5	P.F.	77	Line-line Res. @ 25°C.	3.94 Ohms
Rating - Duty	40C AMB-CONT			Temp. Rise @ Rated Load	35°C
S.F. Amps				Temp. Rise @ S.F. Load	

Load Characteristics at 460 Volts, 60 Hz, 3 HP

% of Rated Load	25	50	75	100	125	150	S.F.
Power Factor	38	58	70	77	81	83	
Efficiency	83.2	88.3	89.8	89.7	89.1	87.7	
Speed	1790	1779	1769	1757	1744	1730	
Line Amperes	2.34	2.79	3.39	4.1	4.91	5.86	

Baldor Electric Company **Fort Smith, Arkansas** BALDOR • RELIANCE

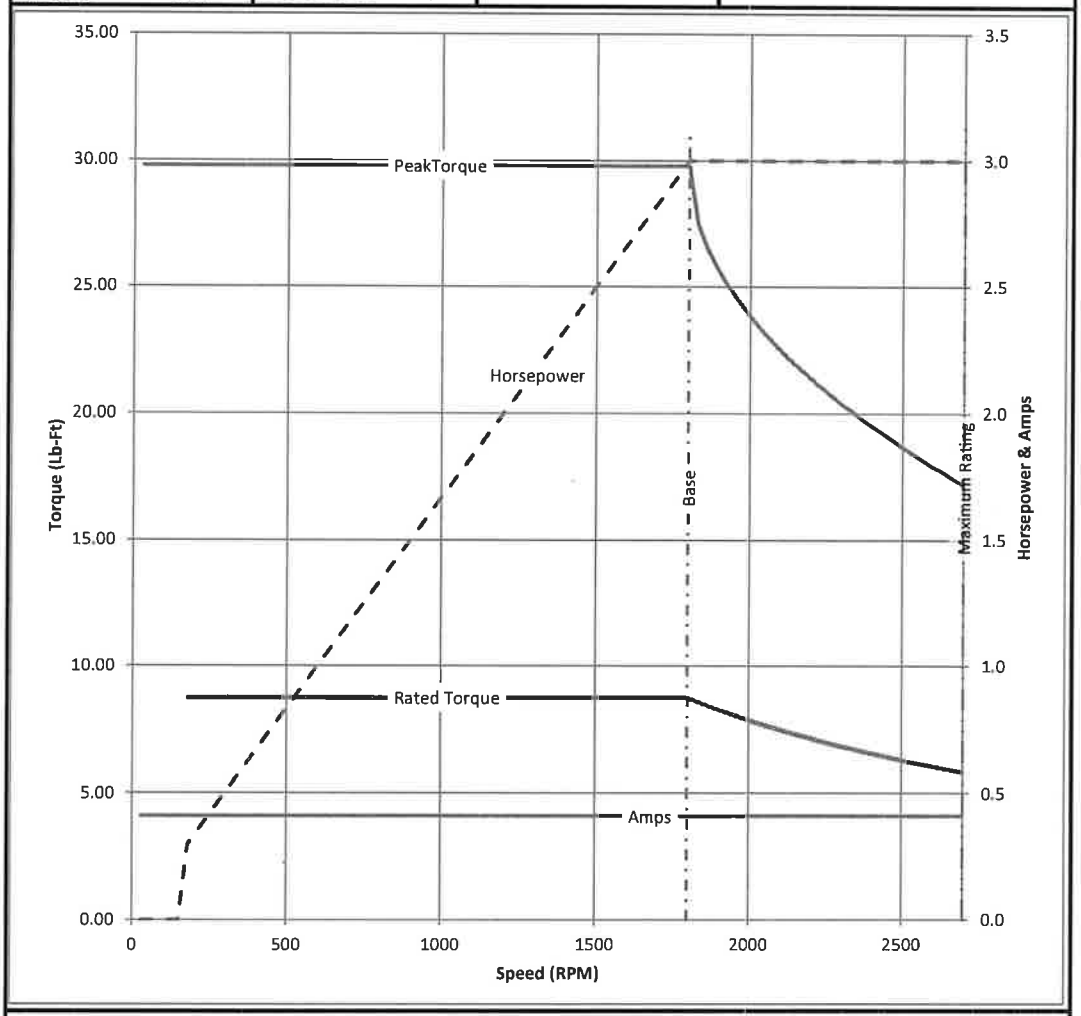
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BALDOR • RELIANCE Product Information Packet: IDXM7542T - 3HP,1755RPM,3PH,60HZ,182TC,0632M,XPFC,F1

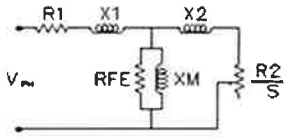
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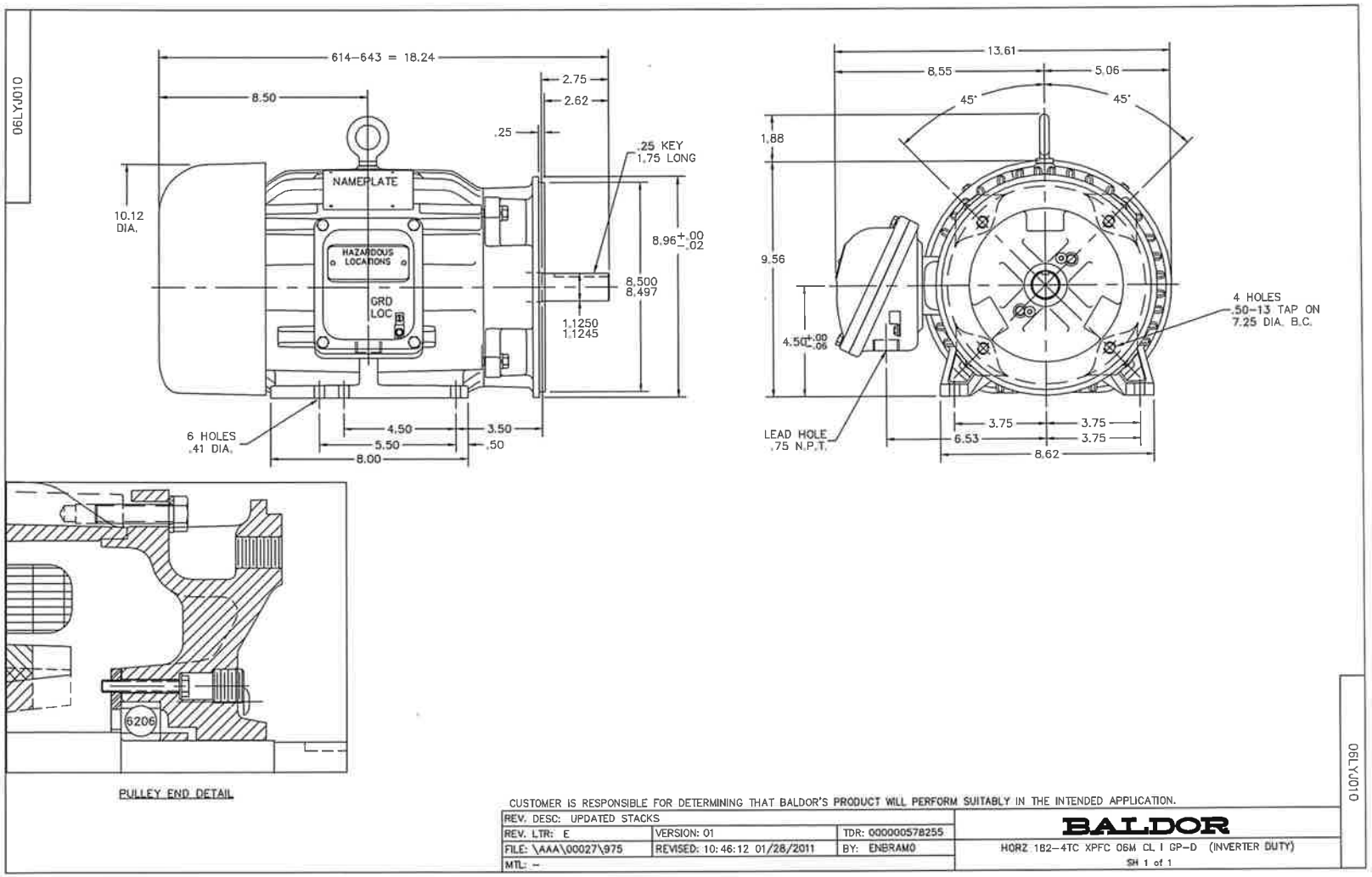
Catalog	IDXM7542T	NP VOLTS	230/460	ENCLOSURE	XPFC	WYE CONN EQ CKT OHMS PER PHASE (BASE RATING, 20C)		
FRAME	182TC	NP AMPS	8.2/4.1	Base Volts	460	R1	1.930	X1	5.490
HP	3 HP	DUTY	Cont	Base AMPS	4.1	R2	1.370	X2	4.581
BASE SPEED	1800	MAX SAFE RPM	2700	Slip Hz	1.43			XM	119.333
PHASE/HZ	3/60	AMB°C/INSUL	40/F	WK² (lb-ft²)	0.298				



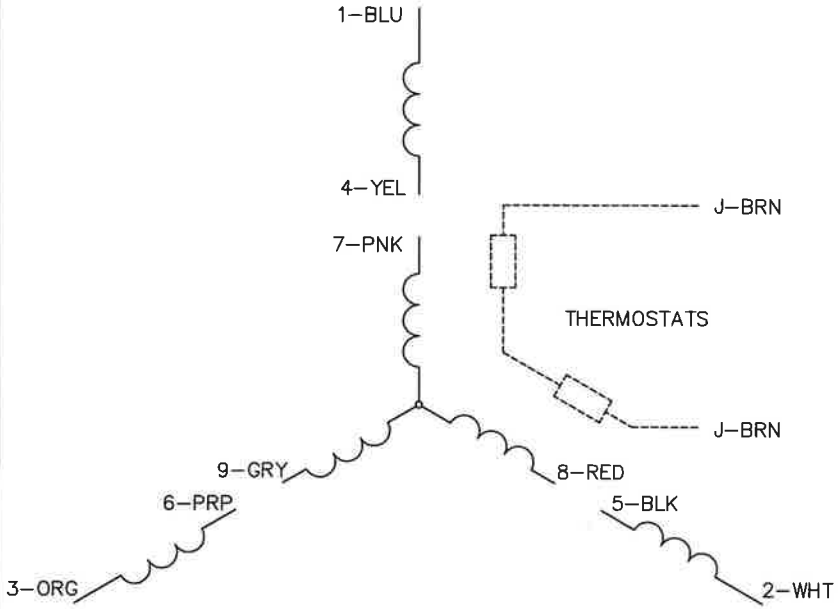
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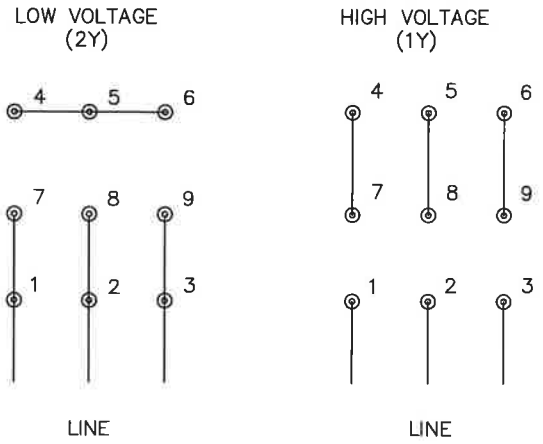


BALDOR A MEMBER OF THE ABB GROUP	DR BY ENR CK BY APP BY ENR DATE 2/27/2013	A-C MOTOR PERFORMANCE CURVES	06J010X181G2 ISSUE DATE 2/27/2013


06LYJ010
614-643 = 18.24
8.50
2.75
2.62
.25
.25 KEY
1.75 LONG
NAMEPLATE
10.12
DIA.
HAZARDOUS
LOCATIONS
GRD
LOC
8.96 +.00 -.02
8.500
8.497
1.1250
1.1245
6 HOLES
.41 DIA.
4.50
3.50
5.50
.50
8.00
13.61
8.55
5.06
45°
45°
1.88
9.56
4.50 +.00 -.06
4 HOLES
.50-13 TAP ON
7.25 DIA. B.C.
LEAD HOLE
.75 N.P.T.
3.75
3.75
6.53
3.75
8.62
6206
PULLEY END DETAIL
CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT BALDOR'S PRODUCT WILL PERFORM SUITABLY IN THE INTENDED APPLICATION.
REV. DESC: UPDATED STACKS
REV. LTR: E
VERSION: 01
TDR: 000000578255
FILE: \AAA\00027\975
REVISED: 10:46:12 01/28/2011
BY: ENBRAMO
MTL: --
BALDOR
HORZ 182-4TC XPFC 06M CL I GP-D (INVERTER DUTY)
SH 1 of 1
06LYJ010

CD0005





NOTES:

1. INTERCHANGE ANY TWO LINE LEADS TO REVERSE ROTATION.
2. THERMOSTATS ARE PROVIDED
3. ACTUAL NUMBER OF INTERNAL PARALLEL CIRCUITS MAY BE A MULTIPLE OF THOSE SHOWN ABOVE.
4. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

CD0005

REV. DESC: REVISE TO SHOW OPTIONAL COLORS			BALDOR ELECTRIC Co.
REV. LTR: E	BY: JLP	REVISED: 01/19/99 10:15	TDR: 0171435
CD0005		FILE: AAA00005140	MDL: –
		MTL: –	3PH, DV, 9 LEADS

BALDOR A MEMBER OF THE ABB GROUP

BALDOR • RELIANCE

Explosion Proof

Installation & Operating Manual

8/12

MN408

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Section 1
General Information

Overview This manual contains general procedures that apply to Baldor Motor products. Be sure to read and understand the Safety Notice statements in this manual. For your protection, do not install, operate or attempt to perform maintenance procedures until you understand the **Warning and Caution** statements.
A **Warning** statement indicates a possible unsafe condition that can cause harm to personnel.
A **Caution** statement indicates a condition that can cause damage to equipment.

Important: **This instruction manual is not intended to include a comprehensive listing of all details for all procedures required for installation, operation and maintenance. This manual describes general guidelines that apply to most of the motor products shipped by Baldor. If you have a question about a procedure or are uncertain about any detail, Do Not Proceed. Please contact your Baldor distributor for more information or clarification.**

Before you install, operate or perform maintenance, become familiar with the following:

- NEMA Publication MG-2, Safety Standard for Construction and guide for Selection, Installation and Use of Electric Motors and Generators.
- IEC 34–1 Electrical and IEC72–1 Mechanical specifications
- ANSI C51.5, the National Electrical Code (NEC) and local codes and practices.

Limited Warranty

www.baldor.com/support/warranty_standard.asp

Safety Notice: This equipment contains high voltage! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation and maintenance of electrical equipment.

Be sure that you are completely familiar with NEMA publication MG-2, safety standards for construction and guide for selection, installation and use of electric motors and generators, the National Electrical Code and local codes and practices. Unsafe installation or use can cause conditions that lead to serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

WARNING: **Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.**

WARNING: **Disconnect all electrical power from the motor windings and accessory devices before disassembly of the motor. Electrical shock can cause serious or fatal injury.**

WARNING: **Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury. National Electrical Code and Local codes must be carefully followed.**

WARNING: **Avoid extended exposure to machinery with high noise levels. Be sure to wear ear protective devices to reduce harmful effects to your hearing.**

WARNING: **Surface temperatures of motor enclosures may reach temperatures which can cause discomfort or injury to personnel accidentally coming into contact with hot surfaces. When installing, protection should be provided by the user to protect against accidental contact with hot surfaces. Failure to observe this precaution could result in bodily injury.**

WARNING: **This equipment may be connected to other machinery that has rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt to install operate or maintain this equipment.**

WARNING: **Do not by-pass or disable protective devices or safety guards. Safety features are designed to prevent damage to personnel or equipment. These devices can only provide protection if they remain operative.**

WARNING: **Avoid the use of automatic reset devices if the automatic restarting of equipment can be hazardous to personnel or equipment.**

WARNING: **Be sure the load is properly coupled to the motor shaft before applying power. The shaft key must be fully captive by the load device. Improper coupling can cause harm to personnel or equipment if the load decouples from the shaft during operation.**

WARNING: **UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.**

WARNING: **Thermostat contacts automatically reset when the motor has slightly cooled down. To prevent injury or damage, the control circuit should be designed so that automatic starting of the motor is not possible when the thermostat resets.**

Safety Notice Continued

WARNING: **Use proper care and procedures that are safe during handling, lifting, installing, operating and maintaining operations. Improper methods may cause muscle strain or other harm.**

WARNING: **Pacemaker danger – Magnetic and electromagnetic fields in the vicinity of current carrying carrying conductors and permanent magnet motors can result result in a serious health hazard to persons with cardiac pacemakers, metal implants, and hearing aids. To avoid risk, stay way from the area surrounding a permanent magnet motor.**

WARNING: **Before performing any motor maintenance procedure, be sure that the equipment connected to the motor shaft cannot cause shaft rotation. If the load can cause shaft rotation, disconnect the load from the motor shaft before maintenance is performed. Unexpected mechanical rotation of the motor parts can cause injury or motor damage.**

WARNING: **Do not use non UL/CSA listed explosion proof motors in the presence of flammable or combustible vapors or dust. These motors are not designed for atmospheric conditions that require explosion proof operation.**

WARNING: **Motors that are to be used in flammable and/or explosive atmospheres must display the UL label on the nameplate along with CSA listed logo. Specific service conditions for these motors are defined in NFPA 70 (NEC) Article 500.**

WARNING: **Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.**

Caution: **To prevent premature equipment failure or damage, only qualified maintenance personnel should perform maintenance.**

Caution: **Do not over tension belts. Excess tension may damage the motor or driven equipment.**

Caution: **Do not over–lubricate motor as this may cause premature bearing failure.**

Caution: **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

Caution: **If eye bolts are used for lifting a motor, be sure they are securely tightened. The lifting direction should not exceed a 20° angle from the shank of the eye bolt or lifting lug. Excessive lifting angles can cause damage.**

Caution: **To prevent equipment damage, be sure that the electrical service is not capable of delivering more than the maximum motor rated amps listed on the rating plate.**

Caution: **If a HI POT test (High Potential Insulation test) must be performed, follow the precautions and procedure in NEMA MG1 and MG2 standards to avoid equipment damage.**

Caution: **The space heaters are designed to operate at or below the maximum surface temperature stated on the nameplate. If the marked ambient and/or voltage are exceeded this maximum surface temperature can be exceeded and can damage the motor windings. If applied in a division 2 or zone 2 environment this excessive temperature may cause ignition of hazardous materials.**

Caution: **Shaker Duty motors must be properly lubricated prior to Start Up to prevent damage. See Section 3.**

If you have any questions or are uncertain about any statement or procedure, or if you require additional information please contact your Baldor distributor or an Authorized Baldor Service Center.

Receiving

Each Baldor Electric Motor is thoroughly tested at the factory and carefully packaged for shipment. When you receive your motor, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your motor.
2. Verify that the part number of the motor you received is the same as the part number listed on your purchase order.

Handling

The motor should be lifted using the lifting lugs or eye bolts provided.

Caution: **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

1. Use the lugs or eye bolts provided to lift the motor. Never attempt to lift the motor and additional equipment connected to the motor by this method. The lugs or eye bolts provided are designed to lift only the motor. Never lift the motor by the motor shaft or the hood of a WPII motor.

2. To avoid condensation inside the motor, do not unpack until the motor has reached room temperature. (Room temperature is the temperature of the room in which it will be installed).
   The packing provides insulation from temperature changes during transportation.
3. When lifting a WPII (Weather Proof Type 2) motor, do not lift the motor by inserting lifting lugs into holes on top of the cooling hood. These lugs are to be used for hood removal only.
   A spreader bar should be used to lift the motor by the cast lifting lugs located on the motor frame.
4. If the motor must be mounted to a plate with the driven equipment such as pump, compressor etc., it may not be possible to lift the motor alone. For this case, the assembly should be lifted by a sling around the mounting base. The entire assembly can be lifted as an assembly for installation.

   Do not lift the assembly using the motor lugs or eye bolts provided. Lugs or eye bolts are designed to lift motor only. If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting. If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting.

Storage

Storage requirements for motors and generators that will not be placed in service for at least six months from date of shipment.

Improper motor storage will result in seriously reduced reliability and failure. An electric motor that does not experience regular usage while being exposed to normally humid atmospheric conditions is likely to develop rust in the bearings or rust particles from surrounding surfaces may contaminate the bearings. The electrical insulation may absorb an excessive amount of moisture leading to the motor winding failure.

A wooden crate "shell" should be constructed to secure the motor during storage. This is similar to an export box but the sides & top must be secured to the wooden base with lag bolts (not nailed as export boxes are) to allow opening and reclosing many times without damage to the "shell".

Minimum resistance of motor winding insulation is 5 Meg ohms or the calculated minimum, which ever is greater. Minimum resistance is calculated as follows: **Rm = kV + 1**

where: (Rm is minimum resistance to ground in Meg-Ohms and kV is rated nameplate voltage defined as Kilo-Volts.)

Example: For a 480VAC rated motor Rm =1.48 meg-ohms (use 5 MΩ).
For a 4160VAC rated motor Rm = 5.16 meg-ohms.

Preparation for Storage

1. Some motors have a shipping brace attached to the shaft to prevent damage during transportation. The shipping brace, if provided, must be removed and stored for future use. The brace must be reinstalled to hold the shaft firmly in place against the bearing before the motor is moved.
2. Store in a clean, dry, protected warehouse where control is maintained as follows:
   a. Shock or vibration must not exceed 2 mils maximum at 60 hertz, to prevent the bearings from brinelling. If shock or vibration exceeds this limit vibration isolation pads must be used.
   b. Storage temperatures of 10°C (50°F) to 49°C (120°F) must be maintained.
   c. Relative humidity must not exceed 60%.
   d. Motor space heaters (when present) are to be connected and energized whenever there is a possibility that the storage ambient conditions will reach the dew point. Space heaters are optional.

   Note: Remove motor from containers when heaters are energized, reprotect if necessary.
3. Measure and record the resistance of the winding insulation (dielectric withstand) every 30 days of storage.
   a. If motor insulation resistance decreases below the minimum resistance, contact your Baldor District office.
   b. Place new desiccant inside the vapor bag and re-seal by taping it closed.
   c. If a zipper-closing type bag is used instead of the heat-sealed type bag, zip the bag closed instead of taping it. Be sure to place new desiccant inside bag after each monthly inspection.
   d. Place the shell over the motor and secure with lag bolts.
4. Where motors are mounted to machinery, the mounting must be such that the drains and breathers are fully operable and are at the lowest point of the motor. Vertical motors must be stored in the vertical position. Storage environment must be maintained as stated in step 2.

5. Motors with anti-friction bearings are to be greased at the time of going into extended storage with periodic service as follows:
   a. Motors marked "Do Not Lubricate" on the nameplate do not need to be greased before or during storage.
   b. Ball and roller bearing (anti-friction) motor shafts are to be rotated manually every 3 months and greased every 6 months in accordance with the Maintenance section of this manual.
   c. Sleeve bearing (oil lube) motors are drained of oil prior to shipment. The oil reservoirs must be refilled to the indicated level with the specified lubricant, (see Maintenance). The shaft should be rotated monthly by hand at least 10 to 15 revolutions to distribute oil to bearing surfaces.
   d. "Provisions for oil mist lubrication" – These motors are packed with grease. Storage procedures are the same as paragraph 5b.
   e. "Oil Mist Lubricated" – These bearings are protected for temporary storage by a corrosion inhibitor. If stored for greater than 3 months or outdoor storage is anticipated, connected to the oil mist system while in storage. If this is not possible, add the amount of grease indicated under "Standard Condition" in Section 3, then rotate the shaft 15 times by hand.
6. All breather drains are to be fully operable while in storage (drain plugs removed). The motors must be stored so that the drain is at the lowest point. All breathers and automatic "T" drains must be operable to allow breathing and draining at points other than through the bearings around the shaft. Vertical motors should be stored in a safe stable vertical position.
7. Coat all external machined surfaces with a rust preventing material. An acceptable product for this purpose is Exxon Rust Ban # 392.
8. Carbon brushes should be lifted and held in place in the holders, above the commutator, by the brush holder fingers. The commutator should be wrapped with a suitable material such as cardboard paper as a mechanical protection against damage.

Non-Regreaseable Motors

Non-regreasable motors with "Do Not Lubricate" on the nameplate should have the motor shaft rotated 15 times to redistribute the grease within the bearing every 3 months or more often.

All Other Motor Types

Before storage, the following procedure must be performed.

1. Remove the grease drain plug, if supplied, (opposite the grease fitting) on the bottom of each bracket prior to lubricating the motor.
2. The motor with regreasable bearing must be greased as instructed in Section 3 of this manual.
3. Replace the grease drain plug after greasing.
4. The motor shaft must be rotated a minimum of 15 times after greasing.
5. Motor Shafts are to be rotated at least 15 revolutions manually every 3 months and additional grease added every nine months (see Section 3) to each bearing.
6. Bearings are to be greased at the time of removal from storage.

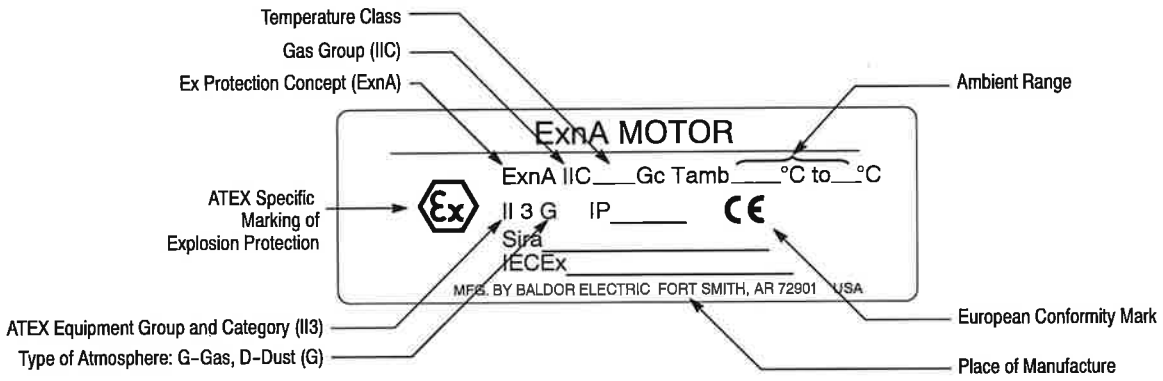
Removal From Storage

1. Remove all packing material.
2. Measure and record the electrical resistance of the winding insulation resistance meter at the time of removal from storage. The insulation resistance must not be less than 50% from the initial reading recorded when the motor was placed into storage. A decrease in resistance indicates moisture in the windings and necessitates electrical or mechanical drying before the motor can be placed into service. If resistance is low, contact your Baldor District office.
3. Regrease the bearings as instructed in Section 3 of this manual.
4. Reinstall the original shipping brace if motor is to be moved. This will hold the shaft firmly against the bearing and prevent damage during movement.

Equipment Marking for IEC Certified Product

IEC certified products have special markings that identify the protection concept and environment requirements. An example is shown in Figure 3-1.

Figure 3-1 IEC Certified Product Markings



Specific Conditions of Use:
If the motor certificate number is followed by the symbol "X", this indicates that the motor has specific conditions of use which are indicated on the certificate. It is necessary to review the product certification certificate in conjunction with this instruction manual.

Operation On Frequency Converters:
If the motor is evaluated for operation with an adjustable speed drive, the type of converter (for example PWM for Pulse Width Modulated) and safe speed ranges (for example 0–120Hz) will be specified in the certification documents or on motor nameplates. It is necessary to consult the adjustable speed drive manual for proper set up. IECEx Certificates are available online at www.iecex.com

Section 2
Installation & Operation

Overview

Installation should conform to the National Electrical Code as well as local codes and practices. When other devices are coupled to the motor shaft, be sure to install protective devices to prevent future accidents. Some protective devices include, coupling, belt guard, chain guard, shaft covers etc. These protect against accidental contact with moving parts. Machinery that is accessible to personnel should provide further protection in the form of guard rails, screening, warning signs etc.

Location

It is important that motors be installed in locations that are compatible with motor enclosure and ambient conditions. Improper selection of the motor enclosure and ambient conditions can lead to reduced operating life of the motor.

Proper ventilation for the motor must be provided. Obstructed airflow can lead to reduction of motor life.

1. **Open Drip-Proof/WPI** motors are intended for use indoors where atmosphere is relatively clean, dry, well ventilated and non-corrosive.
2. **Totally Enclosed and WPII** motors may be installed where dirt, moisture or dust are present and in outdoor locations.

Severe Duty, IEEE 841 and Washdown Duty enclosed motors are designed for installations with high corrosion or excessive moisture conditions. These motors should not be placed into an environment where there is the presence of flammable or combustible vapors, dust or any combustible material, unless specifically designed for this type of service.
IEEE841 motors are suitable for application in Class I Division 2 and Class I Zone 2 areas on sine wave power in accordance with the applicable codes and standards.

Hazardous Locations are those where there is a risk of ignition or explosion due to the presence of combustible gases, vapors, dust, fibers, or flyings. Facilities requiring special equipment for hazardous locations are typically classified in accordance with local requirements. In the US market, guidance is provided by the National Electric Code.

EMC Compliance Statement for European Union
The motors described in this instruction manual are designed to comply 2004/108/EC . These motors are commercial in design and not intended for residential use.

Mounting

Location

The motor should be installed in a location compatible with the motor enclosure and specific ambient. To allow adequate air flow, the following clearances must be maintained between the motor and any obstruction:

Table 2-1 Enclosure Clearance

TEFC / TENV (IC0141) Enclosures	
Fan Cover Air Intake	180 – 210T Frame 1"□(25mm)
Fan Cover Air Intake	250 – 449T Frame 4"□(100mm)
	IEC 112 – 132 1"□(25mm)
	IEC 160 – 280 4"□(100mm)
Exhaust	Envelope equal to the P Dimension on the motor dimension sheet
OPEN/Protected Enclosures	
Bracket Intake	Same as TEFC
Frame Exhaust	Exhaust out the sides envelope A minimum of the P dimension plus 2" (50mm) Exhaust out the end same as intake.

The motor must be securely installed to a rigid foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage.

Foundation caps and sole plates are designed to act as spacers for the equipment they support. If these devices are used, be sure that they are evenly supported by the foundation or mounting surface.

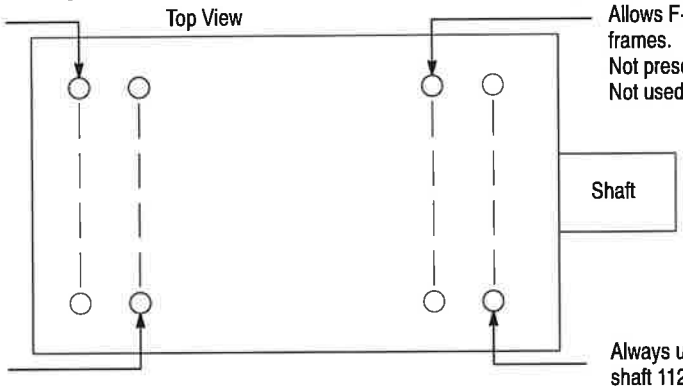
When installation is complete and accurate alignment of the motor and load is accomplished, the base should be grouted to the foundation to maintain this alignment.

The standard motor base is designed for horizontal or vertical mounting. Adjustable or sliding rails are designed for horizontal mounting only. Consult your Baldor distributor or authorized Baldor Service Center for further information.

Frame Mounting Holes

Some motors have standardized frames containing 6 or 8 mounting holes. 6 hole frames are not suitable for field reversal of mounting from F–1 to F–2, etc. Figure 2-2 indicates the proper mounting holes to use.

Figure 2-2 6 & 8 Hole Motor Frame Mounting



For short frame designations 182, 213, 254, 284, 324, 364, 404, 444 (NEMA)

Allows F-1 to F-2 Conversion on 8 hole frames.
Not present on 6 hole frames.
Not used on 8 hole frames.

For long frame designations 184, 215, 256, 286, 326, 365, 405, 445 (NEMA) (IEC) 112M, 132M, 160L, 200L, 225M, 250M, 280M

Always use these holes, closer to the shaft 112S, 132S, 160M, 180M, 200M, 225S, 250S, 280S, (IEC)

Caution: **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

In the case of assemblies on a common base, any lifting means provided on the motor should not be used to lift the assembly and base but, rather, the assembly should be lifted by a sling around the base or by other lifting means provided on the base. Assure lifting in the direction intended in the design of the lifting means. Likewise, precautions should be taken to prevent hazardous overloads due to deceleration, acceleration or shock forces.

Alignment

Accurate alignment of the motor with the driven equipment is extremely important. The pulley, sprocket, or gear used in the drive should be located on the shaft as close to the shaft shoulder as possible. It is recommended to heat the pulley, sprocket, or gear before installing on the motor shaft. Forcibly driving a unit on the motor shaft will damage the bearings.

1. **Direct Coupling**
   For direct drive, use flexible couplings if possible. Consult the drive or equipment manufacturer for more information. Mechanical vibration and roughness during operation may indicate poor alignment. Use dial indicators to check alignment. The space between coupling hubs should be maintained as recommended by the coupling manufacturer.
2. **End-Play Adjustment**
   The axial position of the motor frame with respect to its load is also extremely important. The standard motor bearings are not designed for excessive external axial thrust loads. Improper adjustment will cause failure.
3. **Pulley Ratio**
   The best practice is to not exceed an 8:1 pulley ratio.

Caution: **Do not over tension belts. Excess tension may damage the motor or driven equipment.**

4. **Belt Drive**
   Align sheaves carefully to minimize belt wear and axial bearing loads (see End-Play Adjustment). Belt tension should be sufficient to prevent belt slippage at rated speed and load. However, belt slippage may occur during starting.

Doweling & Bolting After proper alignment is verified, dowel pins should be inserted through the motor feet into the foundation. This will maintain the correct motor position should motor removal be required. (Baldor•Reliance motors are designed for doweling.)

1. Drill dowel holes in diagonally opposite motor feet in the locations provided.
2. Drill corresponding holes in the foundation.
3. Ream all holes.
4. Install proper fitting dowels.
5. Mounting bolts must be carefully tightened to prevent changes in alignment. Use a flat washer and lock washer under each nut or bolt head to hold the motor feet secure. Flanged nuts or bolts may be used as an alternative to washers.

WARNING: **Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.**

Guarding Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions. This is particularly important where the parts have surface irregularities such as keys, key ways or set screws. Some satisfactory methods of guarding are:

1. Covering the machine and associated rotating parts with structural or decorative parts of the driven equipment.
2. Providing covers for the rotating parts. Covers should be sufficiently rigid to maintain adequate guarding during normal service.

Power Connection Motor and control wiring, overload protection, disconnects, accessories and grounding should conform to the National Electrical Code and local codes and practices.

For ExnA hazardous location motors, it is a specific condition of use that all terminations in a conduit box be fully insulated. Fully insulated and lugged terminations must be bolted and provided with lock washer to prevent rotation. Flying leads must be insulated with two full wraps of electrical grade insulating tape or heat shrink tubing.

Grounding In the USA consult the National Electrical Code, Article 430 for information on grounding of motors and generators, and Article 250 for general information on grounding. In making the ground connection, the installer should make certain that there is a solid and permanent metallic connection between the ground point, the motor or generator terminal housing, and the motor or generator frame. In non–USA locations consult the appropriate national or local code applicable.

Motors with resilient cushion rings usually must be provided with a bonding conductor across the resilient member. Some motors are supplied with the bonding conductor on the concealed side of the cushion ring to protect the bond from damage. Motors with bonded cushion rings should usually be grounded at the time of installation in accordance with the above recommendations for making ground connections. When motors with bonded cushion rings are used in multimotor installations employing group fusing or group protection, the bonding of the cushion ring should be checked to determine that it is adequate for the rating of the branch circuit over current protective device being used.

There are applications where grounding the exterior parts of a motor or generator may result in greater hazard by increasing the possibility of a person in the area simultaneously contacting ground and some other nearby live electrical parts of other ungrounded electrical equipment. In portable equipment it is difficult to be sure that a positive ground connection is maintained as the equipment is moved, and providing a grounding conductor may lead to a false sense of security.

Select a motor starter and over current protection suitable for this motor and its application. Consult motor starter application data as well as the National Electric Code and/or other applicable local codes.

For motors installed in compliance with IEC requirements, the following minimum cross sectional area of the protective conductors should be used:

Cross-sectional area of phase conductors, S	Minimum cross-sectional area of the corresponding protective conductor, S_p
mm^2	mm^2
$S < 16$	S
$16 < S \leq 35$	16
$S > 35$	$0{,}5\,S$

Equipotential bonding connection shall made using a conductor with a cross-sectional area of at least 4 mm^2.

Conduit Box For ease of making connections, an oversize conduit box is provided. Most conduit boxes can be rotated 360° in 90° increments. Auxiliary conduit boxes are provided on some motors for accessories such as space heaters, RTD's etc.

AC Power Motors with flying lead construction must be properly terminated and insulated.
Connect the motor leads as shown on the connection diagram located on the name plate or inside the cover on the conduit box. Be sure the following guidelines are met:

1. AC power is within ±10% of rated voltage with rated frequency. (See motor name plate for ratings).
   OR
2. AC power is within ±5% of rated frequency with rated voltage.
   OR
3. A combined variation in voltage and frequency of ±10% (sum of absolute values) of rated values, provided the frequency variation does not exceed ±5% of rated frequency.

Performance within these voltage and frequency variations are shown in Figure 2-4.

Figure 2-3 Accessory Connections

HEATERS H1 —∿∿— H2 H1 —∿∿— H2	One heater is installed in each end of motor. Leads for each heater are labeled H1 & H2. (Like numbers should be tied together).
THERMISTORS TD1 —∿∿— TD2	Three thermistors are installed in windings and tied in series. Leads are labeled TD1 & TD2.
WINDING RTDS RED RED WHITE	Winding RTDs are installed in windings (2) per phase. Each set of leads is labeled 1TD1, 1TD2, 1TD3, 2TD1, 2TD2, 2TD3 etc.
BEARING RTD RED RED WHITE	* One bearing RTD is installed in Drive endplate (PUEP), leads are labeled RTDDE. * One bearing RTD is installed in Opposite Drive endplate (FREP), leads are labeled RTDODE. * Note RTD may have 2-Red/1-White leads; or 2-White/1-Red Lead.

Rotation All three phase motors are reversible. To reverse the direction of rotation, disconnect and lock out power and interchange any two of the three line leads for three phase motors. For single phase motors, check the connection diagram to determine if the motor is reversible and follow the connection instructions for lead numbers to be interchanged. Not all single phase motors are reversible.

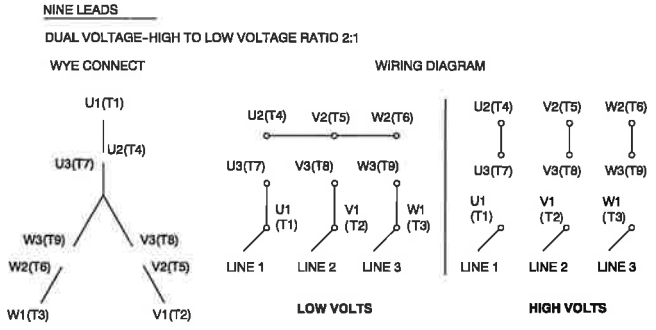
Adjustable Frequency Power Inverters used to supply adjustable frequency power to induction motors produce wave forms with lower order harmonics with voltage spikes superimposed. Turn-to-turn, phase-to-phase, and ground insulation of stator windings are subject to the resulting dielectric stresses. Suitable precautions should be taken in the design of these drive systems to minimize the magnitude of these voltage spikes. Consult the drive instructions for maximum acceptable motor lead lengths, and proper grounding.

Note: Main power leads for CE Marked Motors may be marked U,V,W – for standard configurations, please consult connection diagrams.

Caution: **The space heaters are designed to operate at or below the maximum surface temperature stated on the nameplate. If the marked ambient and/or voltage are exceeded this maximum surface temperature can be exceeded and can damage the motor windings. If applied in a division 2 or zone 2 environment this excessive temperature may cause ignition of hazardous materials.**

Connection Diagrams

AC Motor Connection Diagram



MOTOR WINDING THERMOSTATS

CONTACTS _____ @ _____ °C
FIGURE NUMBER _____

CONTACT RATING

VOLTS	CONTINUOUS AMPERES	INRUSH AMPERES
110 - 120	3.0	30
220 - 240	1.5	15
440 - 480	0.75	7.5
550 - 600	0.60	6.0

THERMOSTATS

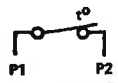
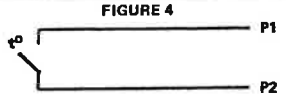
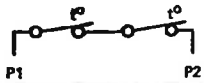
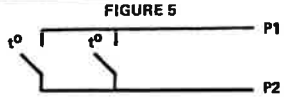
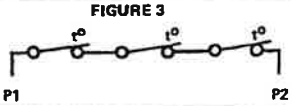
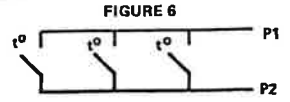
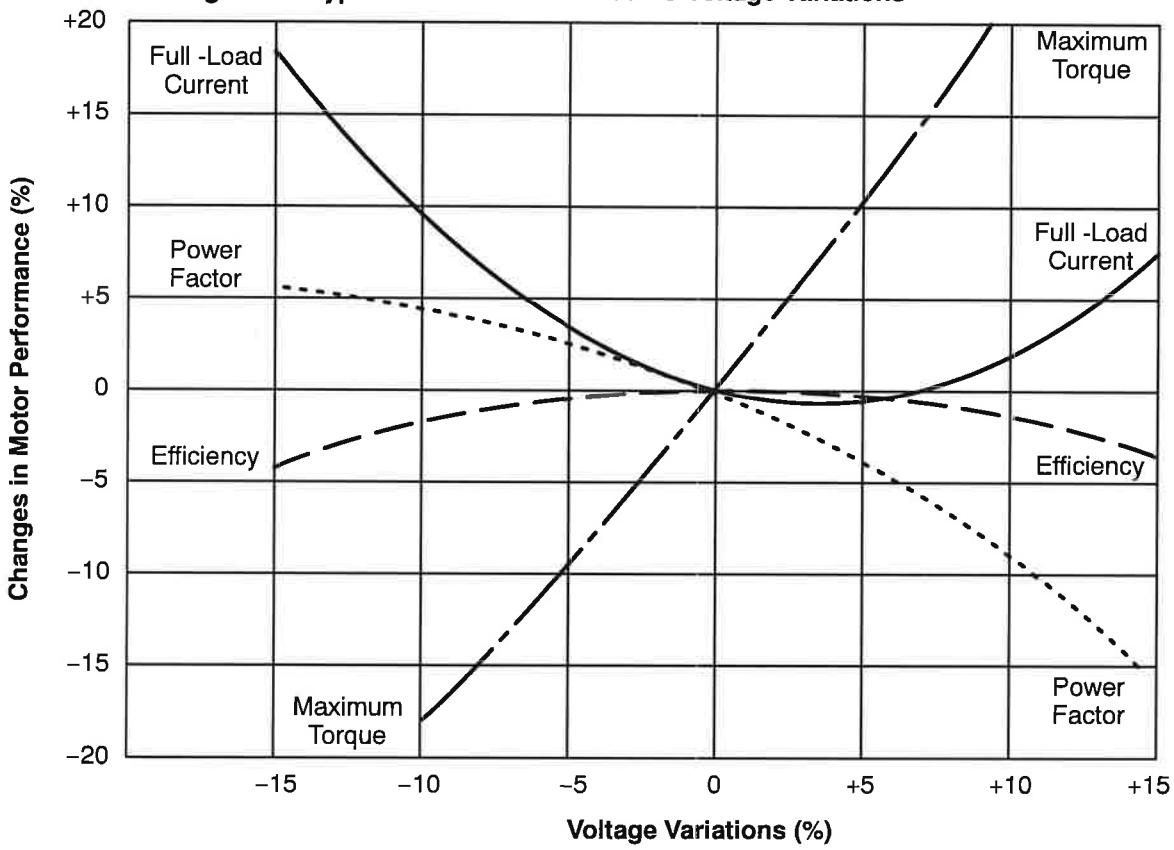
NORMALLY CLOSED	NORMALLY OPEN
FIGURE 1 	FIGURE 4 
FIGURE 2 	FIGURE 5 
FIGURE 3 	FIGURE 6 

Figure 2-4 Typical Motor Performance VS Voltage Variations



Initial Lubrication Baldor•Reliance motors are shipped from the factory with the bearings properly packed with grease and ready to operate. Where the unit has been subjected to extended storage (6 months or more) the bearings should be relubricated (regreasable type) prior to starting. When motors are equipped for oil mist lubrication refer to the instruction manual for installation, operation, and maintenance of oil mist lubrication systems.

Caution: **Shaker Duty motors must be properly lubricated prior to Start Up to prevent damage. See Section 3.**

First Time Start Up Be sure that all power to motor and accessories is off. Be sure the motor shaft is disconnected from the load and will not cause mechanical rotation of the motor shaft.

1. Make sure that the mechanical installation is secure. All bolts and nuts are tightened etc.
2. If motor has been in storage or idle for some time, check winding insulation integrity.
3. Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity.
4. Be sure all shipping materials and braces (if used) are removed from motor shaft.
5. Manually rotate the motor shaft to ensure that it rotates freely.
6. Replace all panels and covers that were removed during installation.
7. Momentarily apply power and check the direction of rotation of the motor shaft.
8. If motor rotation is wrong, be sure power is off and change the motor lead connections. Verify rotation direction before you continue.
9. Start the motor and ensure operation is smooth without excessive vibration or noise. If so, run the motor for 1 hour with no load connected.
10. After 1 hour of operation, disconnect power and connect the load to the motor shaft. Verify all coupling guards and protective devices are installed. Ensure motor is properly ventilated.
11. If motor is totally enclosed fan-cooled or non-ventilated it is recommended that condensation drain plugs, if present, be removed. These are located in the lower portion of the end-shields. Totally enclosed fan-cooled "XT" motors are normally equipped with automatic drains which may be left in place as received.

Coupled Start Up This procedure assumes a coupled start up. Also, that the first time start up procedure was successful.

1. Check the coupling and ensure that all guards and protective devices are installed.
2. Check that the coupling is properly aligned and not binding.
3. The first coupled start up should be with no load. Apply power and verify that the load is not transmitting excessive vibration back to the motor though the coupling or the foundation. Vibration should be at an acceptable level.
4. Run for approximately 1 hour with the driven equipment in an unloaded condition.

The equipment can now be loaded and operated within specified limits. Do not exceed the name plate ratings for amperes for steady continuous loads.

Jogging and Repeated Starts Repeated starts and/or jogs of induction motors generally reduce the life of the motor winding insulation. A much greater amount of heat is produced by each acceleration or jog than by the same motor under full load. If it is necessary to repeatedly start or jog the motor, it is advisable to check the application with your local Baldor distributor or Baldor Service Center.

Heating - Duty rating and maximum ambient temperature are stated on the motor name plate. Do not exceed these values. If there is any question regarding safe operation, contact your local Baldor distributor or Baldor Service Center.

Hazardous Locations

Hazardous locations are those where there is a risk of ignition or explosion due to the presence of combustible gases, vapors, dust, fibers or flyings.

Selection Facilities requiring special equipment for hazardous locations are typically classified in accordance with local requirements. In the US market, guidance is provided by the National Electric Code. In international hazardous location areas, guidance for gas / vapor / mist classification is given in IEC60079-14, or for dust in IEC61241-14. This classification process lets the installer know what equipment is suitable for installation in that environment, and identifies what the maximum safe temperature or temperature class is required. It is the customer or users responsibility to determine the area classification and select proper equipment.

Areas are classified with respect to risk and exposure to the hazard. In the US market, areas are typically classified as follows Class, Division, Group and Temperature Class. In some newer installations in the US and in most international markets, areas are classified in Zones.

Protection Concepts

Class I Division 1 / Zone 1 [Equipment Group I (mining) or II (surface), Equipment Protection Level (EPL) Gb, Mb]

Baldor offers a range of motors suitable for installation in a Division 1 or Zone 1 environment. These motors are known as explosion proof or flameproof.

Motors that are explosion proof or flameproof use specially machined flameproof joints between the end bell or bracket and the frame, as well as along the rotating shaft and at connection box covers and entries. The fit of these flameproof joints are designed to contain the combustion or quench the flame of an explosive gas atmosphere prior to it exiting the motor. These flameproof joints have lengths and widths selected and tested based on the gas group present in the atmosphere. Baldor•Reliance motors are typically designed to meet Class I (Division 1) Group C and D (explosion proof) or Ex d IIB (flameproof).

An application note regarding equipment applied in accordance with the US National Electric Code (NFPA 70-2008) – according to Article 500.8(C) Marking, sub clause (2) in the fine print note, it is noted that Equipment not marked to indicate a division is suitable for both Division 1 and Division 2 locations. These motors are not gas tight. To the contrary, this protection concept assumes that due to the normal heating and cooling cycle of motor operation that any gas present will be drawn into the motor. Since flameproof or explosion proof motors are designed to contain the combustion and extinguish any flame transmission, for this protection concept, only external surface temperatures are of concern. Thermal limiting devices such as thermostats, thermistors or RTDs may be provided on these motors to limit the external surface temperature during overload conditions.

If thermostats are provided as a condition of certification, it is the installer's responsibility to make sure that these devices are properly connected to a suitable switching device. The ATEX directive requires that motor shutdown on thermal trip be accomplished without an intermediate software command. Where intermediate circuitry is involved the circuit shall fall within the scope of a safety, controlling and regulating device as defined in article 1(2) of European Directive 94/9/EC, and shall be covered by an appropriate EC Type Examination Certificate.

Flameproof motors, internationally referred to as Ex d use a protection concept similar to that used in Class I Division 1 motors, with minor differences in the flameproof joints and cable entry designs. Flameproof and explosion proof motors are both type tested. Representative motors are connected to a reference gas and ignited in laboratory conditions to verify that the flame is not transmitted outside the motor enclosure and to determine the maximum internal pressure encountered.

Explosion proof and Flame proof motors shipped without a conduit box require use of a certified box of suitable dimensions and that is appropriate for the classification. Openings in connection boxes must be closed with suitably certified and dimensioned device.

Class I Division 2 / Zone 2 Ex nA, [Equipment Protection Level (EPL) Gc]

This protection concept relies on having no sources of ignition present such as arcing parts or hot surfaces. For this protection concept, internal temperatures as well as external temperatures are considered. In many cases, the internal temperatures are higher than the external temperatures and therefore become the limiting factor in determination of temperature code designation. In these applications, it is very important to use a motor that has been evaluated thermally for use with an inverter or converter, if variable speed operation is desired. Thermostats used for Class I Division 2 and Ex nA motors are used to protect the motor only. For motors using flying lead construction, it is important to use connection lugs and insulate with heat shrink tubing or a double wrap of insulation grade electrical tape to avoid the risk of spark or ignition.

Class II Division 1 / Zone 21 [Equipment Group III, Equipment Protection Level (EPL) Db]

This area classification is one where the risk of ignitable concentrations of dust is present at all or some of the time. The protection concepts used for Class II Division 1 is similar to flamepath, except with additional dust exclusion paths designed for the rotating shaft. In the international designations, this concept is referred to as dust ignition proof or Ex tD. External surface temperature remains the limiting factor. Thermal limiting devices such as thermostats, thermistors or RTDs may be provided on these motors to limit the external surface temperature during overload conditions. If thermostats are provided as a condition of certification, it is the installer's responsibility to make sure that these devices are properly connected to a suitable switching device.

Note: In the North American area classification system, Class III exists for fibers and flyings. In the IEC designation, both dusts and flyings are absorbed into Group III.

Class II Division 2 / Zone 22 [Equipment Group III, Equipment Protection Level (EPL) Dc]

This area classification is one where the risk of exposure to ignitable concentrations of dust are not likely to occur under normal operating conditions and relies heavily on the housekeeping practices within the installation.

Sine Wave Power Operation for Division 1 or 2 and Zone 1 or 2 and Zone 21 or 22 Hazardous Location.

These motors are designed to operate at or below the maximum surface temperature (or T-Code) stated on the nameplate. Failure to operate the motor properly can cause this maximum surface temperature to be exceeded. If applied in a Division 1 or 2 / Zone 1 or 2 and Zone 21 or 22 environment, this excessive temperature may cause ignition of hazardous materials. Operating the motor at any of the following conditions can cause the marked surface temperature to be exceeded.

1. Motor load exceeding service factor nameplate value
2. Ambient temperatures above nameplate value
3. Voltages above or below nameplate value
4. Unbalanced voltages
5. Loss of proper ventilation
6. Altitude above 3300 feet / 1000 meters
7. Severe duty cycles of repeated starts
8. Motor stall
9. Motor reversing
10. Single phase operation of polyphase equipment
11. Variable frequency operation

Variable Frequency Power Operation for Division 1 or 2 and Zone 1 or 2 and Zone 21 or 22 Hazardous Location (motors with maximum surface temperature listed on the nameplate).

Only motors with nameplates marked for use on inverter (variable frequency) power, and labeled for specific hazardous areas may be used in those hazardous areas on inverter power. The motor is designed to operate at or below the maximum surface temperature (or T-Code) stated on the nameplate. Failure to operate the motor properly can cause this maximum surface temperature to be exceeded.

If applied in a Division 1 or 2 / Zone 1 or 2 and Zone 21 or 22 environment, this excessive temperature may cause ignition of hazardous materials. Operating the motor at any of the following conditions can cause the marked surface temperature to be exceeded.

1. Motor load exceeding service factor nameplate value
2. Ambient temperature above nameplate value
3. Voltage (at each operating frequency) above or below rated nameplate value
4. Unbalanced voltages
5. Loss of proper ventilation
6. Operation outside of the nameplate speed / frequency range
7. Altitudes above 3300 feet / 1000 meters
8. Single phase operation of polyphase equipment
9. Unstable current wave forms
10. Lower than name plate minimum carrier frequency

Thermal Limiting

Thermal limiting devices are temperature sensing control components installed inside the motor to limit the internal temperature of the motor frame by interrupting the circuit of the holding coil of the magnetic switch or contactor. They are required for most Division 1 and Zone 1 applications. For Division 2 or Zone 2 applications, motors should be selected that preclude running temperatures from exceeding the ignition temperatures for the designated hazardous material. In Division 2 or Zone 2 classified locations, thermal limiting devices should only be used for winding protection and not considered for limiting all internal motor temperatures to specific ignition temperatures.

Equipotential Bonding and Shaft Current Reduction

Larger motors (ie WP construction) may require proper bonding between motor enclosures and covers to avoid the risk of stray currents during start up. Fastening methods and bonding straps must not be modified.

Bearing currents can exist in some motors for both line-fed and inverter-fed applications. Larger line-fed motors may require at least one insulated bearing to prevent a flow of current through the bearings. Do not defeat such insulation whether the motor is line-fed or inverter-fed applications. Inverter-fed motors may require additional bearing insulation or even a shaft brush. Do not defeat such features. When the motor and the coupled load are not on a common conductive baseplate, it may also be necessary to electrically bond together the stationary parts of the motor and the coupled equipment.

Repair of Motors used in Hazardous Locations

Repair of hazardous certified motors requires additional information, skill, and care. It is the customer's responsibility to select service shops with proper qualifications to repair hazardous location motors. Contact the manufacture for additional repair details. Use only original manufacturer's parts.

Repair of Explosion Proof or Flame Proof Motors Class I Division 1 and Zone 1

In the North American market, recertification programs are offered by Underwriters Laboratories and Canadian Standards Association which allow authorized service shops to mark the rebuilt motors as certified. In the international markets using IEC based requirements, repair should be undertaken only after consulting IEC60079-19 Explosive Atmospheres-Part 19 Equipment repair, overhaul and reclamation. If use of a certified repair facility is desired, consult the IECEX Repair Scheme at

http://www.iecex.com/service_facilities.htm

Explosion proof and flameproof motors achieve their safety based on the mechanical construction - flameproof joints and bearing clearance, and the electrical design including any thermal limiting devices. If it is necessary to repair a flameproof or explosion proof motor, it is critical that the mechanical flameproof joints be maintained. Consult Baldor Electric Company for flameproof joint construction details. Use only Baldor•Reliance supplied parts. Baldor does not recommend reclamation of parts. Since this protection method also relies on temperature being maintained, make sure that any rewinding uses the original electrical designs, including any thermal protection that may be present.

Repair of Dust Ignition Proof Motors - Class II Division 1 and 2, Zone 21 and 22.

For Dust Ignition Proof, proper sealing is required. Do not modify the motor construction to add any additional opening, and ensure that proper sealing is maintained in the connection box and at the shaft seal. Since this protection method also relies on temperature being maintained, make sure that any rewinding uses the original electrical designs, including any thermal protection that may be present

Repair of Class I Division 2 and Zone 2 motors

For Division 2 and Zone 2, the internal and external temperatures are of concern. Since this protection method also relies on temperature being maintained, make sure that any rewinding uses the original electrical designs, including any thermal protection that may be present. Use only Baldor replacement thermostats, if provided.

Section 3
Maintenance & Troubleshooting

WARNING: **UL and EX Listed motors must only be serviced by UL or EX Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.**

General Inspection Inspect the motor at regular intervals, approximately every 500 hours of operation or every 3 months, whichever occurs first. Keep the motor clean and the ventilation openings clear. The following steps should be performed at each inspection:

WARNING: **Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.**

1. Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. Oily vapor, paper pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
2. Perform a dielectric with stand test periodically to ensure that the integrity of the winding insulation has been maintained. Record the readings. Immediately investigate any significant decrease in insulation resistance.
3. Check all electrical connectors to be sure that they are tight.

Relubrication & Bearings Bearing grease will lose its lubricating ability over time, not suddenly. The lubricating ability of a grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Good results can be obtained if the following recommendations are used in your maintenance program.

Type of Grease A high grade ball or roller bearing grease should be used. Recommended grease for standard service conditions is **Polyrex EM (Exxon Mobil)**. Do not mix greases unless compatibility has been checked and verified.

Ball Bearing Motors

Operating Temperature -25°C (-15°F) to 50°C (120°F)

EXXON	POLYREX EM (Standard on Baldor motors)
EXXON	UNIREX N2
EXXON	BEACON 325
CHEVRON OIL	SRI NO. 2 (Compatible with Polyrex EM)
CHEVRON OIL	BLACK PEARL
TEXACO, INC.	PREMIUM RB
TEXACO, INC.	POLYSTAR
AMOCO	RYKON # 2
PENNZOIL	PENNZLUBE EM-2
DARMEX	DARMEX 707
DARMEX	DARMEX 711
PETRO-CANADA	PEERLESS LLG
SHELL OIL	DOLIUM BRB

Minimum Starting Temperature -60°C (-76°F)

SHELL OIL CO.	AEROSHELL 7 (Standard on Baldor motors)
MOBIL	MOBIL 28
MOBIL	MOBILITH SHC 100 (Low Temperature - Arctic Duty)

Roller Bearing Motors

Operating Temperature -25°C (-15°F) to 50°C (120°F)

TEXACO, INC.	PREMIUM RB
MOBIL	MOBILITH SHC 220 (Standard on Baldor motors)
CHEVRON OIL	BLACK PEARL

Relubrication Intervals Recommended relubrication intervals are shown in Table 3-2. It is important to realize that the recommended intervals of Table 3-2 are based on average use.

Refer to additional information contained in Tables 3-3, 3-4 and 3-5.

Table 3-2 Relubrication Intervals *

NEMA / (IEC) Frame Size	Rated Speed - RPM					
	10000	6000	3600	1800	1200	900
Up to 210 incl. (132)	**	2700 Hrs.	5500 Hrs.	12000 Hrs.	18000 Hrs.	22000 Hrs.
Over 210 to 280 incl. (180)		**	3600 Hrs.	9500 Hrs.	15000 Hrs.	18000 Hrs.
Over 280 to 360 incl. (225)		**	* 2200 Hrs.	7400 Hrs.	12000 Hrs.	15000 Hrs.
Over 360 to 449 incl. (315)		**	*2200 Hrs.	3500 Hrs.	7400 Hrs.	10500 Hrs.

* Relubrication intervals are for ball bearings.
For vertically mounted motors and roller bearings, divide the relubrication interval by 2.

** For motors operating at speeds greater than 3600 RPM, contact Baldor for relubrication recommendations.

Table 3-3 Service Conditions

Severity of Service	Hours per day of Operation	Ambient Temperature Maximum	Atmospheric Contamination
Standard	8	40° C	Clean, Little Corrosion
Severe	16 Plus	50° C	Moderate dirt, Corrosion
Extreme	16 Plus	>50° C* or Class H Insulation	Severe dirt, Abrasive dust, Corrosion, Heavy Shock or Vibration
Low Temperature		<-29° C **	

* Special high temperature grease is recommended (Dow Corning DC44). Note that Dow Corning DC44 grease does not mix with other grease types. Thoroughly clean bearing & cavity before adding grease.

** Special low temperature grease is recommended (Aeroshell 7).

Table 3-4 Relubrication Interval Multiplier

Severity of Service	Multiplier
Standard	1.0
Severe	0.5
Extreme	0.1
Low Temperature	1.0

Some motor designs use different bearings on each motor end. This is normally indicated on the motor nameplate. In this case, the larger bearing is installed on the motor Drive endplate. For best relubrication results, only use the appropriate amount of grease for each bearing size (not the same for both).

Table 3-5 Bearings Sizes and Types

Frame Size NEMA (IEC)	Bearing Description (These are the "Large" bearings (Shaft End) in each frame size)			
	Bearing	Weight of Grease to add * oz (Grams)	Volume of grease to be added	
			in^3	teaspoon
56 to 140 (90)	6203	0.08 (2.4)	0.15	0.5
140 (90)	6205	0.15 (3.9)	0.2	0.8
180 (100–112)	6206	0.19 (5.0)	0.3	1.0
210 (132)	6307	0.30 (8.4)	0.6	2.0
250 (160)	6309	0.47 (12.5)	0.7	2.5
280 (180)	6311	0.61 (17)	1.2	3.9
320 (200)	6312	0.76 (20.1)	1.2	4.0
360 (225)	6313	0.81 (23)	1.5	5.2
400 (250)	6316	1.25 (33)	2.0	6.6
440 (280)	6318	1.52(40)	2.5	8.2
440 (280)	6319	2.12 (60)	4.1	13.4
5000 to 5800 (315–355)	6328	4.70 (130)	9.2	30.0
5000 to 5800 (315–355)	NU328	4.70 (130)	9.2	30.0
360 to 449 (225–280)	NU319	2.12 (60)	4.1	13.4
AC Induction Servo				
76 Frame 180 (112)	6207	0.22 (6.1)	0.44	1.4
77 Frame 210 (132)	6210	0.32 (9.0)	0.64	2.1
80 Frame 250(160)	6213	0.49 (14.0)	0.99	3.3

* Weight in grams = .005 DB of grease to be added

Note: Not all bearing sizes are listed.
For intermediate bearing sizes, use the grease volume for the next larger size bearing.

Caution: To avoid damage to motor bearings, grease must be kept free of dirt. For an extremely dirty environment, contact your Baldor distributor or an authorized Baldor Service Center for additional information.

Relubrication Procedure Be sure that the grease you are adding to the motor is compatible with the grease already in the motor. Consult your Baldor distributor or an authorized service center if a grease other than the recommended type is to be used.

Caution: Do not over-lubricate motor as this may cause premature bearing failure.

With Grease Outlet Plug

1. With the motor stopped, clean all grease fittings with a clean cloth.
2. Remove grease outlet plug.

Caution: Over-lubricating can cause excessive bearing temperatures, premature lubrication breakdown and bearing failure.

3. Add the recommended amount of grease.
4. Operate the motor for 15 minutes with grease plug removed. This allows excess grease to purge.
5. Re-install grease outlet plug.

Without Grease Provisions

Note: Only a Baldor authorized and UL or CSA certified service center can disassemble a UL/CSA listed explosion proof motor to maintain it's UL/CSA listing.

1. Disassemble the motor.
2. Add recommended amount of grease to bearing and bearing cavity. (Bearing should be about 1/3 full of grease and outboard bearing cavity should be about 1/2 full of grease.)
3. Assemble the motor.

Sample Relubrication Determination

Assume - NEMA 286T (IEC 180), 1750 RPM motor driving an exhaust fan in an ambient temperature of 43° C and the atmosphere is moderately corrosive.

1. Table 3-2 list 9500 hours for standard conditions.
2. Table 3-3 classifies severity of service as "Severe".
3. Table 3-5 shows that 1.2 in^3 or 3.9 teaspoon of grease is to be added.

Note: Smaller bearings in size category may require reduced amounts of grease.

Table 3-7 Troubleshooting Chart

Symptom	Possible Causes	Possible Solutions
Motor will not start	Usually caused by line trouble, such as, single phasing at the starter.	Check source of power. Check overloads, fuses, controls, etc.
Excessive humming	High Voltage.	Check input line connections.
	Eccentric air gap.	Have motor serviced at local Baldor service center.
Motor Over Heating	Overload. Compare actual amps (measured) with nameplate rating.	Locate and remove source of excessive friction in motor or load. Reduce load or replace with motor of greater capacity.
	Single Phasing.	Check current at all phases (should be approximately equal) to isolate and correct the problem.
	Improper ventilation.	Check external cooling fan to be sure air is moving properly across cooling fins. Excessive dirt build-up on motor. Clean motor.
	Unbalanced voltage.	Check voltage at all phases (should be approximately equal) to isolate and correct the problem.
	Rotor rubbing on stator.	Check air gap clearance and bearings.
		Tighten "Thru Bolts".
	Over voltage or under voltage.	Check input voltage at each phase to motor.
	Open stator winding.	Check stator resistance at all three phases for balance.
	Grounded winding.	Perform dielectric test and repair as required.
	Improper connections.	Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity. Refer to motor lead connection diagram.
Bearing Over Heating	Misalignment.	Check and align motor and driven equipment.
	Excessive belt tension.	Reduce belt tension to proper point for load.
	Excessive end thrust.	Reduce the end thrust from driven machine.
	Excessive grease in bearing.	Remove grease until cavity is approximately $^3/_4$ filled.
	Insufficient grease in bearing.	Add grease until cavity is approximately $^3/_4$ filled.
	Dirt in bearing.	Clean bearing cavity and bearing. Repack with correct grease until cavity is approximately $^3/_4$ filled.
Vibration	Misalignment.	Check and align motor and driven equipment.
	Rubbing between rotating parts and stationary parts.	Isolate and eliminate cause of rubbing.
	Rotor out of balance.	Have rotor balance checked are repaired at your Baldor Service Center.
	Resonance.	Tune system or contact your Baldor Service Center for assistance.
Noise	Foreign material in air gap or ventilation openings.	Remove rotor and foreign material. Reinstall rotor. Check insulation integrity. Clean ventilation openings.
Growling or whining	Bad bearing.	Replace bearing. Clean all grease from cavity and new bearing. Repack with correct grease until cavity is approximately $^3/_4$ filled.

Suggested bearing and winding RTD setting guidelines for Non-Hazardous Locations ONLY

Most large frame AC Baldor motors with a 1.15 service factor are designed to operate below a Class B (80°C) temperature rise at rated load and are built with a Class H winding insulation system. Based on this low temperature rise, RTD (Resistance Temperature Detectors) settings for Class B rise should be used as a starting point. Some motors with 1.0 service factor have Class F temperature rise.

The following tables show the suggested alarm and trip settings for RTDs. Proper bearing and winding RTD alarm and trip settings should be selected based on these tables unless otherwise specified for specific applications.

If the driven load is found to operate well below the initial temperature settings under normal conditions, the alarm and trip settings may be reduced so that an abnormal machine load will be identified.

The temperature limits are based on the installation of the winding RTDs imbedded in the winding as specified by NEMA. Bearing RTDs should be installed so they are in contact with the outer race on ball or roller bearings or in direct contact with the sleeve bearing shell.

Winding RTDs – Temperature Limit In °C (40°C Maximum Ambient)

Motor Load	Class B Temp Rise ≤ 80°C (Typical Design)		Class F Temp Rise ≤ 105°C		Class H Temp Rise ≤ 125°C	
	Alarm	Trip	Alarm	Trip	Alarm	Trip
≤ Rated Load	130	140	155	165	175	185
Rated Load to 1.15 S.F.	140	150	160	165	180	185

Note: • Winding RTDs are factory production installed, not from Mod-Express.
• When Class H temperatures are used, consider bearing temperatures and relubrication requirements.

Bearing RTDs – Temperature Limit In °C (40°C Maximum Ambient)

Bearing Type Oil or Grease	Anti-Friction		Sleeve	
	Alarm	Trip	Alarm	Trip
Standard*	95	100	85	95
High Temperature**	110	115	105	110

Note: * Bearing temperature limits are for standard design motors operating at Class B temperature rise.
** High temperature lubricants include some special synthetic oils and greases.

Greases that may be substituted that are compatible with Polyrex EM (but considered as "standard" lubricants) include the following:

- Texaco Polystar
- Rykon Premium #2
- Chevron SRI #2
- Mobilith SHC-100
- Pennzoil Pennzlube EM-2
- Chevron Black Pearl
- Darmex 707
- Darmex 711
- Petro-Canada Peerless LLG

See the motor nameplate for replacement grease or oil recommendation.
Contact Baldor application engineering for special lubricants or further clarifications.

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4053-92 STREET
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FAX: 780-438-2600

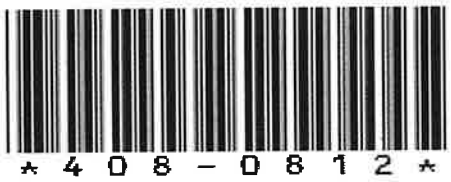
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FAX: 905-829-3302

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MN408
8/12

PROXIMITY SENSOR
APPENDIX INFORMATION

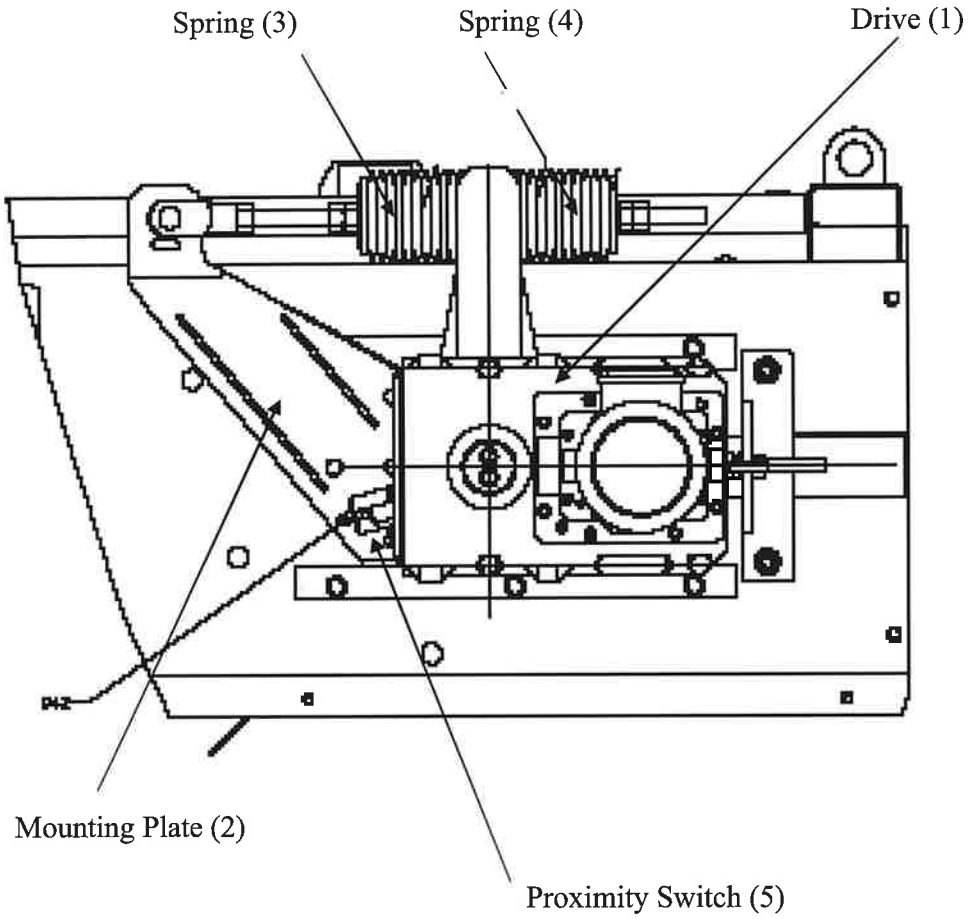
(1x) HOME POSITION

(1x) OVERTORQUE PROTECTION

TYPE: (2x) IFM NF500A

DESCRIPTION: RakeMax Overtorque Protection

The RakeMax is equipped with a mechanical overload protection. The drive assembly (item 1) is mounted to a plate (item 2) which is hold in position by springs (item 3 and 4). The springs are adjusted at the factory to hold the position as long the torque rating of the motor is not exceeding the maximum. The position is indicated by a proximity switch (item 5). The signal of the proximity switch is sent to the control system (PLC) and the system is operating as long the position indication is correct.

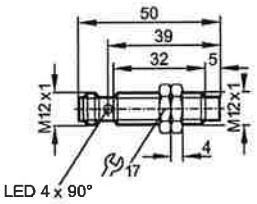


As soon the torque rating is exceeding the maximum the spring is not able anymore to hold the drive assembly in its original position. The plate will move and therefore the proximity switch is loosing the signal because it is moving away from the tag. The PLC is stopping the screen immediately to avoid any damage to the drive and the rake system of the RakeMax.

Overtorque
Proximity Switch
499391 GR ThyssenKrupp Nirosta 4307/4301 3C/2B 1.25 20348 499391 GR

NF500A

Inductive sensors



Made in Germany

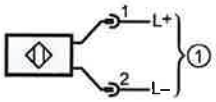
Product characteristics		
Inductive sensor		
Metal thread M12 x 1		
Connector		
ATEX approval		
Group II, category 1D		
Group II, category 1G/2G		
Sensing range 7 mm; [nf] non-flush mountable		
Electrical data		
Electrical design		Connection to certified intrinsically safe circuits with the max. values U = 15 V / I = 50 mA / P = 120 mW
Nominal voltage	[V]	8.2 DC; (1kΩ)
Supply voltage	[V]	7.5...30 DC; when used outside the hazardous area
Current consumption	[mA]	< 1 *)
Protection class		III
Outputs		
Output function		normally closed
Current rating	[mA]	< 30; when used outside the hazardous area
Switching frequency	[Hz]	700
Range		
Sensing range	[mm]	7
Real sensing range (Sr)	[mm]	7 ± 10 %
Accuracy / deviations		
Correction factors		mild steel = 1 / stainless steel approx. 0.7 / brass approx. 0.5 / Al approx. 0.4 / Cu approx. 0.3
Hysteresis	[% of Sr]	1...15
Switch-point drift	[% of Sr]	-10...10
Environment		
Ambient temperature	[°C]	-20...70
Protection		IP 67
Tests / approvals		
Approval		BVS 04 ATEX E 091 X IECEx BVS 06.0003
Marking of the unit		Ex II 1D Ex iaD 20 T 90°C Ta: -20...70°C Ex II 1G Ex ia IIC T6 Ta: -20...55°C Ex II 2G Ex ia IIC T6 Ta: -20...70°C Ex Ex ia IIC T6 zone 0 Ta: -20...70°C
EMC		EN 60947-5-6

NF500A

Shock / vibration resistance		30g (11 ms) / 10-55 Hz (1 mm)
MTTF	[Years]	3119
Safety classification		
Internal capacitance	[nF]	< 210
Internal inductance	[µH]	< 145
Mechanical data		
Mounting		non-flush mountable
Housing materials		brass special coating; active face: PBT; connector: PA
Weight	[kg]	0.061
Displays / operating elements		
Output status indication	LED	yellow (4 x 90°)
Electrical connection		
Connection		M12 connector

Wiring





1 = connection to NAMUR-amplifier

Accessories	
Accessories (included)	2 lock nuts
Remarks	
Remarks	*) damped; (> 2.1 mA undamped)

CE

ifm electronic

Operating instructions
Inductive proximity sensors NAMUR
NF****/ NG****/ NI****/ NM****

UK

704536/00 12/2008

Operating instructions (safety-related part ATEX)
Information on the safe use in hazardous areas

Function and features

- Use in hazardous areas according to the classification
  II 1G / 2G (Group II, category 1G / 2G, apparatus for gas atmosphere).
  The standards EN 60079-0, EN 60079-11, EN 60079-26 and EN 60947-5-6 are applied.
- Use in hazardous areas according to the classification
  II 1D (Group II, category 1D, apparatus for dust atmosphere).
  The unit conforms to the requirements of EN 61241-0, EN 61241-11 and EN 60947-5-6.
  EC type test certificate

BVS 04 ATEX E091X

- Marking

Ex II 1G Ex ia IIC T6 CE 0158 Ex II 1D Ex iaD 20 T 90°C	Ta: -20°C...55°C Ta: -20°C...70°C	NF500A, NF501A NG500A, NG501A
Ex II 1G Ex ia IIB T6 CE 0158 Ex II 1D Ex iaD 20 T 90°C	Ta: -20°C...55°C Ta: -20°C...70°C	NI500A, NI501A
Ex II 2G Ex ia IIC T6 CE 0158 Ex II 1D Ex iaD 20 T 90°C	Ta: -20°C...70°C Ta: -20°C...70°C	NF500A, NF501A NG500A, NG501A NI500A, NI501A
Ex II 2G Ex ia IIB T6 CE 0158 Ex II 1D Ex iaD 20 T 90°C	Ta: -20°C...70°C Ta: -20°C...70°C	NM500A, NM501A

Installation / Setup

Only qualified staff with a knowledge of protection classes, regulations and provisions for apparatus in hazardous locations may install, connect and set up the units.
Check whether the classification (see „Marking“ above and marking on the unit) is suitable for the application.

- Sensor connection: Only to intrinsically safe certified circuits or evaluation amplifiers which do not exceed the following maximum values of the units:

Ui = 15 V, Ii = 50 mA, Pi = 120 mW

- Maximum effective internal inductance (Li) and capacitance (Ci) per sensor:

Article no.	Internal inductance in µH	Internal capacitance in nF
NF500A	145	210
NF501A	115	210
NG500A	85	200
NG501A	190	200
NI500A	120	250
NI501A	210	230
NM500A	450	250
NM501A	710	220

Installation remarks / Mounting

- Adhere to the relevant national regulations and provisions.
- The unit must conform to the corresponding installation regulations.
- Avoid electrostatic charging from housings and cables.
- When used in zone 0, the sockets must be protected against intensive electrostatic charging.
- To avoid electrostatic charging steps must be taken to ensure the equalisation of potential of metal parts (plug housing, fixing elements, etc.).
- Protect the units efficiently against damage.
- The units must not be installed in the partition between different zones.

Special conditions for safe operation

- Always refer to the operating instructcions as space restrictions may not allow all markings to be applied to the unit.

Maintenance / Repair

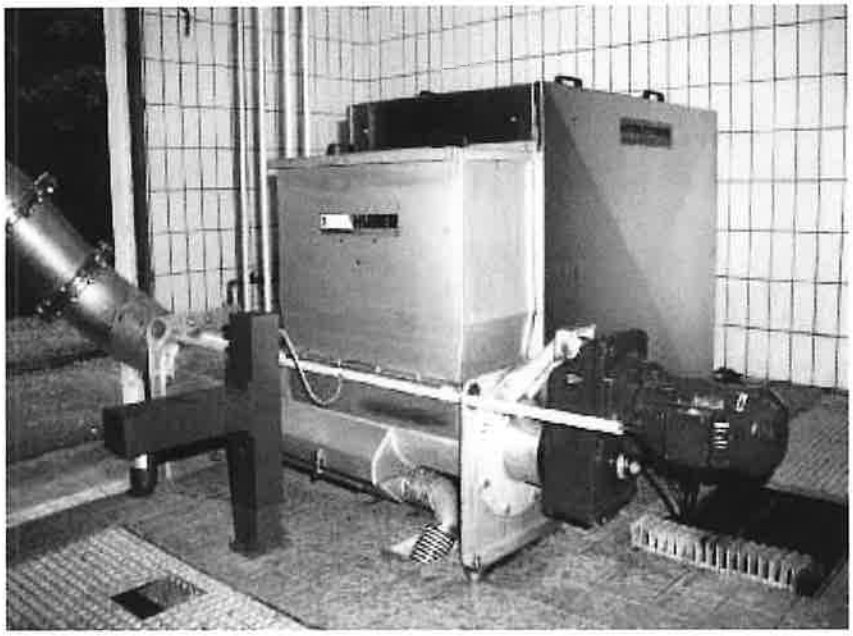
The unit must not be modified nor can it be repaired. In case of a fault please contact the manufacturer.
If needed, you can obtain data sheets or EC type test certificates from the manufacturer.

TAB 5

HUBER TECHNOLOGY
WASTE WATER Solutions

Operating Instructions

HUBER Screenings Wash Press WAP



HUBER TECHNOLOGY, Inc.

9735 NorthCross Center Court STE A
Huntersville, NC 28078

Original operating instructions
HHUSA Version 04/13

Screenings Wash Press WAP



NOTICE

This manual is part of the machine and must be available for the operators any time.
The safety instructions must be observed.
In case of selling the machine, the manual must be included.

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1 Product Specification

1.1 Intended use

The plant is designed to be used for washing the soluble organic components (feces) out of the screenings, for dewatering them afterwards and for compaction and final transport into a container.

For screenings washout the plant is **applied**:
- in wastewater treatment plants (municipal and industrial)
- for industrial process and partial flows

The intended use also includes:
- Observance of the start-up, operation and maintenance conditions as set out in these operating instructions
- Taking foreseeable malpractice into account
- Operation by **skilled workers** only (who are familiar with the correct procedures and know the dangers)

⚠ WARNING

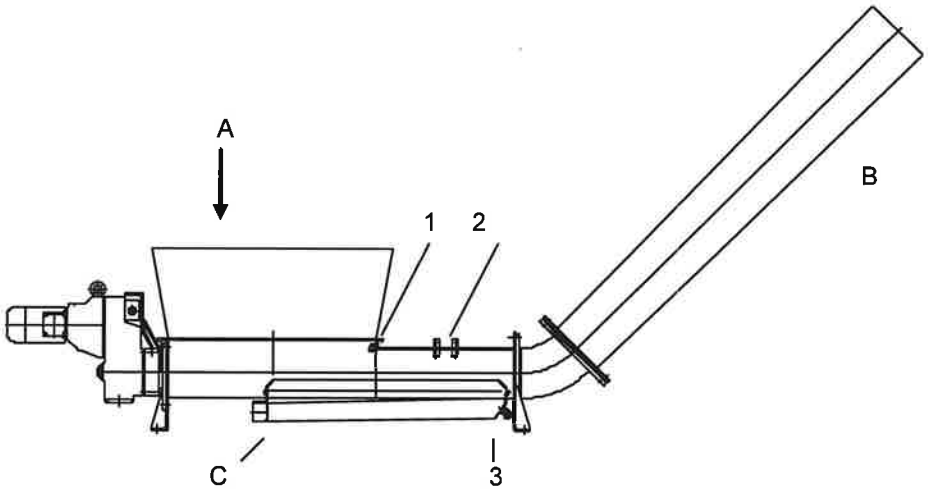
The machine is intended exclusively for the above specified use.
Any additional use or rebuilding of the equipment without prior written approval by the manufacturer does not comply with the intended use.
The manufacturer will not assume liability for consequential damage. The operator alone will bear the risk.
Do not start up the machine before there has been ensured that all safety devices are completely mounted and operable, and that the plant into which the machine may be incorporated complies with the rules.

The machine is suitable to be used in Class 1 Division 1 areas.

1.2 Definition of terms for machine components

Definition of terms:

Terms for equipment components according to the following drawing



A Feed trough (unwashed screenings)
B Screenings discharge (washed and compacted screenings)
C Wash and press water outlet
1 Wash water into the trough
2 Wash water into the rising pipe
3 Wash water for pan wash

These components form the machine body to which optional equipment can be attached. The Wash Press is driven by a gear motor with hollow shaft.

1.3 Specification of plant components

Components of the stationary equipment and their functions:

Machine body.
The rising pipe is the central and stationary component and therefore has a stable design:

- Internal guide bars prevent that the screenings fed into the trough turn with the screw.
- The front plate is the bottom end of the trough, in which the bottom bearing is installed. The bottom bearing consists of a bearing bush and is covered by double lip sealing rings.
- The press zone, where the screenings are dewatered, is situated at the discharge side prior to the screenings discharge pipe. The bottom of the trough is perforated to enable water or wash water from screenings washing to run off.
- The wash water collecting trough is situated underneath and equipped with a wash water connection and water outlet.
- Screenings are discharged through the discharge pipe that is flanged to the discharge end.

Gear motor:
The gear motor is directly flanged to the rising pipe. The torque is transferred onto the shaft pivot by means of an adjusting spring connection. The gear motor has also the function of the axial and radial drive-end bearing of the screw.

Components of the rotating parts and their functions:

Auger:
- The central screw shaft transmits the torque onto the compacting screw.
- The top and bottom shaft pinions are secured by adjusting springs.
- A stainless steel sleeve on the discharge end bottom shaft pinion is provided for wear protection.
- The axial screw bearing is a roller bearing.
- The screw flights have a different design and pitch and end at the discharge section.

1.4 Functional description

The Wash Press is designed to wash out soluble organics (feces) from the screenings in one process step. Then, the screenings are dewatered, compacted and transported.
The plant is fed directly from a screen (drum, step, travelling, or bar screen) or a separate feed unit (screw or belt conveyor).

The screenings to be treated are discharged into the Wash Press via the feed trough. A certain amount of screenings starts the washing and compacting screw which transports the screenings into the closed pipe. At the same time, a washing cycle starts, i.e. wash water is introduced into the trough and closed pipe. As an option, the wash water can be added also via the compacting screw. To optimize washing, the conveying screw can be operated in an impulse/pause mode. The design of the screw is able to increase the surface of the soluble components (feces) in the screenings, thus achieving an optimal washing degree. The wash water together with the washed-out components flows through the screening area of the rising pipe and is returned into the waste water flow in the inlet of the sewage treatment works. The washed screenings are then dewatered, compacted and conveyed into a skip by means of a conical discharge pipe.
The screenings discharge construction can be adjusted to the individual local requirements. The complete plant together with the screen can be installed as a completely encased unit and is thus entirely hygienic.

When using solenoid valves, we recommend using filtered service water. The wash water demand depends on the individual setting and the requested washing result.

Optional equipment:

- Automatic pan washing reduces the required cleaning work.

Supply limits:

Mechanical:
- Feed trough
- Screenings discharge pipe
- Lifting eyes on the machine:
- Wash water distributor

Electrical:
- Screws in the terminal box; the correct type of connection (star or delta) can be read from the identification plate.
- Terminal block inside the control panel

1.5 Functional description of components

1.5.1 Bagging unit

The screenings are discharged into a plastic bag fixed at the discharge of the screen. The bagging unit reduces odor annoyance as would be caused by screenings lying in the skip or container.

Design of the bagging unit for endless bags:
The bagging unit consists of a transition piece to take up the folded 295 ft (90 m) long plastic bag. When you replace the skip, pull the bag (Longo-Pack bag, article no. 706880) approx. 1 ft (30cm) downwards. Lace the bag and cut it through above the knot. Lace also the end that hangs down so that the hose can again be filled with screenings.

Switch off the machine prior to replacing the bags and wear gloves!

2 Safety

2.1 General safety instructions

⚠ DANGER

„DANGER" indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

„WARNING" indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

„CAUTION" indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE

„NOTICE" indicates a property damage message. Follow notices to avoid material damage!

These operating instructions have to remain attached to the machine. It must be made sure that the operating instructions are ready to hand any time for any person that has to perform work on the machine. In addition to these operating instructions, instructions in the sense of the labor protection law and ordinance regulating the use of tools have to be available.
As these operating instructions contain fundamental instructions to be observed when installing, operating and servicing the machine, the responsible staff must read the instructions prior to machine installation and start-up. The operating instructions must at any time be available ready to hand at the installation place of the machine/plant. Not only the general safety instructions contained in this chapter have to be observed but also the special safety instructions added under the main items.

2.1.1 Operator's duty of care

The plant has been constructed and manufactured taking into consideration a risk analysis and after careful selection of the applicable harmonized standards and other technical specifications. The machine complies with the state-of-the-art technology and offers a maximum amount of safety.

To achieve such safety in practical operation, it is however necessary to take any measures required therefore. It is the operator's duty of care to plan these measures and control their implementation.

The operator must especially ensure that

- The equipment is applied according to its intended use (see chapter Product Specification)

- The equipment is operated only in a perfect ready-to-operate condition and especially the safety devices are regularly controlled.
- Protective gear for the operating, maintenance and repair personnel is available and used.
- These operating instructions are permanently available on site complete and in a legible condition.
- Only sufficiently qualified and authorized personnel are in charge of machine operation, maintenance and repair.
- Such personnel receive regular briefing concerning all questions of safety and environmental protection and know these operating instructions, especially the safety instructions contained.
- Any safety and warning symbols attached to the machine remain there in a legible condition.

2.1.2 Definition of safety symbols



⚠ WARNING

Occupational safety symbol
This symbol will accompany all safety instructions that are associated with risks to life and/or limb. Follow these instructions and proceed carefully! At the same time, follow all applicable laws, general safety and accident prevention regulations.



⚠ WARNING

Electric current warning
This symbol warns of electric current. Prior to performing any work, switch off mains isolator and make sure that the system is off-circuit.
At the same time, follow all applicable laws, general safety and accident prevention regulations.



⚠ WARNING

Be careful not to get caught when starting up, servicing or repairing the machine!

NOTICE

This symbol is found where special attention is required to ensure compliance with instructions concerning correct operating sequences to prevent damage to the machine or its function.

Instructions directly attached to the machine, e.g.
- Instructions and warning signs
- Labels for liquid connections
- Arrow showing the direction of rotation

must be strictly followed and kept in absolutely legible condition.
Signs or labels that have become illegible must be replaced immediately.

2.1.3 Qualification and training of personnel

Only well-trained and briefed persons who know these operating instructions and act according to these instructions are authorized to operate the machine. The individual areas of

responsibility of operating staff must be defined clearly. The area of authority, responsibility and control of the personnel must be precisely regulated by the operator. The operator must further ensure that the personnel have fully understood these operating instructions.
Personnel being trained must in the beginning work under the supervision of an experienced person. The completed successful training and briefing must be confirmed in writing.

Any electrical control and safety devices must generally be operated by instructed and authorized persons only.

Any person performing work on the machine must read these operating instructions and confirm by signature that the operating instructions have been understood.

2.1.4 Safety instructions for maintenance, inspection, installation

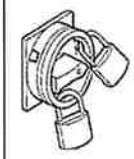
Any maintenance work must be carried out by qualified staff only.
Any inspection and installation work must be carried out by authorized and qualified staff only.

Work on the plant may only be carried out after the plant has been isolated.

Enclosed rooms of wastewater treatment plants that must be entered for service and maintenance have to be aerated in a way that prevents a dangerous explosive atmosphere, lack of oxygen and presence of harmful concentrations of gas or vapor.

⚠ WARNING

Secure the machine against unexpected start in case of open access to the screenings discharge resp. secure the access to this danger area before changing the screenings container or doing maintenance work or disassembling on a downstream machine.



⚠ WARNING

Shutdown procedure: Switch off mains isolator and lock it.
Each person who is commissioned to perform maintenance work on the machine must have his own padlock. Starting the machine is only possible when all padlocks on the mains isolator have been removed.

Do not immediately re-start the machine, if the reason why it has stopped is unclear. Somebody could have stopped the machine in order to make a manual adjustment and may have forgotten to secure it against starting. The unexpected start could result in serious injury of personnel.

It is in your own interest to clean the machine prior to working on it to prevent the danger of infections.

⚠ CAUTION

Always protect yourself by means of waterproof protective gear, boots, gloves, and, if possible, also by face protection during cleaning of the machine - especially if a high pressure cleaner is being used – to avoid being hit by waste water, organic material, etc.

Re-attach all safety equipment, covers, grates completely to their original place and assure that they are properly and completely reattached.

Use only tools and means that are expressly intended for such work.

Before starting the machine again, check the items mentioned in chapter *Start-up*.

2.1.5 Other dangers

Other dangers are potential, non-apparent dangers.

Despite all precautions taken, there are other dangers, such as:

- To be caught by unintentional movements of the machine
- To slip on wet or dirty ground
- Danger of falling in front of or onto the machine during maintenance work
- Malfunctioning control
- Allergies and irritations caused by contact with waste water or screenings
- Infections caused by bacteria or pollution
- Explosions or fire caused by gas or fumes
- Increased water passage after heavy rainfall for example

2.1.6 Unauthorized rebuilding and production of spare parts

Alterations or changes to the machine:

For safety reasons, it is not permitted to make unauthorized alterations or changes to the machine. This applies also to welding work on bearing components.

Any intended modifications, alterations or changes require the prior written consent of Huber Technology.

Use only original spare parts, original wearing parts and original accessories as these are especially designed for the machine. Components purchased from other sources give no guarantee that they have been designed and manufactured to suit the specific operating and safety requirements.
Components purchased from other sources give no guarantee that they have been designed and manufactured to suit the specific operating and safety requirements.

2.2 Machine identification

Any specifications made in these operating instructions apply to only the type of machine that is named on the title page.
The identification plate is attached to the screenings discharge and specifies the following.

- Name and address of supplier
- Serial name and type, optionally serial number
- Year of manufacture

Always forward the machine type, year of manufacture and order number when inquiring or ordering spare parts to ensure perfect and prompt processing or your queries and orders.

2.3 Incorporated safety systems

The incorporated safety systems are subject to regular checkups.

Mains isolator
The mains isolator is located on the control panel and disconnects/connects the machine from/with the mains supply.

Padlock the mains isolator after switch-off prior to performing service or repair work.

Emergency cutoff circuit
The machine is included in an emergency cutoff circuit.
The emergency cutoff switch is located on the control panel and/ or local control station.
Whenever the emergency cutoff switch is operated, the machine or complete plant including incorporated units will be set into a safe operating state.

Motor temperature control
The machine is equipped with a thermostat for motor temperature control with overload protection. The motor of the machine is switched off in the event of too much heat built-up. The overcurrent safety device using a thermal delay mu st be set to disrupt the drive motor from the power system within the delay $t_{E..}$

Plant control
Internal plant control includes a 4-conductor feed system, 3 phase, with separate earth line with GREEN line coating.
Additionally earth the machine casing for potential equalization



⚠ WARNING

Control panels can only be opened by an authorized person. Take care that doors of control panels are only opened by skilled staff for maintenance work and fault detection, otherwise the doors must stay locked.

NOTICE

These operating instructions are part of the machine and have to be available for the operating staff at any time.
The safety instructions contained must be observed.
It is strictly prohibited to override any safety instructions or change the mode of action of safety instructions.

2.4 Safety measures

It is the operator's responsibility to instruct his operating and servicing staff concerning:

- Protective devices on the machine,
- Control of observance of safety measures.

This copy of operating instructions has to be stored to be at hand when needed in the future. Observe the intervals for inspection and control measures! In these operating instructions, the work is described so that it can be understood

- **by an instructed person** (referring to chapter *Operation and operation modes*
- by skilled staff (referring to chapters Transport, Installation, Maintenance, Trouble Shooting and Repair).

The chapters ***Transport, Installation, Maintenance, Trouble Shooting and Repair*** are intended **for skilled staff only**. Any work described under these chapters must be performed by skilled staff only.

Instructed person
An instructed person is a person that has been instructed by a skilled person, and trained if necessary, about the assigned jobs and possible risks arising from improper performance and informed about necessary protective devices and protective measures.

Skilled persons
Skilled persons are persons that are able to evaluate assigned jobs and recognize possible risks, due to their professional skills, expertise and experience and knowledge of corresponding standards.

2.5 Operator's duty of care

The operator has to obtain the local operating license and observe the respective requirements.

In addition, the operator has to observe the local laws concerning

- Safety of personnel (accident prevention regulations)
- Safety of work equipment (protective gear and maintenance)
- Product disposal (Waste Management Law)
- Material disposal (Waste Management Law)
- Cleaning (cleaning agent and disposal)
- Environmental compliance

Connections:
The operator has to ensure before start-up of the machine, if installation and start-up are performed by the operator himself, to comply with local standards (such as for electrical connection for instance).

NOTICE

Lighting
The operator has to provide sufficient and equal lighting in all areas of the plant. The recommended illumination level is 300 lux.

3 Handling and Transporting

Observe the following points to avoid damage to the machine or persons when handling the equipment:

- Only qualified persons are permitted to perform transport work, observing the safety instructions.
- Lifting and righting of the equipment must be done only by the lifting eyes provided.
- Use only the lifting devices specified hereunder to transport the machine.

Read also the chapter General Safety Instructions.

3.1 Dimensions and weight

The plant is available in different sizes. The machine size and arrangement are adjusted to suit specific site requirements (available space, channel depth, discharge height).

The dimensions are specified in the installation drawings in TAB 8.

The weight of the press depends on the machine size and design. The weight of this unit including discharge pipe is located on the installation drawings in TAB 8.

All weights apply to machines without extra equipment for outdoor installation or any other optional equipment. **Project specific weights of each machine can be found on the installation drawings in TAB 8.** The machines are packed on palettes for trucking, and in sea-water-proof boxes for sea transport.

3.2 Permitted transport devices and auxiliaries

⚠ CAUTION
Have transport and unloading done by experienced experts only.

Fork lift or building machine of sufficient lifting capacity to handle the weight and size of the equipment, to be operated by qualified personnel only. Rope slings or straps of required load bearing capacity. Prior to unloading, remove the small parts supplied with the machine, such as supports, from the transport rack.



⚠ WARNING

Attachment: Hook shackle, load hook etc. into the lifting eyes on the upper side of the plant. Fixing points are marked with the symbol LIFT HERE (as illustrated here). The ropes of the lifting device must hang freely and must not be attached more than 60° from the vertical. The machine must hang horizontally during unloading.

Never wrap a chain around the machine as this may slip and cause the machine to tilt over. In addition, the machine will rust on those points where it gets into touch with black steel if it is not re-pickled.

Inspect all materials for damage before and during unloading. Any transport damage found should be noted on the bill of lading and the forwarder and manufacturer/supplier notified immediately.

NOTICE

Make sure the delivery is complete by carefully checking all received materials against the bill of delivery.

3.3 Storage

When selecting the storage place take care that the components cannot be damaged by vehicles or careless working. Make sure the components cannot get dirty due to splashes of concrete or mortar and protect the machine against spark fountains from angle grinders etc. Cover the motor (in order to avoid ingress of water) on machines stored outdoors, but do not wrap it. Never expose the control panel to rain (temperature down to 23°F / - 5°C is permissible).

3.4 Transport to the installation place

As the situation and possibilities are different on each individual site, we cannot provide exact installation instructions. This work must be carried out by qualified fitters.

You always need lifting equipment for transporting the machine from the intermediate storage place to the installation place because of the machine weight.

As lifting equipment up to the building are used: caterpillars, power shovel, cranes etc. dependent on the access ways. Lifting equipment mostly used in a building is: Polyester slings, tripods, chain tackle block, fork lift, transport rollers, tackles.

⚠ CAUTION

Wear safety shoes with steel caps to prevent injuries.



⚠ WARNING

Always stand clear off a suspended load!

Unpacking:

Do not loosen the clamping bands or steel ropes before the machine is right in its installation place.

4 Installation

Observe the following safety instructions when installing the machine to avoid critical injuries, damage to the machine and other damage.

- Only qualified persons are permitted to perform installation work, observing the safety instructions.
- Check the machine for transport damage prior to starting with any installation work.
- Make sure that only authorized persons have access to the working area and that installation work does not endanger any other persons.
- When laying machine connections, make sure that no one can trip over laid cables, hoses, pipelines, etc.
- Observe the prescribed bending radii when laying cables/hoses/pipelines.
- Observe the instructions for operating media, lubricants, auxiliary material used.

Read also the chapter *General Safety Instructions*.

4.1 Acceptable environmental conditions

The machine is manufactured for installation in a building or for outdoor installation as specified by the customer.



⚠ CAUTION

Stainless steel parts can get very hot in case of heavy solar radiation, danger of burning.

Frost protection:
Machines without trace heating and insulation and/or casing must not be operated in winter due to the danger of freezing. Appropriate measures must be taken (e.g. complete emptying) to ensure that the machine cannot freeze.

Protection against dust and water:
As the atmosphere in the buildings is permanently humid, the equipment is designed to resist these conditions.

All components in contact with water and solids are made of stainless steel which is insusceptible to moisture and wetness.
The gear motors are made for IP 65 and are therefore protected against permeation of dust and spray water from any direction.
The solenoid coils, if fitted to the machine, also provide IP 65 protection.

Protection against explosion:

Gear motor	Class 1 Division 1
Solenoid valves	Class 1 Division 1

Lighting
The lighting must make safe working on each part of the plant possible without any risk.

NOTICE

Lighting
The operator has to provide sufficient and equal lighting in all areas of the plant. The recommended illumination level is 300 lux.

4.2 Site requirements

Cover the channel in the installation area and fix a railing along open channel sections.

There must be enough space available around the machine for repair and maintenance work.
Required minimum **distance** to the machine:

- 3.3 ft (1 m) at the side
- 5 ft (1.5 m) in front of
- 8.2 ft (2.5 m) behind the machine

Make sure the door/gate in the building offers sufficient space to pass the machine. It is recommended to attach a suitable mounting support to the ceiling, in the direction of the machine's axis.

Static dimensioning of the points where the machine is supported on the floor or top of the channel must be carried out according to the weights specified in the manufacturer's data sheet.

4.3 General instructions for installation

Installation must be carried out in accordance with these instructions if installation is not part of the supply contract with Huber Technology. If installation is not performed by Huber Technology, Huber Technology cannot accept responsibility for incorrect offloading or installation.
Installation must be performed by qualified and experienced personnel.

Prior to installation:

- Completely read these instructions. They contain important information how to prevent damage caused by lack of knowledge.
- Approach roads must be provided so that the machine can be installed either by means of a crane in case of outdoor installation or by a lifting truck and rollers as well as by lifting chain block or hoist in case of installation in a building.
- Electrical power must be provided to be available on site at the installation date.

Preliminary work:

- If it is an installation in a building, make sure a mounting support is fitted centrally above the installation place.
- Prepare a closable water supply line exiting from the bottom (see installation drawing).
- Prepare sufficiently sized cable ducts for electrical installation from the control panel to the machine. (For details see installation drawing).

Preparatory work:

- Check all assembly and fixing material making sure it is complete.
- Prepare all material necessary for water connection.
- Prepare all cables according to the cable list (see wiring diagram) and all necessary small material.
- Prepare lifting device that is able to lift the load during installation.
- Clean the installation place with a broom before installation in order to prevent injuries caused by slipping.

4.4 Assembly and installation

4.4.1 Mechanical installation

General instructions:

- Fix lifting devices (2 chain hoists or similar) to the prepared installation supports over the installation place. If necessary, prepare points of suspension with required load bearing capacity and arrange in such a way that the plant can hang above the installation area without manual moving.
- Fix safety load hooks to the transport eyes, or rope straps to the machine and lifting device.

NOTICE

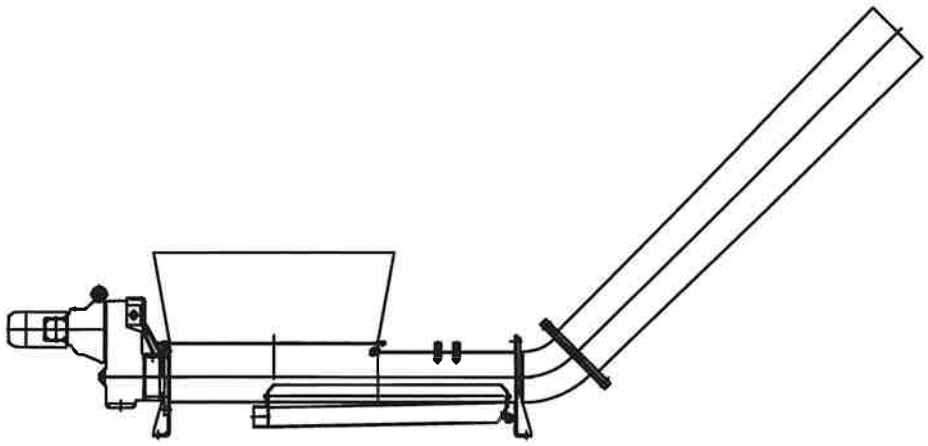
Blow the holes for the stainless steel plugs under pressure after drilling (using bellows, air pump, etc.) to ensure a professional durable adhesive joint.

Use grease for all unlockable screws, thus providing a durable mobility of thread.

How to proceed:
Make sure that the machine is standing on firm horizontal ground. Static dimensioning of the points where the machine is supported on the floor or top of the channel must be carried out according to the weights specified in the manufacturer's data sheet. Faulty fixing may cause damage to the machine.

The discharge pipe design must be adjusted to suit the individual situation. The pipe weight should never be transferred onto the Wash Press. The maximum loads of 1000 N horizontally and 2500 N vertically must not be exceeded. The discharge pipe must be manufactured in a cone shape and supported on the floor.

Contact Huber Technology if you have critical applications or dimensioning cases. Faulty dimensioning and installation may lead to damage of the machine.



Sealings must be clamped in between the flange connections to avoid leakage of wash water and press liquor.

Make sure that the discharge pipes are screwed tight and the support is able to bear the necessary load. Note: The weight of the pipes multiplies when they are filled with screenings.

Connect the wash water feed line. Preferably use flexible hoses which are tested suitable for 145 PSI (10 bar). Take care that the hoses are laid in such a proper way that they cannot cause accidents or damage to the machine. Only filtered service water is allowed to be used for solenoid valves.

Mount a flexible jointing ring onto the machine flange. Put the feed trough onto the machine and screw it to the machine. Use corrosion-free M10 screws.

Then, mount the wash water outlet.

Machines that are installed outdoors must completely be frost-protected, as well as the wash water feed system, if the plant has not been designed with a heating. Frost may damage the machine and cause massive operating troubles!

Make sure the water can run off without problems via a line or hose. Backwater into the collecting trough must strictly be avoided. The outlet line should therefore have a slope of minimum 1%.

4.4.2 Electrical installation

Electrical installation to be carried out by qualified electricians only.

General:
The following instructions are offered for guidance if installation is not included in the supply contract.
If installation is not included in the supply contract, Huber Technology cannot accept responsibility for incorrect installation.

Wiring:

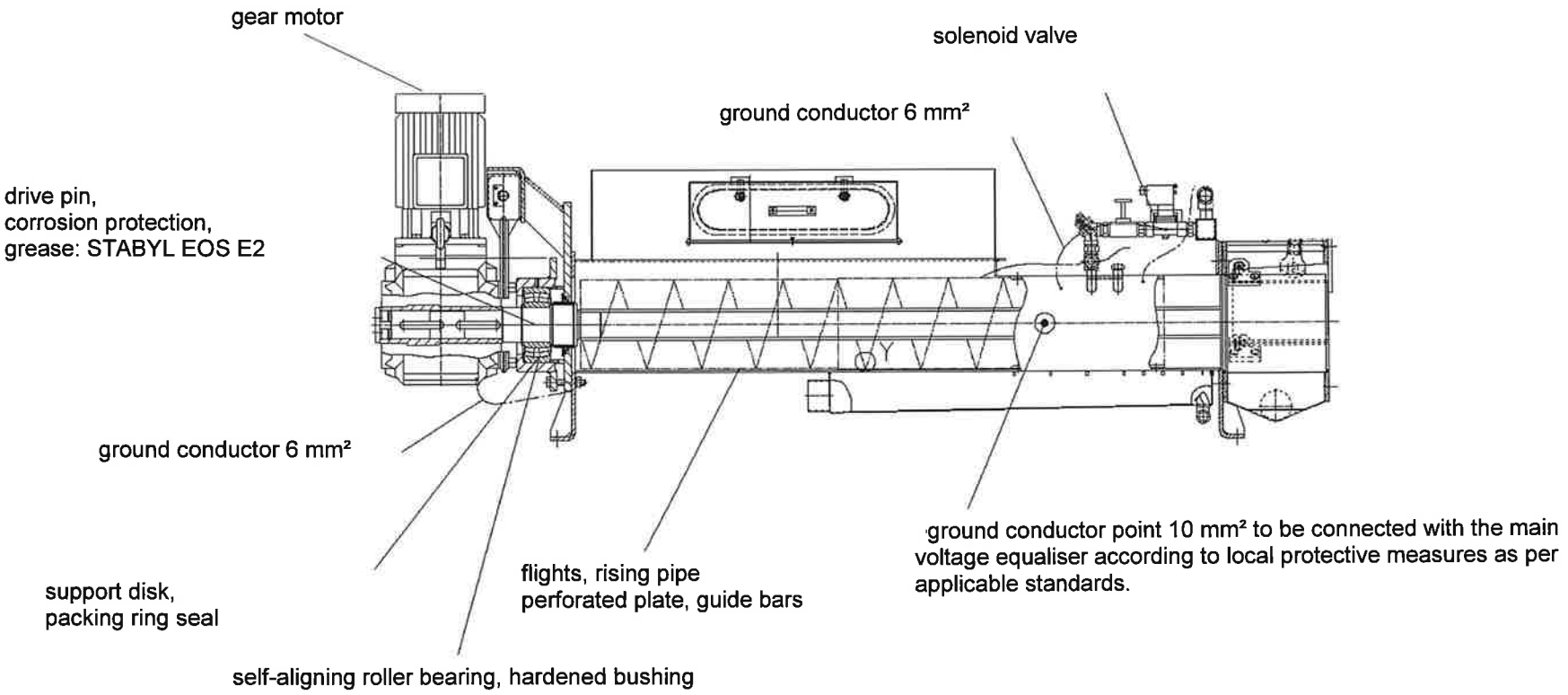


⚠ WARNING

Make sure that power supply is disconnected!
Secure this condition by appropriate measures!

- Prepare ground connection to the plant prior to beginning any other work, and ground the gear motor and solenoid valves (optional). The protection system of the terminal sockets must correspond to the protection system in which the plant has been installed. Refer to the drawing on the following page which shows the required earth connections.
- Fix the control panel with bolts in the intended position.
- Fix the adjacent control box with dowels next to / onto the machine.
- Prepare all cables between the machine, control panel and adjacent control box and connect the plant to the power supply according to the specifications in the wiring diagram.

Prior to first start and prior to recommissioning (e.g. after changing the power supply) check the rotation direction of the motors!


gear motor
solenoid valve
ground conductor 6 mm²
drive pin,
corrosion protection,
grease: STABYL EOS E2
ground conductor 6 mm²
ground conductor point 10 mm² to be connected with the main voltage equaliser according to local protective measures as per applicable standards.
flights, rising pipe
perforated plate, guide bars
support disk,
packing ring seal
self-aligning roller bearing, hardened bushing

5 Start-up

Observe the following safety instructions for machine start-up to avoid damage to the machine or injuries.

- Only qualified persons are permitted to perform start-up work, observing the safety instructions.
- Check before the first start-up that all tools and foreign objects have been removed.
- Activate all safety devices and emergency cutout switches before start-up.
- Prior to initial start-up close the water supply hose and flush the pipe network. This will prevent that pollution particles can impair the function of or damage (optional) solenoid valves.

Read also the chapter *General Safety Instructions*.

5.1 Customer-supplied connections

All customer-supplied connections must be installed on the marked positions, or at least as close as possible, according to the manufacturer's instructions respectively installation drawing.

5.1.1 Electrical connection

The electrical connections must be laid to the installation place of the control panel.

Please refer to wiring diagram in control section for further information.

5.1.2 Connection for wash water

Required operational water pressure: min. 30 psi, max. 75 psi

Water quality:
Use screened or filtered service or used water, with no particles bigger than 200 micron grain size. The water should have an as low as possible chloride and ferric oxide content and preferably a pH > 6.5.
If this is disregarded, the servo bores of the solenoid valves will clog and jet intensity reduced respectively the valves not perfectly close any longer.

Water supply line:
The wash water demand depends on the individual setting and the requested washing result.

Service water:

SV for wash water in the trough and rising pipe	approx. 13.2 gpm
SV for wash water discharge trough (pan wash)	max. amount of water

- Dimension the supply line one size bigger if the line is longer than 328 ft / 100 m (shock pressure, line loss).
- The connection in the support leg area should emerge from an adjacent wall or the floor and should be lockable.
- A water connection (not below ¾") for cleaning work, maintenance etc. is required. For very greasy wastewater a warm water connection or steam jet should be available.
- The connection must be made of high-quality rubber fabric hose or a pipe connection.
- If fresh water is used, it is necessary to provide a return flow inhibitor to prevent return flow of wastewater into the potable water network.
- If solenoid valves are used, a rubber hose is preferably recommended because its elasticity reduces shock pressures when the valve closes.

5.2 Checks prior to initial start-up

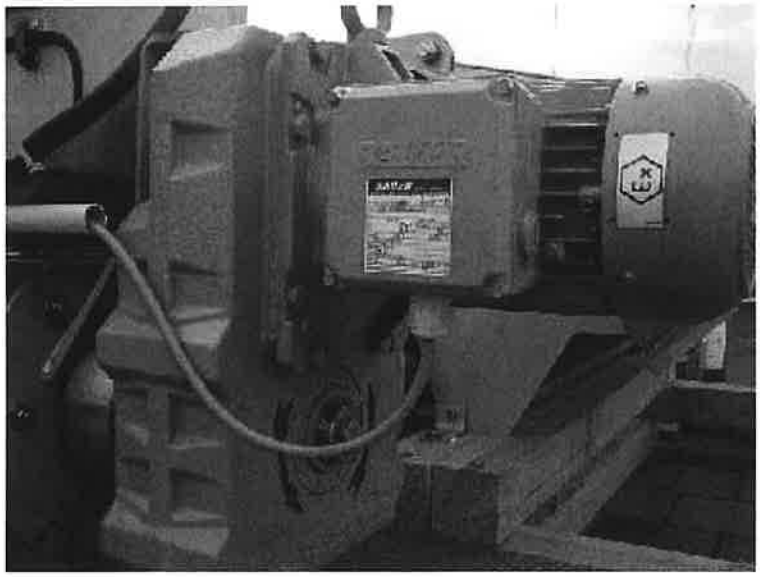
Prior to start-up:

Make yourself familiar with the
- operation and control elements of the machine
- machine equipment
- operation principle of the machine
- immediate environment of the machine
- safety devices of the machine
- measures to be taken in case of emergency

Perform the following work prior to any start-up:

- Check and make sure that all safety device are attached and in a ready-to-operate condition.
- Check the machine for visible damage and eliminate any damage found immediately or report them to the supervisory staff, as machine operation is only permitted if the machine is in a perfect condition.
- Check and make sure that authorized persons only have access to the operation area of the machine and no other persons are endangered by starting the machine.
- Remove any objects or other material from the operation area of the machine, which is not needed for machine operation.

Check that the screw-type cable fitting fits tight and re-tighten the screw, if necessary, to prevent ingress of water into the motor. (See below picture of the screw-type cable fitting.)



5.3 Start-up

- Check that the machine has been properly mounted and connected. Huber Technology will refuse any liability for improper installations.
- Check the rotating direction. The screenings must be transported towards the discharge pipe.
- Check that the switch-on commands for the Wash Press, solenoid valves and pump are carried out.
- Check the conveying direction after having started the Wash Press.
- Check whether the water feed and washing cycle work properly. Adjust the ideal volume of feed water considering that the water volume is not too big and runs off through the screening bottom without any problems.
- Check that the wash water flows back into the channel.
- Set the running time dependent upon screenings quality and pollution degree.

The Wash Press is designed for the normal application in sewage treatment works and will operate without any problems providing all peripheral conditions stipulated by the manufacturer are met (with regard to installation, electrical control, wash water volume, etc.).

Avoid to use the Wash Press if stones, grit, wood, metal pieces, or any other hard material is to be expected. Such material can lead to destruction of the machine.

⚠ CAUTION
Never grip into the machine or into the feed trough. Before any intervention, make sure that the mains isolator is switched off and starting of the machine is excluded.

6 Operation

Observe the following instructions when operating the machine to avoid damage to the machine or injuries.

- Never use the machine for any other purpose than the intended use!
- Inform yourself about the correct behavior in case of a fault prior to switching the machine on.
- Check prior to switching the machine on that the following units are in a ready-to-operate condition:
  - Protective devices
  - Emergency cutout switch

Read also the chapter *General Safety Instructions*.

6.1 Control philosophy (See TAB 2 for Project Specific Controls)

The electrical control regulates all automated functions of the plant both in automatic and hand mode. After switching the mains isolator on, the plant works in automatic mode. The control panel must be installed outside the screening room in a non-hazardous environment.

7 Troubleshooting and Repair

Symptom	Possible cause	Repair
The Wash Press does not start.	• Wrong motor voltage • No voltage	• Adjust the correct voltage. • Make sure power supply is OK and switch on mains isolator. Plant may be set on MANUAL
The motor rotates but the compacting screw does not move.	• Gearing is defective. • Auger shaft is broken.	• Replace gearing. • Weld or replace the shaft.
Motor protection and/or current relay responds.	• Compacting screw is blocked by a solid object. • Discharge pipe is clogged. • Motor protection or current relay is adjusted too low. • Electrical feed line is insufficiently dimensioned.	• Reverse screw by inching manually and remove the object. • Screw off discharge pipe and clean it. Modify discharge pipe design if necessary. • Adjust current relay. • Make sure power supply is OK.
Screenings do not move forwards although the screw is operating.	• Screenings are too sludgy or too greasy. • Press body or washing zone is clogged. • There are too many screenings per washing cycle in the trough. • Screenings are too much dewatered, which causes blockages inside the discharge pipe. • Compacting screw and/or guide bars are worn.	• Remove the materials by adding washed screenings. • Reverse the screw by inching manually and remove the blockings by adding water. • The screenings volume must be adjusted to the specific conditions. If necessary, re-adjust the wash water volume. • Adjust the discharge pipe to the specific conditions. • Replace compacting screw and guide bars.
The requested washing effect is not achieved.	• Wash water supply is interrupted (no pressure). • A solenoid valve is defective. • The regulating valves are closed. • Wash water feed line is too small. • Wash water is too dirty. • Water filter is dirty. • Water entrance openings are clogged. • The adjusted control parameters are not optimal for the specific material.	• Check wash water supply. • Check valves. • Check settings. • Lay a bigger feed line. • Find the cause. Connect to a different source. • Clean the filter. • Clean the entrance openings. • Optimize control parameters.
Screenings are not dewatered.	• The holes in the press body are blocked with dirt or grease.	• Clean with high pressure! • Remove water collecting trough. Clean dewatering holes.

	• Brush is worn (exception: size 1) • Wash water outlet is blocked.	• Replace brush. • Clean the outlet.

8 Maintenance and Repair

⚠ CAUTION

Enclosed rooms of wastewater treatment plants that must be entered for service and maintenance have to be aerated in a way that prevents a dangerous explosive atmosphere, lack of oxygen and presence of harmful concentrations of gas or vapor.

⚠ CAUTION

The chapter maintenance and repair is intended for skilled staff only.
Any maintenance or repair work must be performed by skilled staff only.
Skilled staff has to be equipped with personal protective gear (such as gloves, etc.).

Skilled persons
Skilled persons are persons that are able to evaluate assigned jobs and recognize possible risks, due to their professional skills, expertise and experience and knowledge of corresponding standards.

Regular cleaning and plant maintenance is required to ensure trouble-free plant operation.



⚠ CAUTION

Always wear protective glasses and rubber gloves if harmful materials have been processed by the machine.

The machine is subject to vibrations during operation, which may cause screw and clamp connections to get loose. To prevent damage, regularly check the machine.

⚠ CAUTION

It is essential to proceed as described under 2.1.4 when shutting down the machine prior to performing maintenance, repair or cleaning work. Use only tools and means that are expressly intended for such work.

Observe the following instructions when performing maintenance or repair work on the machine to avoid damage to the machine or injuries.

- Prior to performing any repair work, shut off a wide area around the machine.
- Switch off all voltage sources and secure the voltage sources to prevent they are unintentionally switched on again. If the machine is installed in a tank, switch off the mains switch before opening the tank.
- Never use any other than the specified operating media.
- Never use any other than the spare parts specified in the HUBER spare parts lists.

Read also the chapter *General Safety Instructions*.

8.1 Cleaning and inspection schedule

NOTICE

Check the potential equalization regularly, as described in chapter 2.3, Incorporated safety systems!

Daily:
- Check screenings container and replace or empty it if necessary to avoid back-up of screenings into the discharge unit.

Weekly:
- Lubricate the self-aligning roller bearing (two grease gun strokes).
- *Wash the pan manually, if no automatic washing takes place. Open the valve and wash for at least 30 sec.*
- Check the water supply system including the solenoid valves and wash water pump. If required, clean the water supply line.

Monthly:
- Hose down the complete plant including the inside of the trough with a high pressure cleaning device if possible. This prevents sedimentation and chloride accumulation that may lead to corrosion in the long run.
- Check the water collecting trough for sedimentation. Clean the trough.
- Check the pollution degree of the dewatering holes: Remove the water collecting trough and clean the dewatering holes with a high pressure cleaner.
- Check the oil seals of the main bearing for leakage. Replace the oil seals, if required.

Half-yearly:
- Check the compacting screw for wear. If the compacting screw / brush is worn too much, the screenings cannot be discharged and the dewatering zone not properly be cleaned any more. Replace the brush / compacting screw. Worn screws can normally be repaired in the Huber manufacturing and service facility.

Yearly:
- Check the guide bars for wear. If the bars are worn too much, the screenings will no longer be transported. Replace the guide bars.
- Check the upmost screw flight. Replace this flight, if it is worn.

⚠ CAUTION

Never use a high pressure unit to clean electrical plant equipment!

8.2 Inspection and preventive maintenance

8.2.1 Operating media and lubricant replacement

Gear motor:
The screen is equipped with a gear motor, the technical data and required lubricant amounts of which can be taken from the attached motor data sheet. The required lubricant amount is additionally specified on the identification plate. If two amounts are specified, the first refers to the main gearing whereas the second refers to the intermediate gearing.

Separate operating instructions for the gear motor are attached in TAB 6. They include a list of permissible types of lubricant.

One recommended lubricant is Kluberoil G-4-220-US (Huber Technology article #SP-KLG4220).

Under normal operational conditions it is recommended to replace the lubricant after approx. 15,000 operation hours. Independent of the operation time, lubricant replacement is recommended after 2-3 years at the latest.

8.3 Repair

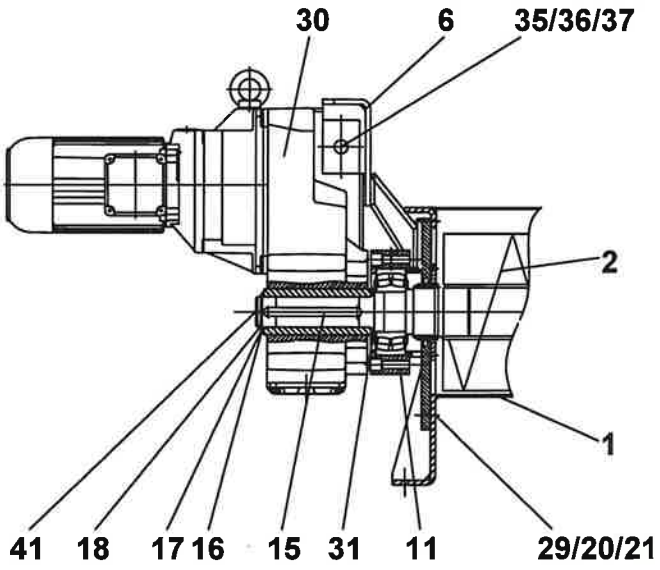
8.3.1 Gear motor replacement

Dismounting the gear motor:

- Remove the (optional) swivel joint (41), if any.
- Remove the guard ring (18), shim (17) and supporting disk (16).
- Remove the torque support / gear motor (35, 36, 37).
- Remove the gear unit (30). (Use a draw-off device, if required.)

Re-assembly of the gear motor:

- Re-assembly by proceeding in reverse order.
- Note: The shaft and gearing bore must be lubricated with a special lubricant (e.g. STABYL EOS E2 by Fuchs Lubritech) before assembly.



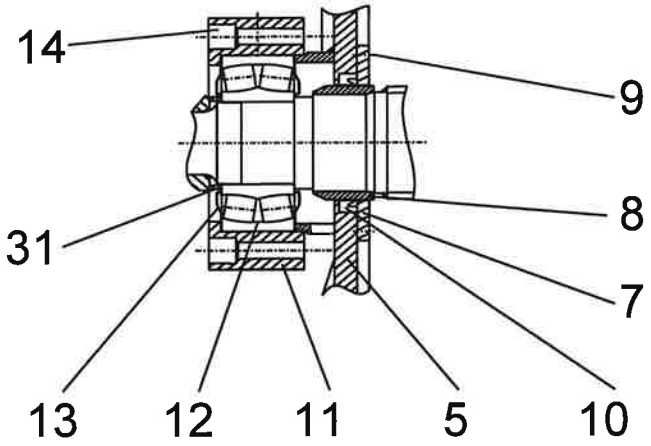
8.3.2 Dismounting and re-assembly of the compacting screw:

- Remove the (optional) swivel joint (41), if any.
- Remove the guard ring (18), shim (17) and supporting disk (16).
- Remove the torque support / gear motor (35, 36, 37).
- Remove the gear unit (30). (Use a draw-off device, if required.)
- Remove the adjusting spring (15).
- Remove the fixing screws (20, 21, 29).
- Remove the bearing with bearing shell (11) from the shaft and remove the spacer (31).
- Draw the compacting screw (2) out of the rising pipe (1).

Re-assembly by proceeding in reverse order. The shaft, gearing bore and bearing must be lubricated with a special lubricant (e.g. STABYL EOS E2 by Fuchs Lubritech) before assembly.

8.3.3 Dismounting the self-aligning roller bearing and sealing rings

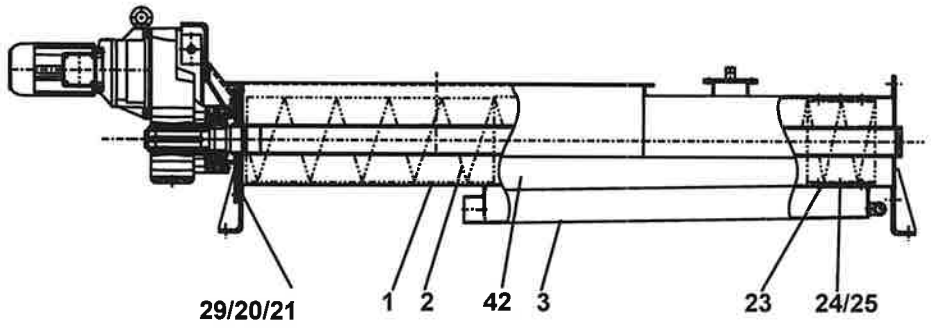
- Remove the (optional) swivel joint (41), if any.
- Remove the guard ring (18), shim (17) and supporting disk (16).
- Remove the torque support / gear motor (35, 36, 37).
- Remove the gear unit (30). (Use a draw-off device, if required.)
- Remove the adjusting spring (15).
- Remove the fixing screws (20, 21, 29).
- Remove the bearing with bearing shell (11) from the shaft and remove the spacer (31).
- Draw the compacting screw (2) out of the rising pipe (1).
- Remove the cylindrical screws (14).
- Remove the bearing shell (11) from the bearing flange (5).
- Remove the Nilos ring (13).
- Remove the bearing (12).
- Remove the screws (9) of the bearing flange (5) and the guard ring (7).
- Remove the packing ring (10).
- Check the stainless steel sleeve (8) for wear.



Re-assembly by proceeding in reverse order. The bearing (12) must be filled with plenty of lubricant. The shaft, gearing bore and bearing must be lubricated with a special lubricant (e.g. STABYL EOS E2 by Fuchs Lubritech) before assembly.

8.3.4 Dismounting guide bars:

- Dismount the discharge pipe.
- Open the four eccentric locks (42) and remove the reject tray (3).
- Remove the fixing screws (24) and washers (25).
- Remove the guide bars (23).



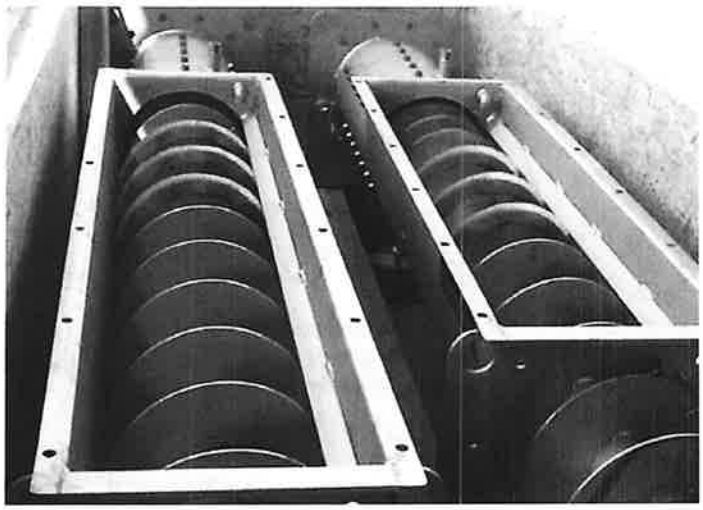
Or alternatively

- Loosen the fixing screws (20, 21, 29) and pull back the compacting screw (2) (approx. 2 in / 500 mm back).
- Remove the reject tray (3).
- Remove the fixing screws (24) and washers (25).
- Remove the guide bars (23).

Re-assembly by proceeding in reverse order.

8.3.5 Changing the brush:

- Remove hopper for easy access to the screw.
- Remove setscrews holding brush to the edge of the screw flights.
- Turn the screw by removing the fan cover from the motor and turning the fan
- Pull the brush out while turning the screw.
- Thoroughly clean the screw flights where the brush is mounted.
- Wind the new brush in place while turning the screw starting at the discharge end.
- Install the setscrews to secure the brush to the flights.



8.4 Spare parts, components subject to wear

Long life and corrosion resistance against all municipal and most industrial sorts of wastewater as all components which are in contact with water are completely made of stainless steel, acid-treated in a pickling bath and passivated.

a) Components subject to wear
Our guarantee does not include wearing parts that are subject to natural wear during operation. Wearing parts are defined as parts that show increased wear due to their function, the degree of wear depending on operational conditions, running hours and plant maintenance.

Main wearing parts of the plant:
- Packing ring on gear motor
- Stainless steel sleeve
- Last screw flight in the press zone
- Guide bars
- Brush (exception: size 1)

Our guarantee applies to conventional municipal applications with municipal screenings. Other applications or input of other media (such as very big stones, metal parts, wooden pieces > 3 Inches (80 mm) will greatly reduce the life of the wear parts. The life time of the brush depends on the screenings content of the wastewater. The average life time of the brush – supposing typical grit content – is approximately 800 operation hours.

b) Spare parts
For other spare parts such as gear motor, solenoid valve, etc. see TAB 8.

Whenever you order spare parts please specify:
- Machine type
- Size
- Order number = machine number
- Year of manufacture
- Operational voltage of the corresponding electrical component
- Order no. from the spare part list (appendix)
- Required quantity
- Delivery address

8.5 Regular tests of machines

The regular tests for maintenance of the plant's nominal condition shall include after every 1000 respectively 4000 operation hours, at least however after 1 respectively 3 years, checkup of the components listed below. Replace the components, if they show signs of an unacceptable operating condition.

Operating hours	Interval	Subject	Recommended method
1000	1 year	Operating condition: auger	Check for play. (Use a lever to check the play.) Check the guide bars and screw flights for wear.
2000	2 years	Auger Leakage test Drive-end shaft seal (packing ring seal)	Leakage test
4000	3 years	Operating condition: Auger: Drive-end self-aligning roller bearing	Check for bearing play.



⚠ CAUTION

There is a danger of burning in the area of the drive motors

NOTICE

Additionally observe the separate operating instructions for electro motors, drives and bearings for maintenance.



⚠ CAUTION

Repair or extensive maintenance work on machines in hazardous locations should be performed in a separate room on the dismounted machine.

9 Shutdown

Observe the following safety instructions for machine shutdowns to avoid damage to the machine, injuries or environmental damage.

- Qualified staff only is authorized to carry out shutdowns.
- Contact the manufacturer for questions concerning disposal of the machine.
- Take care of environmentally sound disposal of operating media, auxiliary material and lubricants (such as gearbox oil). Observe the regulations for eco-friendly waste disposal!
- Lifting and righting of the equipment must be done only by the lifting eyes provided.
- Use only the lifting devices specified hereunder to transport the machine.

Read also the chapter *Transport*.

Read also the chapter *General Safety Instructions*.

9.1 Temporary shutdown

- Remove the screenings discharge pipe, empty the pipe.
- Clean the feed trough and Wash Press with a high-pressure unit.
- Then, let the machine operate. This will empty the machine, screenings are discharged. The emptying process can be accelerated by throwing polystyrene into the trough while the machine is running until all screenings have been discharged.
- If the machine is installed outdoors the motor should be covered (in order to avoid ingress of water) but not wrapped. Otherwise, water may ingress into the terminal box.
- It is recommended to change the gearbox oil prior to start-up after a several-year shutdown. Further conservation is not necessary.

9.2 Final shutdown / disposal

Qualified staff only is authorized to perform electrical and mechanical shutdowns.
Prior to a final shutdown, follow the instructions for a temporary shutdown and the following additional instructions:

- Drain the gearbox oil. Disposal of gearbox oil: Observe the regulations for eco-friendly waste disposal!

10 Additional Information

If you require more information, please write or phone. We will do our best to support you.

Our US headquarters:

Huber Technology, Inc.
9735 NorthCross Center Court STE A
Huntersville, NC 28078

Phone: 1-704-949-1010
Fax: 1-704-949-1020
E-mail: huber@hhusa.net

Our customer service:

Phone: 1-877-US HUBER
E-mail: service@hhusa.net
parts@hhusa.net

We will help you to quickly find the right specialist to answer your questions.

Or visit our website http://www.huber-technology.com providing up-to-date information concerning our Business Unit Service.

Our service comprises **preventive maintenance, routine servicing, and short-term repair**. Our service hotline is available **24 hours a day, 7 days a week.**

Our qualified team offers a customer-oriented and reliable service. This service includes:

- **Installation supervision and start-up service**
- **Operator training**
- **Inspection and preventive maintenance**
- **Fine tuning of equipment for optimum performance**
- **Trouble shooting**
- **Routine and emergency repair**
- **Spare parts**

These additional services guarantee reliable plant operation, which is an important aspect for both municipal and industrial applications, and will help you to meet the requirements within your area of responsibility.

HUBER Technology, Inc.

11 Technical Specification (2x) Wash & Press WAP Size: 4

DIMENSIONS & WEIGHT	See next page & drawings in TAB 8
CAPACITY	Max. Capacity 140 cu.ft/h, for best washing result 53 to 88 cu.ft/h
VOLUME REDUCTION	up to 70%
WEIGHT REDUCTION	up to 70%
WATER CONSUMPTION	16 GPM (plant water)
DEWATERING CAPACITY	up to 40%
OPENINGS FOR DEWATERING	5 mm = .20"
FRAME MATERIAL	AISI 304L SST. Washer body is .12" thick bent plates. Motor torque support is made of .20" thick bent plates. Guide bars are bolted with AISI 316 SST hardware and manufactured of .38" thick Hardox 400.
BEARING	Roller bearing 22313 MBW 33
SURFACE TREATMENT	All stainless steel components are submerged in an acid pickling bath to passivate all surfaces. The gear motor drive is painted with: Abrasive blast clean 35 µm special self-etching primary coat red-brown (RAL 3009) 40 µm one-component waterborn refinishing paint (RAL 7031) 40 µm high solid two-component polyurethan sky blue (RAL 5015) minimum thickness for complete geared motor 115 um
DRIVE MECHANISM	Three-phase geared motor, mounted on the shaft of the screw. Danfoss Bauer beveled gearbox & Baldor motor directly mounted on the worm gear Outgoing RPM of gear is 15.5 at 60 Hz

HUBER TECHNOLOGY
WASTE WATER Solutions

HUBER Wash & Press WAP

Specification Details

All dimensions are in inches unless otherwise noted.

General Information	
Machine Size	**WAP 4**
Maximum throughput with good washing results [ft³/h]	53 - 88
Maximum throughput (peak flow) [ft³/h]	140
Maximum launder channel inflow [GPM]	135

Material Thickness	
Rising pipe	0.12
Press zone pipe (area of guide bars)	0.12
Discharge pipe	0.10
Screw flights over perforated plate	0.39
Screw flights in press zone	0.79
Flange/foot	0.31
Trough	0.12
Guide bars (in press zone only)	0.39

Material Type	
Rising pipe / screw (SST)	304L
Welded hard metal on press flights *	Tubrodur
Hardness of Tubrodur	60-62 HRC
Guide bars	Hardox 400
Hardness of Hardox 400	48 HRC

Dimensions	
Screw shaft diameter	3.50 x .20
Screw diameter	10.2
Perforation / wash zone	RV 0.20 / 0.39
Perforation / press zone	0.20
Length of press zone	4.72
Screw pitch in the trough	5.91
Screw pitch in the press zone	4.72

Spray Wash Systems *(solenoid valve rated for 140 psi)*	
Water connection in collecting tray diameter (at presszone; only service water)	1"
Wash water demand (if no launder is connected) [GPM]	16
Water pressure (service water) [PSI]	30 to 75
Water pressure (screened wastewater) [PSI]	14.5
Service water quality; grain size	< 200 µm

Self-aligning roller bearing
Heavy duty sealing

* one hard metal seams welded around the entire external circumference, one quarter of the last flight holohedral welded.
GLD = slide ring sealing

DATA SHEET 1999.10.01

HARDOX® 400

ABRASION RESISTANT PLATE

HARDOX 400 is an abrasion resistant plate with a hardness of about 400 HB, intended for applications where demands are imposed on abrasion resistance in combination with impact and/or good cold bending properties. HARDOX 400 possesses very good weldability.

APPLICATIONS

Crushers, sieves, feeders, measuring pockets, skips, journals, cutting edges, conveyors, buckets, knives, gears, sprockets, dumptrucks, loaders, industrial trucks, lorries, bulldozers, excavators, slurry pipe systems, screw conveyors, presses etc.

CHEMICAL COMPOSITION
(ladle analysis)

Plate thickness mm	C max %	Si max %	Mn max %	P max %	S max %	Cr max %	Ni max %	Mo max %	B max %	CEV typv.	CET typv.
4 –10	0,14	0,70	1,60	0,025	0,010	0,30	0,25	0,25	0,004	0,33	0,23
(10)– 20	0,14	0,70	1,60	0,025	0,010	0,50	0,25	0,25	0,004	0,37	0,26
(20)– 32	0,18	0,70	1,60	0,025	0,010	1,00	0,25	0,25	0,004	0,48	0,29
(32)– 51	0,22	0,70	1,60	0,025	0,010	1,40	0,50	0,60	0,004	0,58	0,35
(51)– 80	0,27	0,70	1,60	0,025	0,010	1,40	1,00	0,60	0,004	0,62	0,41
(80)– 130	0,32	0,70	1,60	0,025	0,010	1,40	1,50	0,60	0,004	0,70	0,48

$$CEV = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Cu + Ni}{15}$$

$$CET = C + \frac{Mn + Mo}{10} + \frac{Cr + Cu}{20} + \frac{Ni}{40}$$

The steel is grain-refined.

HARDNESS

HBW
370–430

MECHANICAL PROPERTIES
Typical values for
20 mm plate thickness.

Yield strength R_e N/mm²	Tensile strength R_m N/mm²	Elongation A_5 %	A_{50} %
1000	1250	10	16

IMPACT PROPERTIES
Typical value for
20 mm plate thickness.

Testing temperature °C	Impact energy Charpy-V, longitudinal J
–40 (–40°F)	45

TESTING

Brinell hardness HBW according to EN ISO 6506-1, on a milled surface 0,5-2 mm below plate surface per heat and 40 t.

FORM OF SUPPLY

Quenched. When necessary, hardness is adjusted by means of subsequent tempering.

DIMENSIONS

HARDOX 400 is supplied in plate thicknesses of 4–130 mm. More detailed information on dimensions is provided in our brochure General Product Information E-40.

TOLERANCES

According to EN 10 029.
– Tolerances on thickness according to Class A.
– Tolerances on flatness according to Class N.
(Normal tolerances)

SURFACE FINISH

According to EN 10 163-2.
– Requirements according to Class A.
– Repair conditions according to Subclass 1.
(Repair by welding is allowed).

E-151, HARDOX is a registered trade mark for SSAB Oxelösund AB, Sweden

SSAB OXELÖSUND

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Phone. +46 155-25 40 00
Fax +46 155-25 40 73
Telex 50950 SSAB S
www.oxelosund.ssab.se

DATA SHEET

HARDOX 400

GENERAL TECHNICAL DELIVERY REQUIREMENT

According to our brochure E-40, General Product Information.

HEAT TREATMENT

HARDOX 400 is not intended for further heat treatment.

FABRICATION

HARDOX 400 has obtained it's mechanical properties by quenching. The properties of the delivery condition can not be retained after a preheating temperature above 250°C (480°F).
HARDOX 400 is not suited for applications requiring hot working at temperatures above 250°C (480°F) since the material may then loose it's good properties.

For information concerning welding and fabrication, see our brochures listed below or consult our Technical Customer Service.

Fabrication	**Brochure No:**
Machining	En-10
Welding	En-11
Bending Shearing	En-12
Cutting	En-14

Appropriate health and saftey precautions must be taken when welding, cutting,grinding or otherwise working on the product. Grinding, especially of primer coated plates, may produce dust with high particle concentration. Our Technical Customer Service Department will prov de further information on request.

NTN BEARING CORPORATION OF AMERICA

BEARING DATA SHEET
Spherical Roller Bearings

NTN Part Number 22313BD1C3

Weight N/A (lbs) / N/A (kg)

DIMENSIONS

DIMENSION	IMPERIAL	METRIC
Bore d	2.5591 (in)	65.000 (mm)
O.D.D.	5.5118 (in)	140.000 (mm)
Width B or W	1.8898 (in)	48.000 (mm)
rs min	0.0827 (in)	2.100 (mm)
da min	3.0315 (in)	77.000 (mm)
da max	5.0394 (in)	128.000 (mm)
Da min	0.0787 (in)	2.000 (mm)
Da max	0.0150 (in)	0.380 (mm)
ras max	0.0705 (in)	1.790 (mm)
e	0.1051 (in)	2.670 (mm)
Y1	0.0689 (in)	1.750 (mm)
Y2		
Y0		

FEATURES/OPTIONS

OPTION	CODE	DESCRIPTION
Series	231	231 Spherical
Intrnl Dsgn	B	Roller Bearing
Cage		Series
Ring Mod.	D1	Asymmetrical
Internal Clr.	C3	rollers
Tolerance		Standard cage
		Lubrication holes and groove
		Radial clearance greater than normal
		Class 0 (equiv. to ABEC 1); standard

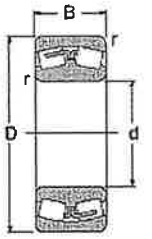
BASIC LOAD RATINGS

Static	71,650 (LBF)	320,000 (N)
Dynamic	59,745 (LBF)	265,000 (N)

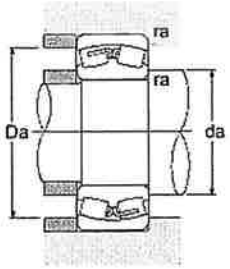
LIMITING SPEEDS

Oil	3,700.00 (RPM)
Seals	N/A
Grease	2,400.00 (RPM)

REFERENCE DRAWING



Cylindrical bore



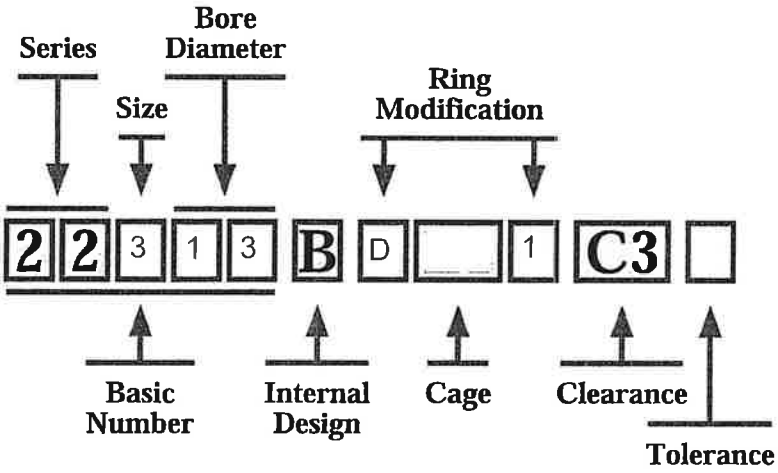
Equivalent bearing load
dynamic
$Pr = XFr + YFa$

$\frac{Fa}{Fr} \le e$		$\frac{Fa}{Fr} > e$	
X	Y	X	Y
1	Y1	0.67	Y2

static
$Por = Fr + YoFa$

For values of e, Y1, Y2, and Yo see the table below.

NTN SPHERICAL ROLLER BEARING NUMBERING SYSTEM



2. SERIES

213:	Standard series spherical roller bearings
222, 223:	Standard series spherical roller bearings
230, 231, 232, 239:	Standard series spherical roller bearings
240, 241:	Standard series spherical roller bearings
W:	Wide series spherical roller bearing with integral seals

3. INTERNAL DESIGN

B:	One piece ribbed inner ring, asymmetrical rollers and center guided retainer
C:	Plain inner ring, center floating guide ring
UA:	Inner ring without center guide, asymmetrical rollers, and outer ring center-guided retainer (limited thrust capabilities)
E:	High capacity spherical roller bearings

4. CAGE

No Symbol:	Standard cage
J:	Pressed steel cage
L1:	Machined brass cage
T2:	Nylon cage

6. RING MODIFICATION

D1:	Oil groove and holes
K:	1:12 tapered bore

7. INTERNAL CLEARANCE

C1:	Radial clearance less than C2
C2:	Radial clearance less than normal
No Suffix:	Normal internal clearance
C3:	Radial clearance greater than normal
C4:	Radial clearance greater than C3
C5:	Radial clearance greater than C4
CSXX:	Special radial clearance; XX is mean value in 0.001 mm units

8. TOLERANCE

No Symbol:	Class 0 (equivalent to ABEC 1); standard
PXn:	Special tolerance, from 1 onward
Vn:	Special requirement, from 1 onward
VS1:	Special tolerance for shaker screen bearings (C3 clearance)
VS2:	Special tolerance for shaker screen bearings (C4 clearance)

TAB 6

HUBER Technology, Inc. • Huntersville, NC

HUBER TECHNOLOGY

Motor Data Sheet (2x) HUBER Wash & Press WAP Size: 4

Gearbox Manufacture:	Danfoss-Bauer, Somerset, NJ
Motor Manufacture:	Baldor, Fort Smith, AR
Enclosure:	XPFC
Explosion Proof Rating:	Class 1, Division 1, Group D
Gearbox:	BK60-24V-C
Motor:	VEM7044T-I, Continuous, Thermostats
Horsepower (HP):	5.0
Motor Speed (RPM):	1750
Output Shaft Speed (RPM):	15.5
Nominal Torque Output Shaft (lbf-in):	20,180
NEMA Nominal Efficiency (%):	89.5 Premium Efficient
Gear Ratio:	113.2
Hertz/Phase/Voltage:	60/3/230/460 (Y)
Full Current Load (A):	13/6.5
Frame Size:	NEMA184TC, C-Flange
Service Factor:	1.15
Maximum Ambient Temperature:	40°C
Winding Material:	Copper
Frame Material:	Steel
Insulation Class:	F
NEMA Design Code:	B
Color:	sky blue (RAL 5015)

GEARBOX APPENDIX INFORMATION

TYPE: DANFOSS-BAUER BK60

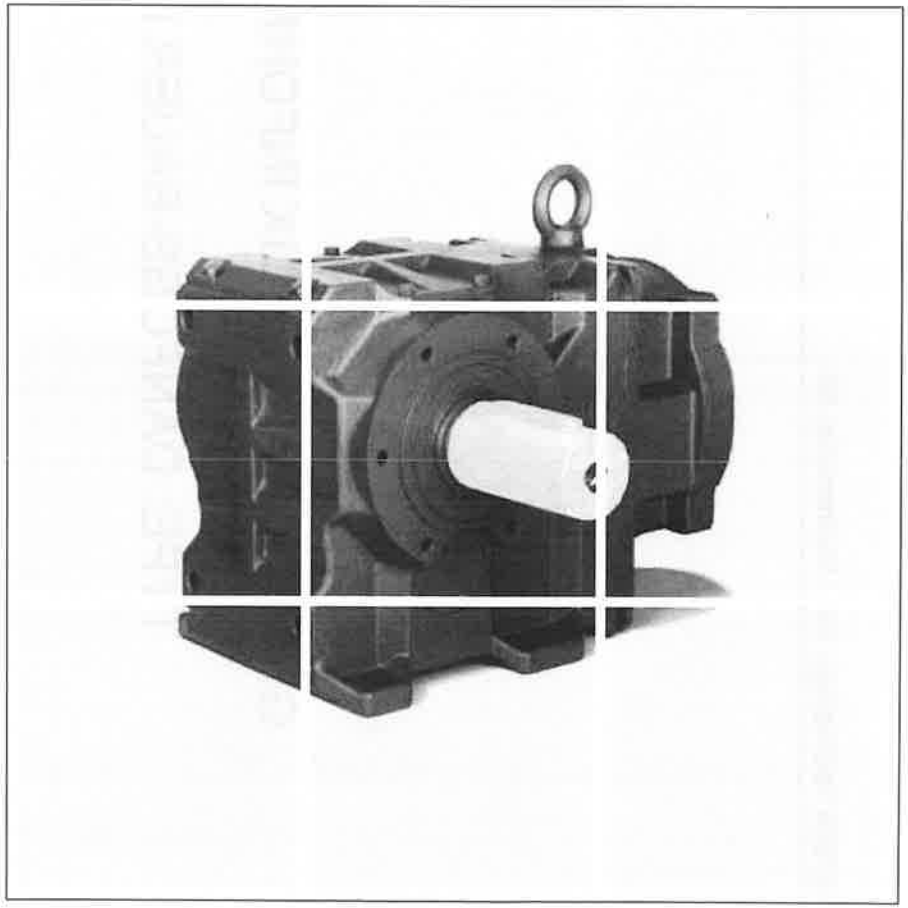
BAUER

ET-BK 60

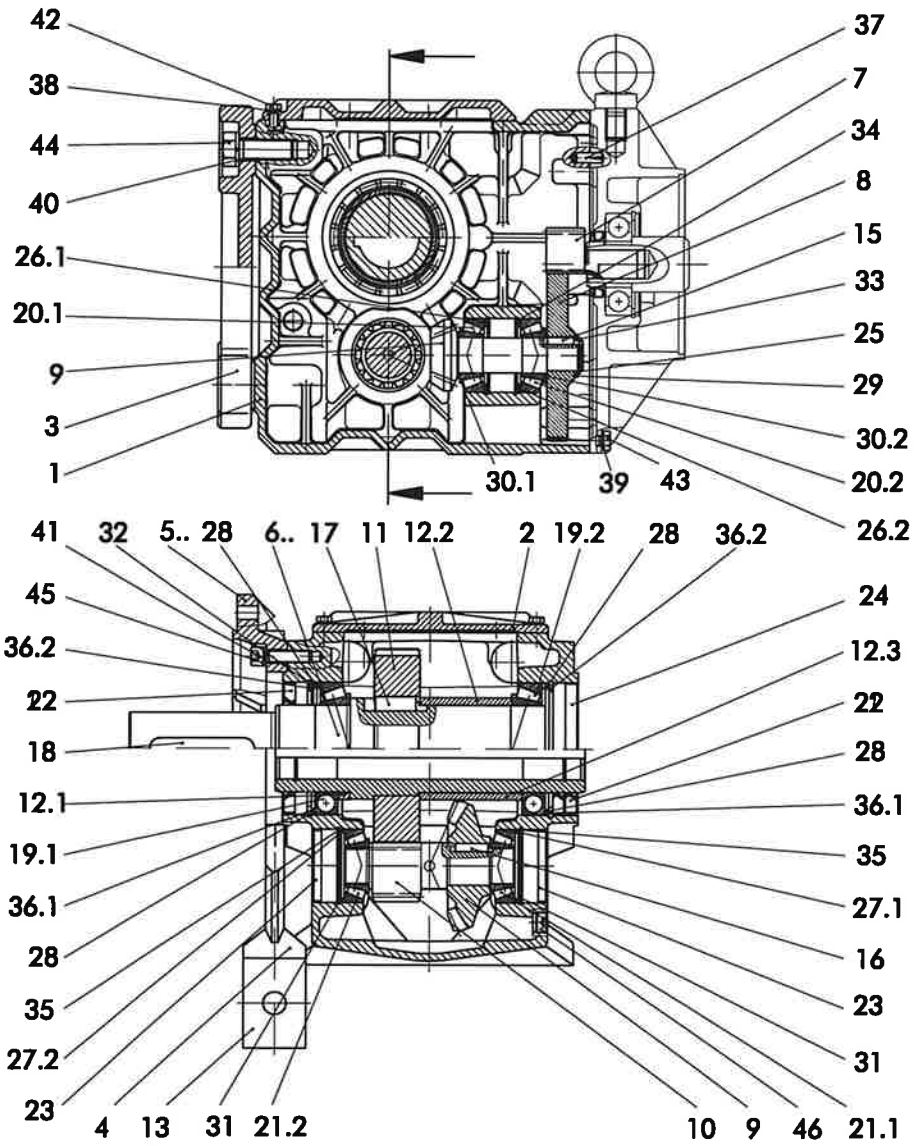
Parts list
and sectional drawing

Gear unit type

Part-No.	Order No.	Quantity		Designation
47	–			Lubricant
46	2503018	1		Cover screw
45	2503026	0/6		Fillister head screw with flange or torque arm
44	2507552	0/4		Hexagon bolt with foot plate
43	1001078	8		Hexagon bolt
42	1316656	8		Hexagon bolt
41	1011634	0/6		Spring washer with flange or torque arm
40	1439022	0/4		Spring washer with foot plate
39	1010441	8		Spring washer
38	1010492	8		Spring washer
37	2506670	2		Dowel pin
36.2	2508737	0/2		Retainer ring with reinforced bearings
36.1	1000349	0/2		Retainer ring with normal bearings
35	1248901	2		Retainer ring
34	1248901	2		Retainer ring
33	2511061	1		Retainer ring
32	*	1		Tuning package with reinforced bearings
31	*	2		Tuning package
30.2	*	1		Tuning package
30.1	*	1		Tuning package



A.5-8/98-ET-BK 60 Printed in Germany



Right to change the design reserved.

Gear unit type

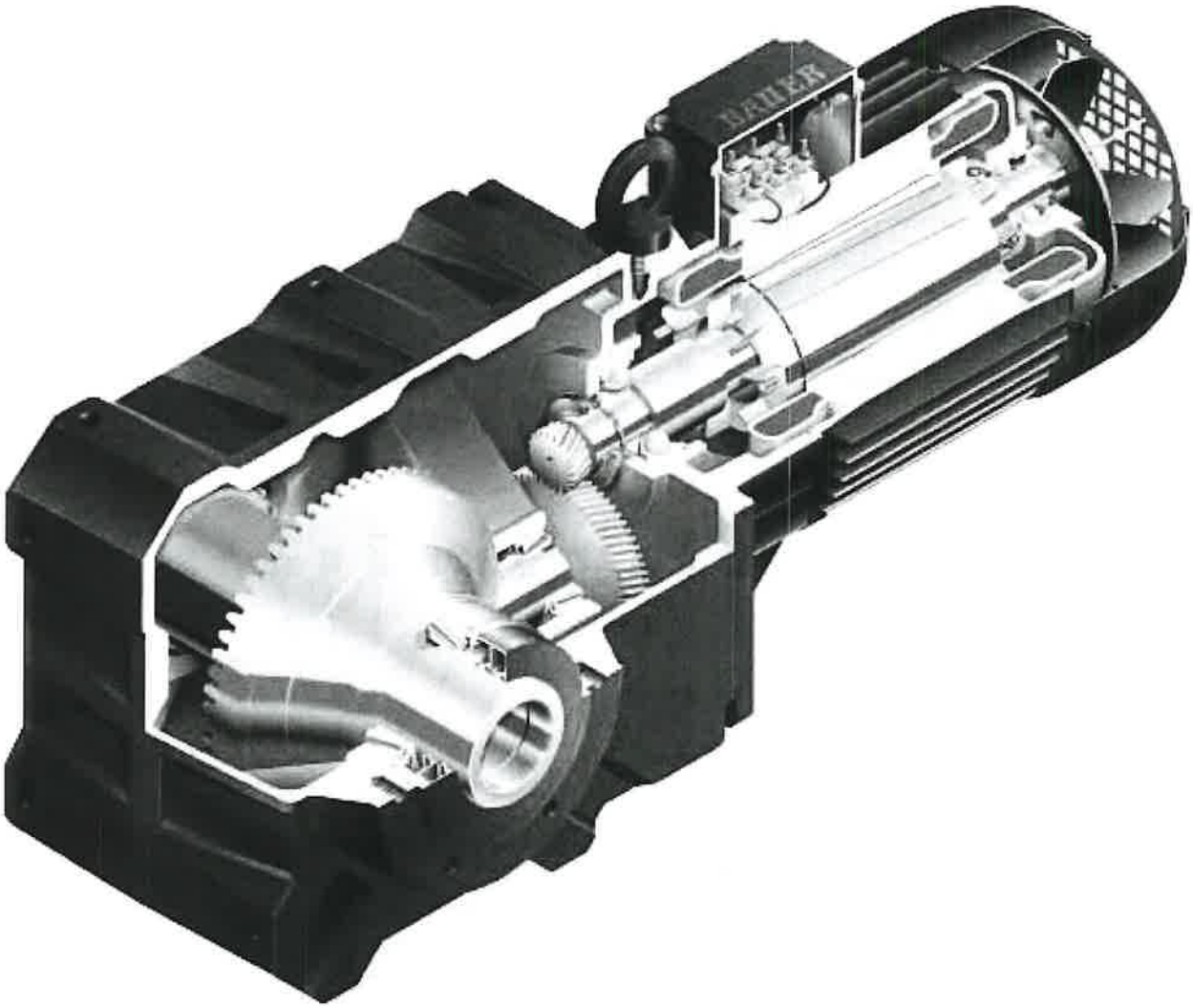
ET-BK 60

Part-No.	Order No.	Quantity	Designation
29	*	1	Tuning package
28	2508729	2/4	Supporting plate 4 off with reinforced bearings
27.2	2508711	1	Supporting plate
27.1	2510944	1	Supporting plate T3 measure
26.2	2508711	1	Supporting plate
26.1	2520591	1	Supporting plate T1 measure
25	1451995	1	Supporting plate
24	1448382	0/1	Sealing cover with solid shaft on one side
23	2507561	2	Sealing cover
22	2502879	1/2/4	Shaft seal
21.2	2508443	1	Tapered roller bearing
21.1	2510529	1	Tapered roller bearing L3V measure
20.2	2508443	1	Tapered roller bearing
20.1	2520559	1	Tapered roller bearing L1 measure
19.2	1402471	0/2	Tapered roller bearing with reinforced bearings
19.1	1028821	0/2	Ball bearing with normal bearings
18	1000594	0/1/2	Key with solid shaft
17	2507226	1	Key
16	2507587	1	Key
15	2507218	1	Key
14			
13	1387499	0/2	Rubber buffer with torque arm
12.3	2507617	0/1	Spacer with normal bearings
12.2	2507609	0/1	Spacer with reinforced bearings
12.1	2507595	0/1	Spacer with normal bearings
11	*	1	Gear
10	*	1	Pinion shaft
9	*	1	Bevel gear set
8	*	1	Gear
7	*	1	Pinion
6.5	2507528	0/1	Hollow shaft for SSV
6.4	2507510	0/1	Hollow shaft with keyway
6.3	2507501	0/1	Solid output shaft, both sides
6.2	2519739	0/1	Solid output shaft H
6.1	2507498	0/1	Solid output shaft V
5.2	2507285	0/1	Flange Ø 350
5.1	2503867	0/1	Flange Ø 300
4	2503891	0/1	Torque restraining arm
3	2508745	0/1	Foot plate
2	2507536	1	System cover
1	*	1	Attachment housing

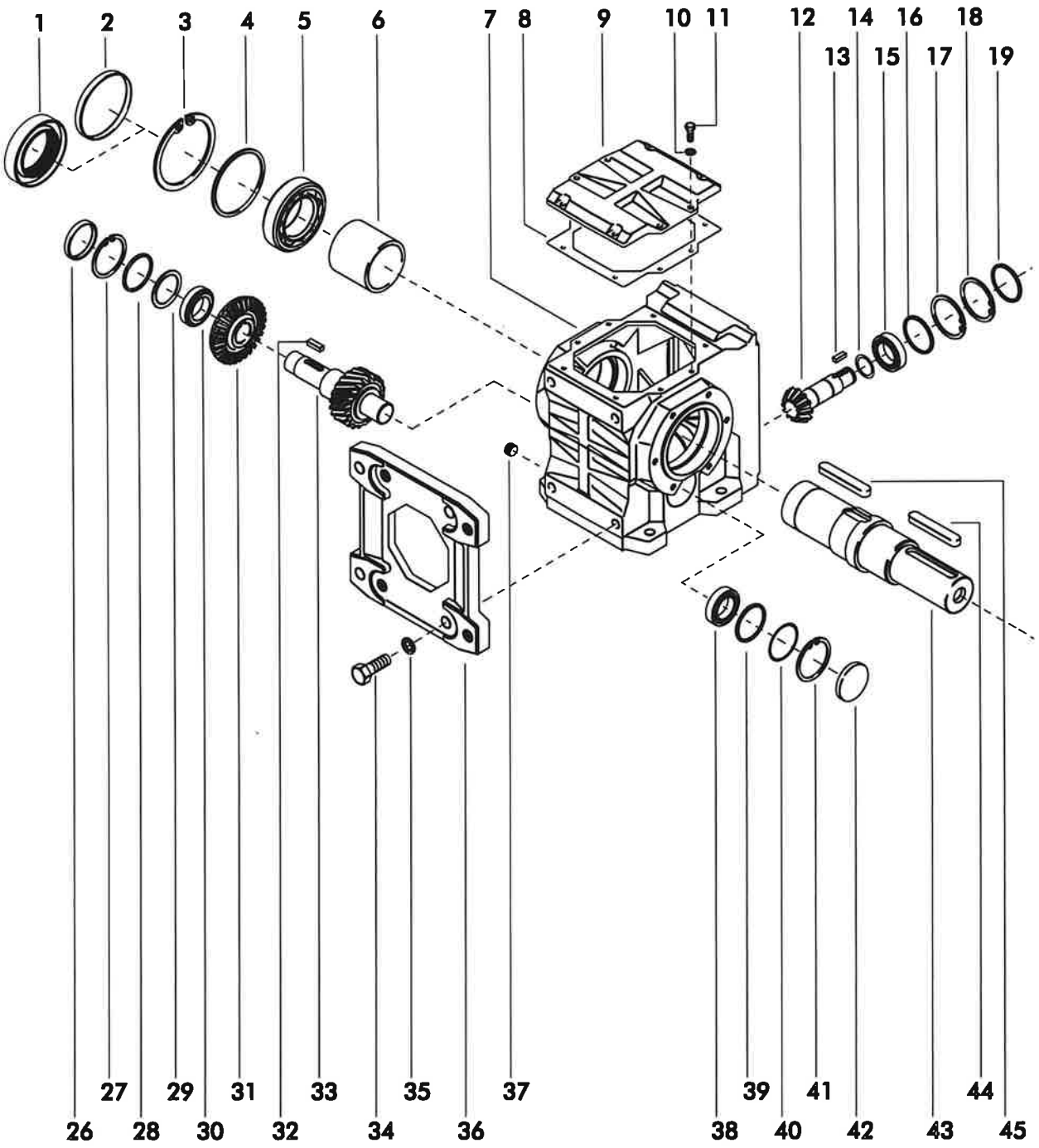
* ATTENTION
Please clearly state serial number when ordering these spare parts.

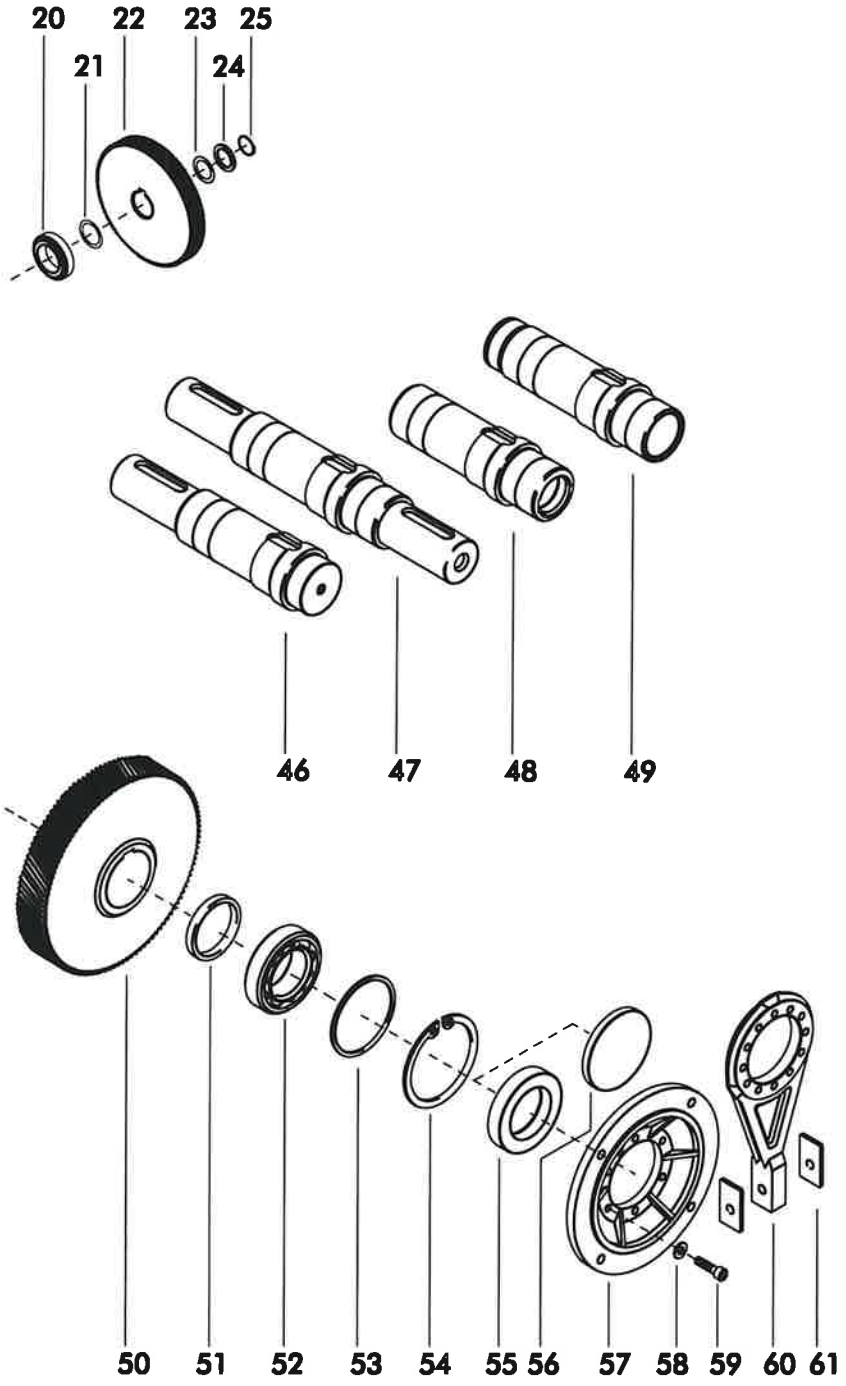
5 BK series bevel geared motors

5.1 Section through a BAUER bevel geared motor



5.2.2 Explosion diagram of 3-stage bevel gears BK60

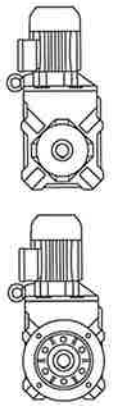




Part	Designation
1	Shaft seal
2	Sealing cover
3	Retainer ring
4	Support washer
5	Roller bearing
6	Spacer
7	Attachment housing
8	Liquid seal
9	System cover
10	Spring washer
11	Hexagon bolt
12	Conical pinion
13	Key
14	Tuning package
15	Roller bearing
16	Support washer
17	Retainer ring
18	Retainer ring
19	Support washer
20	Roller bearing
21	Tuning package
22	Gear
23	Tuning package
24	Tuning package
25	Retainer ring
26	Sealing cover
27	Retainer ring
28	Tuning package
29	Support washer
30	Roller bearing
31	Bevel gear
32	Key
33	Pinion shaft
34	Hexagon bolt
35	Spring washer
36	Foot plate
37	Cover screw
38	Roller bearing
39	Support washer
40	Tuning package
41	Retainer ring
42	Sealing cover
43	Solid output shaft V
44	Key
45	Key
46	Solid output shaft H
47	Solid output shaft, both sides
48	Hollow shaft with keyway
49	Hollow shaft for shrink disk
50	Gear
51	Spacer
52	Roller bearing
53	Support washer
54	Retainer ring
55	Shaft seal
56	Sealing cover
57	Flange
58	Spring washer
59	Allen screw
60	Torque restraining arm
61	Rubber puffer

5.3 Standard fitting position for bevel geared motors

The following standard fitting positions are defined for BAUER bevel geared motors.



H4

5.4 Standard lubricant quantities for bevel gears

Lubricant quantity in l or kg

Gear type	H1	H2	H3	H4	V1	V2
BK10	0.83	0.83	0.92	1.65	0.92	0.92
BK20	1.5	1.5	1.6	2.8	1.65	1.65
BK30	2.2	2.2	2.3	4.2	2.4	2.4
BK40	3.5	3.5	3.5	6.7	3.7	3.7
BK50	5.8	5.8	5.8	11.0	6.0	6.0
BK60	6.0	8.7	6.9	11.7	8.6	8.6
BK70	10.2	15.0	11.5	21.2	13.5	14.5
BK80	18.0	25.5	19.0	37.0	23.5	25.5
BK90	33.0	48.0	36.0	70.7	45.0	48.0

Lubricant quantities and lubricant types should be compared with the rating plate.

5.5 Removing and fitting bevel gears

5.5.1 Dismantling the gear stage

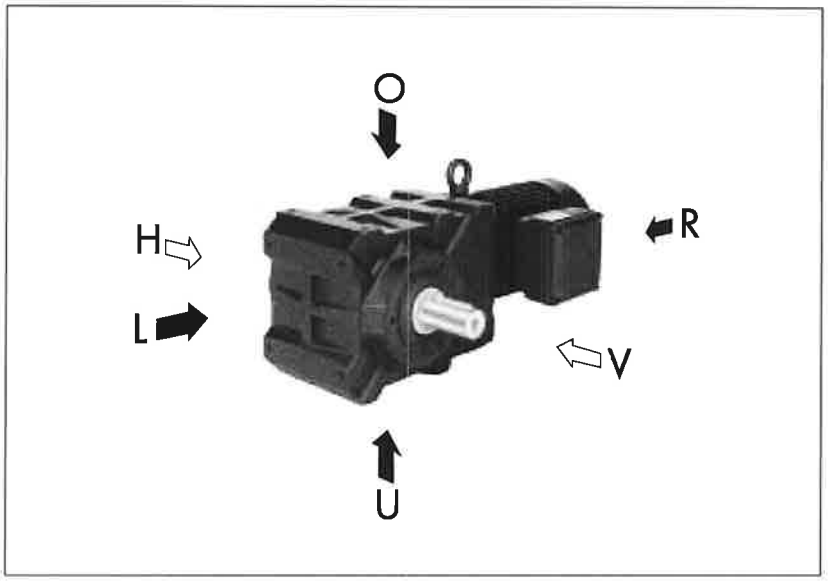
Remove wheel 2 after draining the lubricant and removing the motor stage. Then remove the radial shaft seal and the sealing cap on the output shaft, the circlips and supporting ring with matching packet.

To press out the output shaft move it together with the bevel wheel in the direction of gear side V until they touch a stop that can be felt. The bevel gear stage teeth are then disengaged.

In this position support the bevel gear with appropriately prepared elements against the gear housing so that no harmful pressure can act on the bevel pinion when pressing out the output shaft.

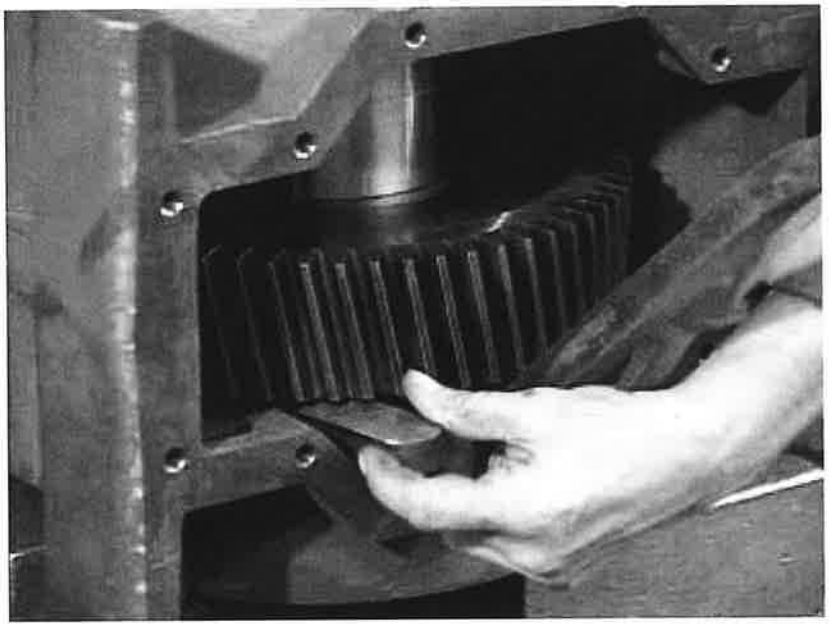
Press out the output shaft in the direction of gear side H.

Then remove the bevel pinion shaft together with bearing.



Note:
The bevel gears are 3-stage from size BK60.

Before removing the bevel gear stage dismantle the output shaft. To do this, support the end wheel using suitable stops against the gear housing. Then press out the output shaft in the direction of gear side V.



To remove the bevel gear remove the sealing caps, circlips and support disks. Now move the pinion shaft together with bevel wheel in the direction of gear side H as far as the stop so that the teeth are disengaged. After removing the feather key from wheel 2, carefully push the bevel pinion into the gear as far as it will go. After pulling the pinion shaft back remove the outer bearing and the circlips for both pinion shaft bearings. then pull the pinion shaft out together with the inner bearing.

Now push pinion shaft 2 with bevel wheel back again and tilt the complete pinion shaft out of the bearing and remove it through the assembly opening.

5.5.2 Fitting the gear stage

It is important for the gear stage to be fitted so that it can function correctly, which involves trouble-free running of the bevel gear stage (tooth edge play, appearance of the bearing surface after bedding in) in particular. This is only guaranteed once the bevel gear stage has been matched precisely in relation to its position in the gear housing with the aid of adjusting washers.

If the position of the bevel gear or of the bevel pinion in the gear alters due to new components (see matching diagram), then re-matching and therefore a fresh definition of the actual dimensions for the matching packets is required.

These can be calculated with the aid of equations in accordance with matching plan BK-AR1 for BK10 to BK50 and BK-AR2 for BK60 to BK90. The nominal dimensional variations required for the calculation are shown in the measuring points listed in the matching plan.

Note:
The bevel gear stage must be replaced as a unit due to paired wheel sets.

The pinions can be fitted more easily if they are heated and cooled alternately.

Now fit the bevel pinion again as the first step in accordance with the corresponding matching plan. To do this, pre-assemble the inner bearing without the outer bearing ring but together with the computed matching packet on the pinion shaft.

Important: The matching packet must be pressed in between the pinion shaft shoulder the inner bearing ring so that there is no play

Now place the outer ring for bearing 1 in the housing as well as the supporting rings and the circlips.

Fit the outer bearing ring for bearing 2 and insert the pre-assembled pinion shaft into the bearing from the inside, then push on the heated inner ring for bearing L2 (approx. 150°C) so that there is no play.

By rotating the pinion shaft several times make sure that the rollers abut the bevel roller bearings to achieve play-free running of the pinion shaft.

Fit the bevel gear in accordance with the matching plan. Again, make sure that there is no play after fitting as described for the bevel pinion.

Important: The torsional backlash must be between 0.05 mm and 0.25 mm as a minimum.

Now fit the output shaft in the case of the 3-stage gear sizes.

Fit the output shaft bearing with supporting ring and circlip on gear side H and then inert spacer sleeve and heated end wheel and fit the output shaft. It is advisable to heat the inner ring for the fitted bearing beforehand.

Finally, fit the front bearing with supporting ring and circlip.

If the output shaft bearing is reinforced adjust the bevel roller bearings with the matching packets so that there is no play.

Note:

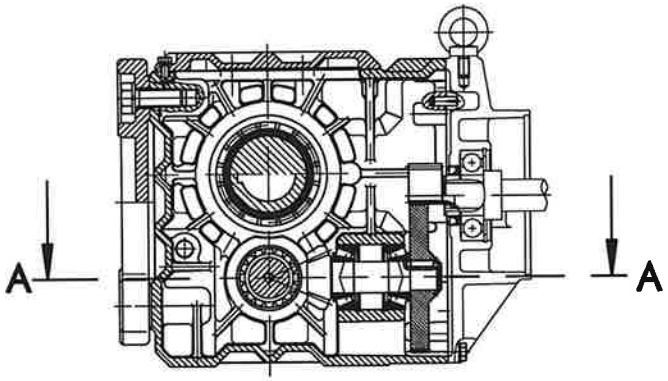
Coat the shaft sealing rings and sealing caps on the outer jacket with a slip additive to make fitting easier.

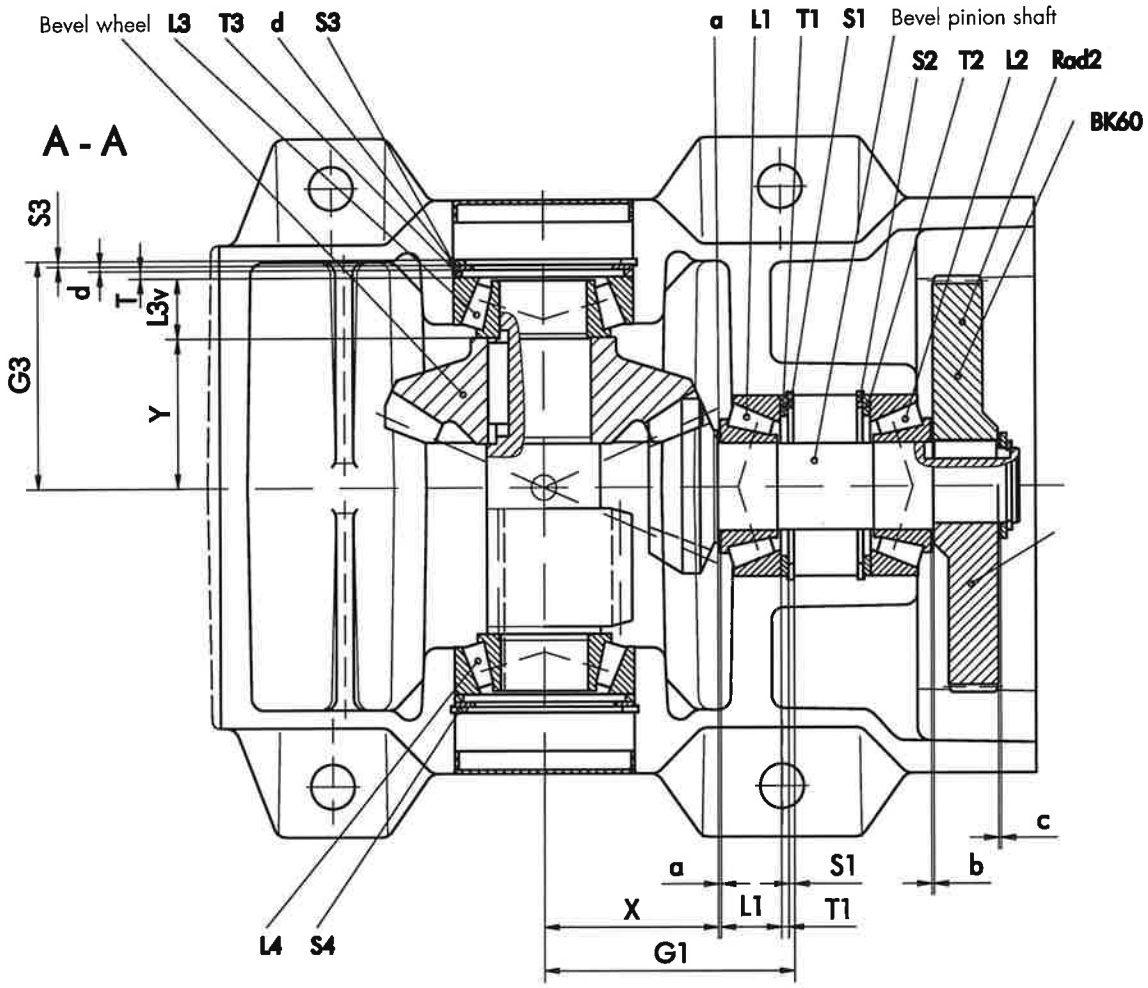
In the case of a double shaft seal both sealing rings should be fitted together in one unit. Grease the sealing lips before fitting.

It is advisable to heat wheel 2 to about 160°C to make fitting easier.

As a matter of principle: Cool the output shaft and pinion shaft to make fitting easier.

5.5.4 Matching and fitting three-stage bevel gears BK60





Measure points:

G1 measured at housing

G3 measured at housing

L1 measured at bearing

L3v measured at bearing

S1 Nominal thickness circlip

S3 Nominal thickness circlip

T1 measured at supporting ring

T3 measured at supporting ring

X nominal dimension ± inscribed deviation at bevel pinion shaft

Y nominal dimension ± inscribed deviation at bevel wheel

Assembly instructions for bevel pinion:

1.) Fit circlip S1, supporting ring T1 and outer ring bearing L1 in the housing.

2.) Coord. dimension a = G1 – (X + L1 + T1 + S1)

3.) Draw matching packet a and inner ring baering L1 onto bevel pinion shaft; fit in housing.

4.) Fir circlip S2, supporting ring T2 and bearing L2 so that there is no play.

5.) Select thickness of matching packet so that enclosure is flush with shaft shoulder.

6.) Insert key. draw wheel 2 up as far as top on shaft shoulder and matching packet b.

7.) Fill space between wheel 2 and circlip with matching washers and supporting ring.

Attention: Fit supporting ring against circlip!

Nominal Dimensions

BK	60	70	80	90
G1	100.1	126.1	156.35	191.35
G3	90.75	103.25	127	150
L1	24.25	24.75	35	41
L3v	24.25	27.25	35	41
S1	2.2	2.7	2.7	3.7
S3	2.2	2.7	2.7	3.7
T1	3	3.5	3.5	3.5
T3	3	3.5	3.5	3.5
X	69.5	94	114	142
Y	59.5	68	84	100
a		1.15		
b	1.5	1.5	1.5	1.5
c	1	1	1.2	1.2
d		1.8		

Assembly instructions for bevel wheel:

8.) Shaft sealing ring(s), circlip S3, matching packet d, supporting ring T3 and bearing L3 in this sequence fit in.

Attention: The 1mm thick matching washer must fit against the circlip!

Coord. dimension:
Matching dimension d = G3 – (Y + L3v + T3 + S3)

9.) Insert bevel wheel in housing and place on fitted parts.

10.) Fit pinion shaft (R5) and bearing L4 so that there is no play.

11.) Fill space between bearing L4 and circlip S4 with matching washer and supporting ring.

Attention: Fit supporting ring against bearing L4!
1mm thick matching washer must fit against circlip!

5.6 Assembly advice for shaft-mounted execution with hollow shaft and keyway

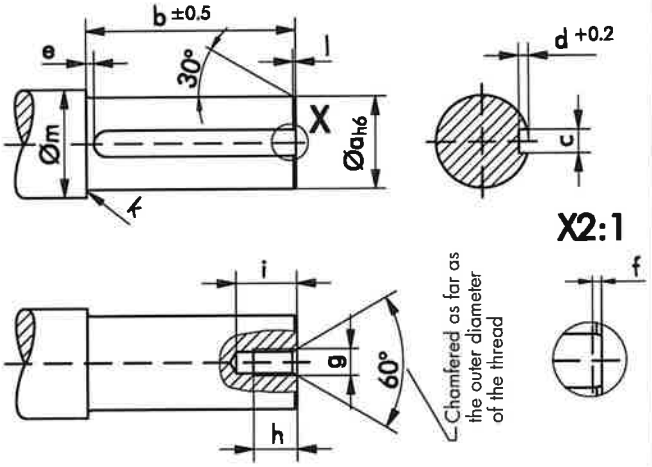
Assembly: Screw the threaded bolt into the face thread of the shaft to be driven. Press the shaft-mounted gear onto the shaft with the aid of the nut via the thrust piece and the circlip.

Retaining: Rotate the thrust piece and draw it with the fixing screw against the circlip.

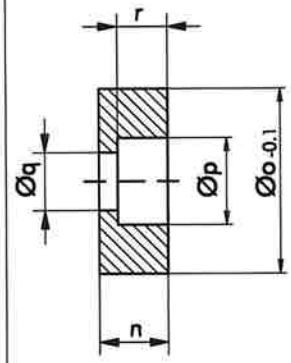
Dismantling: Place the thrust piece between shaft face and circlip. The press-off screw presses against the shaft face and draws off the shaft-mounted gear.

The parts are not supplied.

Item 1 Shaft journal

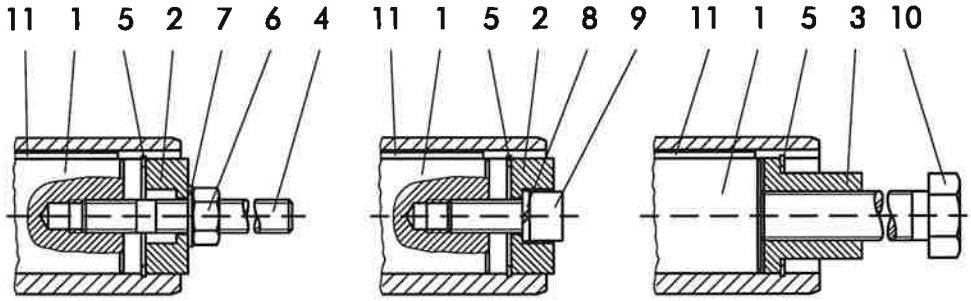


Item 2 Washer



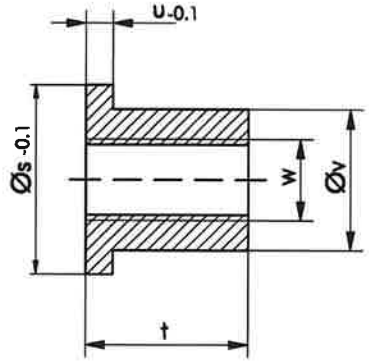
x Edges broken
Material: C45 DIN17200

Type	Dimensions																
	Item 1 Shaft journal												Item 2 Washer				
	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r
BK10	25	148	8	4	5	2	M8	18	24	2,5	1,5	33	13,5	24,8	15	9	8,5
BK20	30	170	8	4	5	2	M10	20	26	3	1,5	38	15	29,8	18	11	10
BK30	35	201	10	5	5	2	M10	20	26	3	1,5	43	16	34,8	18	11	10
BK40	40	235	12	5	5	2	M12	22	29	3	2	48	18	39,8	20	13,5	12
BK50	50	254	14	5,5	6	3	M16	30	37	3,5	2	58	21	49,8	26	17,5	15
BK60	60	273	18	7	6	3	M20	38	46	3,5	2	68	24	59,8	33	22	18
BK70	80	316	22	9	8	4	M20	38	46	4	2	90	27	79,8	33	22	20
BK80	100	360	28	10	8	5	M24	45	54	4	3	110	32	99,8	40	26	25
BK90	120	432	32	11	8	6	M24	45	54	4,5	3	130	35	119,8	40	26	28

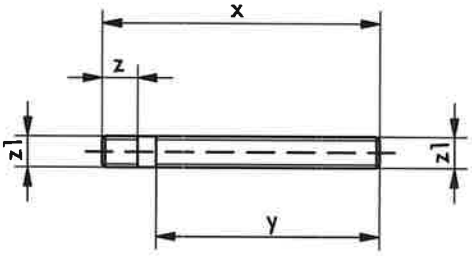


Assembly Holding Dismantling

Item 3 Sleeve



Item 4 Threaded bolt



Material: steel, tensile strength ≥ 1000 N/mm²
Thread rolled

x Edges broken
Material: C45 DIN17200

Type	Dimensions									Circlip DIN 472	Nut DIN 934-8	Washer DIN 125-St	Spring washer DIN 7980	Cylinder screw DIN 912-8.8	Hexagon screw DIN 933-8.8	Key DIN 6885 Width x Hight x Length
	Item 3, Sleeve					Item 4, Threaded bolt										
	s	t	u	v	w	x	y	z	z1	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11
BK10	24,8	24	5	16	M12	200	170	20	M8	25x1,2	M8	8,4	8	M8x30	M12x190	AB 8x7x141
BK20	29,8	28	5	20	M14	230	195	23	M10	30x1,2	M10	10,5	10	M10x30	M14x210	AB 8x7x163
BK30	34,8	28	5	23	M14	260	220	23	M10	35x1,5	M10	10,5	10	M10x35	M14x240	AB 10x8x194
BK40	39,8	40	6	31	M20	300	260	28	M12	40x1,75	M12	13	12	M12x35	M20x290	AB 12x8x228
BK50	49,8	48	6	36	M24	340	290	37	M16	50x2,0	M16	17	16	M16x40	M24x320	AB 14x9x245
BK60	59,8	60	6	44	M30	370	310	45	M20	60x2,0	M20	21	20	M20x50	M30x350	AB 18x11x264
BK70	79,8	60	8	55	M30	420	360	45	M20	80x2,5	M20	21	20	M20x50	M30x400	AB 22x14x304
BK80	99,8	72	10	75	M36	480	410	55	M24	100x3,0	M24	25	24	M24x60	M36x450	AB 28x16x347
BK90	119,8	72	10	80	M36	560	480	55	M24	120x4,0	M24	25	24	M24x60	M36x520	AB 32x18x418

ADDITIONAL GEARBOX LUBRICATION INFORMATION

TYPE: DANFOSS-BAUER BK60

Maintenance and Service Procedures for Danfoss-Bauer NEMA C-Face Gear Motors

A. Gearbox Lubrication

All Danfoss Bauer gearmotors come shipped from the factory with the correct type and quantity of lubricant installed. The lubricant recommended service interval is 2 years or 15,000 hours, which ever occurs first. The lubricant change procedure is very simple usually taking no more than 10 minutes. Lubricant types can be found on the motor tag and attached documentation. Lubricant change procedures are as follows:

1. Locate the lowest plug on the gearbox, this will be your drain plug.
2. Place a drain pan under the drain plug and remove the drain plug with a metric allen key of the correct size to speed draining remove the uppermost plug on the gearbox.
3. Reinstall the drain plug
4. Locate the recommended oil type and quantity in nametag or motor data sheet.
5. Install the recommended quantity and type of oil. Reinstall the uppermost plug.

Caution As the number one oil related problem of Danfoss Bauer Gearmotors is overfilling, it is recommended that the only time the oil plugs be touched is when the oil is changed.

1. Many people ask why there is no sight glass, dipstick, or level plugs on Danfoss Bauer Gearboxes, the reason for this is simple, they are not needed:
2. Danfoss Bauer gearmotors are designed to be mounted in many different positions. As such there would need to be many different level devices on each gearbox. This would increase the cost, the chance for leaks and the chance for overfilling due to confusion.
3. It is much easier to visually inspect the gearmotor for signs of leaks than to check an oil level device. Gearmotors do not consume oil, so unless there is a leak the oil level will remain constant.
4. Because gear motors are stationary devices, any substantial leakage will be detected long before there could be an oil related failure.

F. BK Series Gearbox Rebuild

The rebuild procedures are fairly simple and usually take less then 3 hours. The procedure begins after the coupling housing is removed from the gearbox housing (see F. above). The procedure is as follows:

1. Drain gearbox lubricant See A. above.
2. Remove bolts from gearbox to coupling housing flange.
3. Using a sharp chisel split the clutch housing to gearbox connection.
4. Remove the clutch housing from the gearbox.
5. Remove the shrink disk from the output shaft.
6. Remove the retaining ring from the top of the secondary gear shaft.
7. Using a 2 jaw gear puller remove primary driven gear from secondary pinion.
8. Remove shaft seals from both sides of the output shaft.
9. Remove retaining rings and support spacers and shim washers from both sides of the gearbox be sure to mark them so as to be sure to reinstall them in the correct positions later..
10. Using a soft mallet tap the output shaft toward the output side of the gearbox this will remove any loading from the bevel pinion during disassembly.
11. Support bevel output gear with key stock cut to length, heat output gear and press output shaft out of the gearbox from opposite the shrink disk side.
12. Remove output bevel gear from the gearbox housing

13. Drive the intermediate bevel pinion toward the inside of the gearbox to disengage it from the tapered roller bearing.
14. Remove the output, bearings from the gearbox.
15. Remove intermediate gear, bearings, spacers and shim washers from the gearbox journal be sure to mark all shims to ensure proper positioning during reassembly.
16. Inspect all parts to be reused for excessive wear. The bearings and output seals must be replaced during a rebuild.
17. Heat the output gear to 150 C and freeze output shaft and intermediate bevel pinion to facilitate assembly.
18. Install retaining rings, spacers and bearings into the intermediate journal making sure that the parts are installed in the correct positions.
19. Drive bevel pinion into intermediate bearings, install spacers and key.
20. Heat primary driven gear to 100 deg. C and install on secondary pinion gear while supporting the pinion. It is very important that when completed the intermediate gears will spin freely with no more than .3 mm of axial play.
21. Install retaining ring to secure primary driven gear.
22. Insert front output bearing, spacers and retaining ring into the gearbox journal.
23. Insert and align output gear into gearbox.
24. Press output shaft from shrink disk side into bearing & gear until shaft seats in gear.
25. Allow assembly to cool.
26. Install shrink disk side bearing spacers and retaining ring into the gearbox journal.
27. Pack the seal lips with grease and Coat the exterior of the output seals with sealant and press them into the gearbox assembly.
28. To retain enclosure integrity, sealant must be used on the mating surfaces. We recommend using Loctite® 515 or equivalent.

Lubricant grades

Gear oils CLP 220 to DIN 51502 or DIN 51517 or in special cases particularly soft and long-fibre greases GLP 00f with good EP characteristics are suitable for lubricating the gear unit. The lubricant should be suitable for low-friction and almost wear-free continuous operation. The damage stage in the FZG test to DIN 51354 should be above stage
12 and specific wear should be below 0.27 mg/kWh. The lubricant must not foam, should offer protection against corrosion and should not attack the internal paintwork, the roller bearings and gearwheels or
the gasket.

Different grades of lubricant should not be mixed as this would impair the lubricating properties. A long operating period can only be ensured by using the lubricants listed below or proven equivalent lubricants. The original lubricant can also be supplied from the works in small packs of 5 and 10 kg (11 and 22 lbs) respectively.

Please refer to MB 89.. (available upon request) in case the geared motors shall be encased prior to usage for a longer period of time.

Wear-protecting EP gear oils in accordance with the following table have proved to be particularly successful:

Producer	Gear units type series **BG, BF, BK60 – BK90** Mineral oil CLP 220
BP	Energol GR-XP 220
CASTROL	Alpha SP 220 or Hypoy EP 90
ELF	Reductelf SP 220
ESSO	Spartan EP 220 or GP 90
FINA	Giran 220
FUCHS	Renolin CLPF 220 Super or Renolin CLP 220
KLÜBER	Klüberoil GEM 1-220
MOBIL	Mobilgear 630
SHELL	Omala Oil 220
TOTAL	Carter EP 220

Attention:

Synthetic gearbox oils with Polygycol basis (e.g. PGLP...) must be kept separate from mineral oils and disposed of as Special Waste.

Unless the ambient temperature is below approximately –10° C (14° F) the viscosity grade VG 220 (SAE 90) and AGMA 5 EP in North America to international viscosity classification at 40° C (100° F) ISO 3448 and DIN 51519 is recommended.

For lower ambient temperatures oils of lower viscosity grade and correspondingly improved starting characteristics should be used, for example ISO VG 46 (SAE 75). These grades may in fact even be necessary in the temperature range around freezing point if the initial break-away torque of a drive is reduced to give a smooth start or if the motor has a comparatively low output. For ambient temperatures ranging continuously above +30° C (86° F) oils of ISO VG 680 (SAE 140) or AGMA 8 EP should be used.

Lubricant quantities

The optimum amount of lubricant for the specified design/mounting position is stated on the motor rating plate (symbol). It should be noted that, depending on the gearbox layout, the gearwheels and roller bearings at the top must also be reliably lubricated. In special cases the oil level gauge should be observed. For other layouts enquiries can be made in the works about the required amount of lubricant.

Lubricating the roller bearings

The maintenance intervals for roller bearings vary according to the operational speed, ambient temperature, load etc.

The roller bearings fitted in the gear unit are charged at the works with roller bearing grease and during operation they are lubricated by the gearbox lubricant.

Roller bearings in the gear unit which have been thoroughly cleaned or replaced during overhauls must be lubricated with an ageing-resistant, anti-corrosion lithium roller bearing grease of high working stability and of consistency No. 2 or No. 3.

Approximately half the free space between the rolling members should be filled with grease. Excess greasing increases the bearing temperature and should therefore be avoided.

9.1.6.7 AGMA Classification

Service factors and AGMA classes are comparable in the following way:

AGMA class	I	II	III
required Service Factor	1.0	1.4	2.0

9.1.6.8 Guide for the classification of typical gear motor applications

AGMA Classes and service factors by application

Application	Hrs. per day	
	3-10	24
PRINTING PRESSES	I	II
PULLERS		
Barge Haul	II	III
PUMPS		
Centrifugal	I	II
Proportioning	II	II
Single Acting 3 or more Cylinders	II	II
Double Acting 2 or more Cylinders	II	II
Single Acting 1 or 2 Cylinders*		
Double Acting Single - Cylinder		
Rotary - Gear Type	I	II
Lobe, vane	I	II
RUBBER INDUSTRY		
Mixer	III	III
Rubber Calender	II	II
Rubber Mill (2 or more)	II	II
Sheeter	II	II
Tire Building Machines	II*	II
Tire Tube Press Openers	I	I
Tubers and Strainers	II	II
SEWAGE DISPOSAL EQUIPMENT		
Bar Gereens	II	
Chemical Feeders	I	II
Collectors Circuline or Straightline	I	II
Dewatering Screens	II	II
Grit Collectors	I	II
Scrum Breakers	II	II
Slow or Rapid Mixers	II	II
Sludge Collectors	I	II
Thickeners	II	II
Vacuum Filters	II	II

MOTOR APPENDIX INFORMATION

TYPE: BALDOR 5.0 HP

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Product Information Packet

VEM7044T-I

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Part Detail							
Revision:	C	**Status:**	PRD/A	**Change #:**		**Proprietary:**	No
Type:	AC	**Prod. Type:**	3644M	**Elec. Spec:**	36WGT031	**CD Diagram:**	CD0005
Enclosure:	XPFC	**Mfg Plant:**		**Mech. Spec:**	36M654	**Layout:**	36LYM654
Frame:	184TC	**Mounting:**	F1	**Poles:**	04	**Created Date:**	10-12-2015
Base:	N	**Rotation:**	R	**Insulation:**	F	**Eff. Date:**	02-16-2017
Leads:	9#16					**Replaced By:**	
Literature:		**Elec. Diagram:**					

Nameplate NP0977XPSLEV

NO.					CC	010A	
SER.					TEMP CODE	T3C	
SPEC.	36M654T031G3						
CAT.NO.	VEM7044T-I						
HP	5 55C AMB @ 1.0SF						
VOLTS	230/460						
AMPS	13/6.5						
RPM	1750 75C RISE				MOTOR WEIGHT	115	
HERTZ	60	PH	3	CL F	DE BRG	6206	
SER.F.	1.15	DES	B	CODE K	ODE BRG	6205	
FRAME	184TC			GREASE	POLYREX EM		
RATING	40C AMB-CONT						
USABLE AT 208V	13.6			NEMA-NOM-EFF	89.5	PF	80
	NEMA MG-1 PT 5,IP55						

Parts List		
Part Number	**Description**	**Quantity**
SA308925	SA 36M654T031G3	1.000 EA
RA296262	RA 36M654T031G3	1.000 EA
37CB1005A02	CONDUIT BOX-MACH-EXPL.PROOF-GROUP "C"MTR	1.000 EA
11XW1032G06	10-32 X .38, TAPTITE II, HEX WSHR SLTD U	1.000 EA
HW3001B01	BRASS CUP WASHER, FOR #8 SCREW	1.000 EA
06EP1709A19	FREP XPFC DRAIN,GROUP C (8.38 DIA. BC)	1.000 EA
HW4506A02	BREATHER/DRAIN-EXP PROOF-.125-27 NPTF Al	1.000 EA
HW3022E05	.125 DIA X .500 ROLLED SPRING PIN	1.000 EA
HW5100A05	WVY WSHR F/205 & 304 BRGS	1.000 EA
36EP1703A17	PUEP - GROUP C & E, DRAIN (HW4506A02)	1.000 EA
HA2009A81	SLINGER FOR GROUP E MTRS - 06 BRG.	1.000 EA
80XN0632J06	SET SCREW, 6-32 X 3/8", HEX SOCKET, AS	2.000 EA
51XN1032A20	10-32 X 1 1/4 HX WS SL SR	2.000 EA
HW4506A02	BREATHER/DRAIN-EXP PROOF-.125-27 NPTF Al	1.000 EA
HW3022E05	.125 DIA X .500 ROLLED SPRING PIN	1.000 EA
HW1001A10	WASHER, #10 SPLT LK, ZN X	2.000 EA
HW4001A01	1/4 HX SOC PIPE PLG (F/S) ALLOY STEEL W/	2.000 EA
60XN1032A07	10-32 X 1/2 TRUSS HEAD, TORX SERRATED ZN	2.000 EA
51XB1214A16	12-14X1.00 HXWSSLD SERTYB	1.000 EA
36FH3003	FAN COVER, CAST	1.000 EA
51XW1032A08	10/32X1/2 HXWSHR HD, SL, SERATED	4.000 EA
37CB1502A01	CONDUIT BOX LID-MACH-EXPL.PROOF-GROUP "C	1.000 EA
RM1020A42	O-RING, -154 BUNA-N, .103 CS X 3.737 ID	1.000 EA
HW2501E16	3KEY, 1/4 SQ X 1.750	1.000 EA

Parts List (continued)

Part Number	Description	Quantity
HA7000A02	KEY RETAINER RING, 1 1/8 DIA, 1 3/8 DIA	1.000 EA
85XU0407S04	4X1/4 U DRIVE PIN STAINLESS	6.000 EA
LB1359F	ALUM XP CAUTION LABEL	1.000 EA
LB9002A50	CMC-5000 BRADY WIRE MARK	1.000 EA
MJ1000A02	GREASE, POLYREX EM EXXON (USe 4824-15A)	0.050 LB
36FN3000A01SP	EXFN, PLASTIC, 7.00 OD, .912 ID	1.000 EA
MG1025G29	WILKOFAST, 789.229, DARK CHARCOAL GRAY	0.022 GA
HA3105A18	THRUBOLT- 3/8-16 X 13.375 X	4.000 EA
LB1119N	WARNING LABEL	1.000 EA
LC0145B01	CONNECTION LABEL	1.000 EA
NP0977XPSLEV	SS XP UL CSA-EEV CC CL-I GP-C&D	1.000 EA
G0PA1000	PKG GRP, PRINT PK1026A06	1.000 EA
PK3082	STYROFOAM CRADLE	1.000 EA
MN416A01	TAG-INSTAL-MAINT no wire (1000/bx) 11/14	1.000 EA

AC Induction Motor Performance Data

Record # 32376 - Typical performance - not guaranteed values

Winding: 36WGT031-R071	**Type:** 3644M	**Enclosure:** XPFC

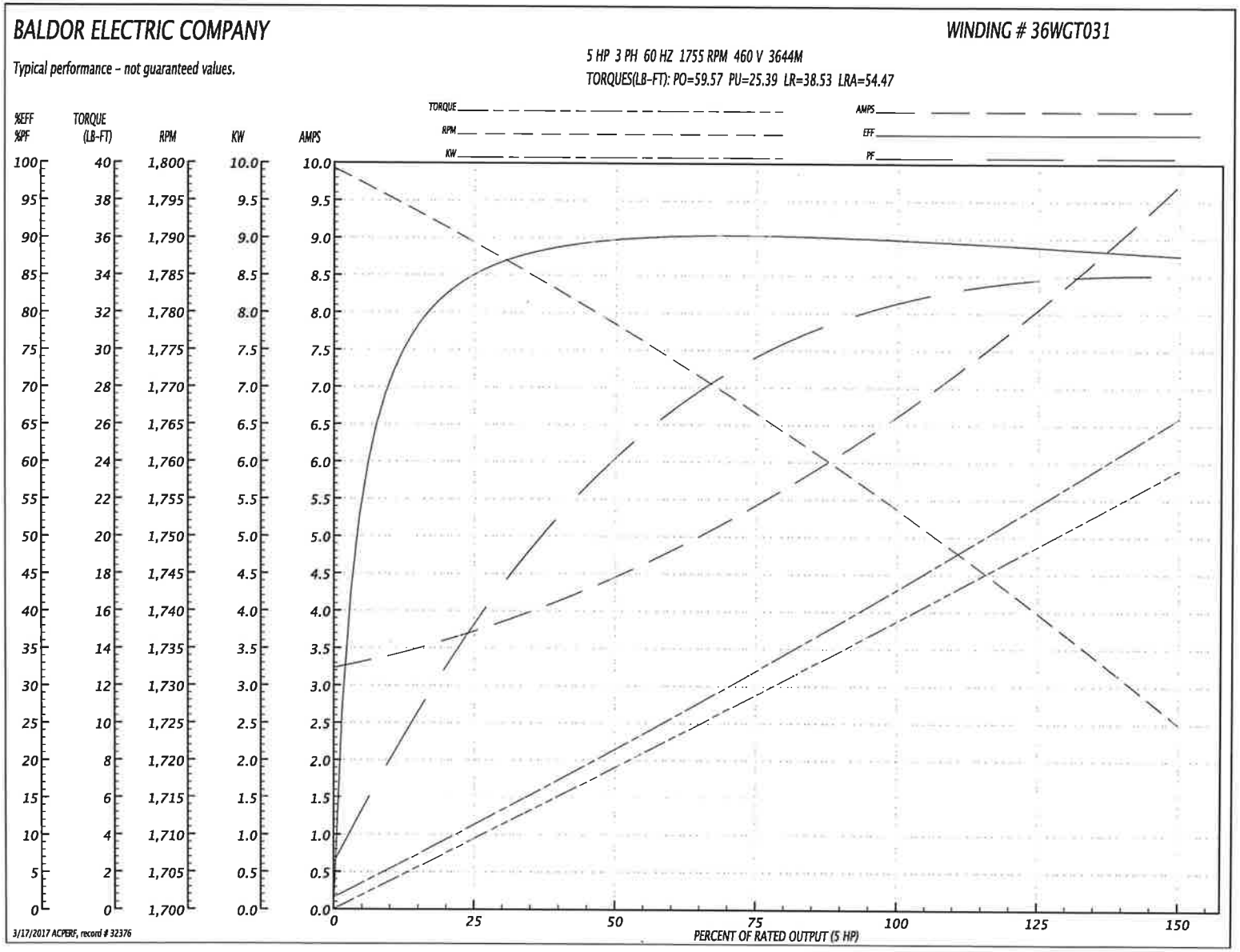
Nameplate Data			
Rated Output (HP)	5		
Volts	230/460		
Full Load Amps	13/6.5		
R.P.M.	1750		
Hz	60	Phase	3
NEMA Design Code	B	KVA Code	K
Service Factor (S.F.)	1.15		
NEMA Nom. Eff.	89.5	Power Factor	80
Rating - Duty	40C AMB-CONT		
S.F. Amps			

460 V, 60 Hz: High Voltage Connection	
Full Load Torque	15.1 LB-FT
Start Configuration	direct on line
Breakdown Torque	59.57 LB-FT
Pull-up Torque	25.39 LB-FT
Locked-rotor Torque	38.53 LB-FT
Starting Current	54.47 A
No-load Current	3.32 A
Line-line Res. @ 25°C	2.26 Ω
Temp. Rise @ Rated Load	54°C
Temp. Rise @ S.F. Load	65°C
Locked-rotor Power Factor	51.7
Rotor inertia	0.409 LB-FT2

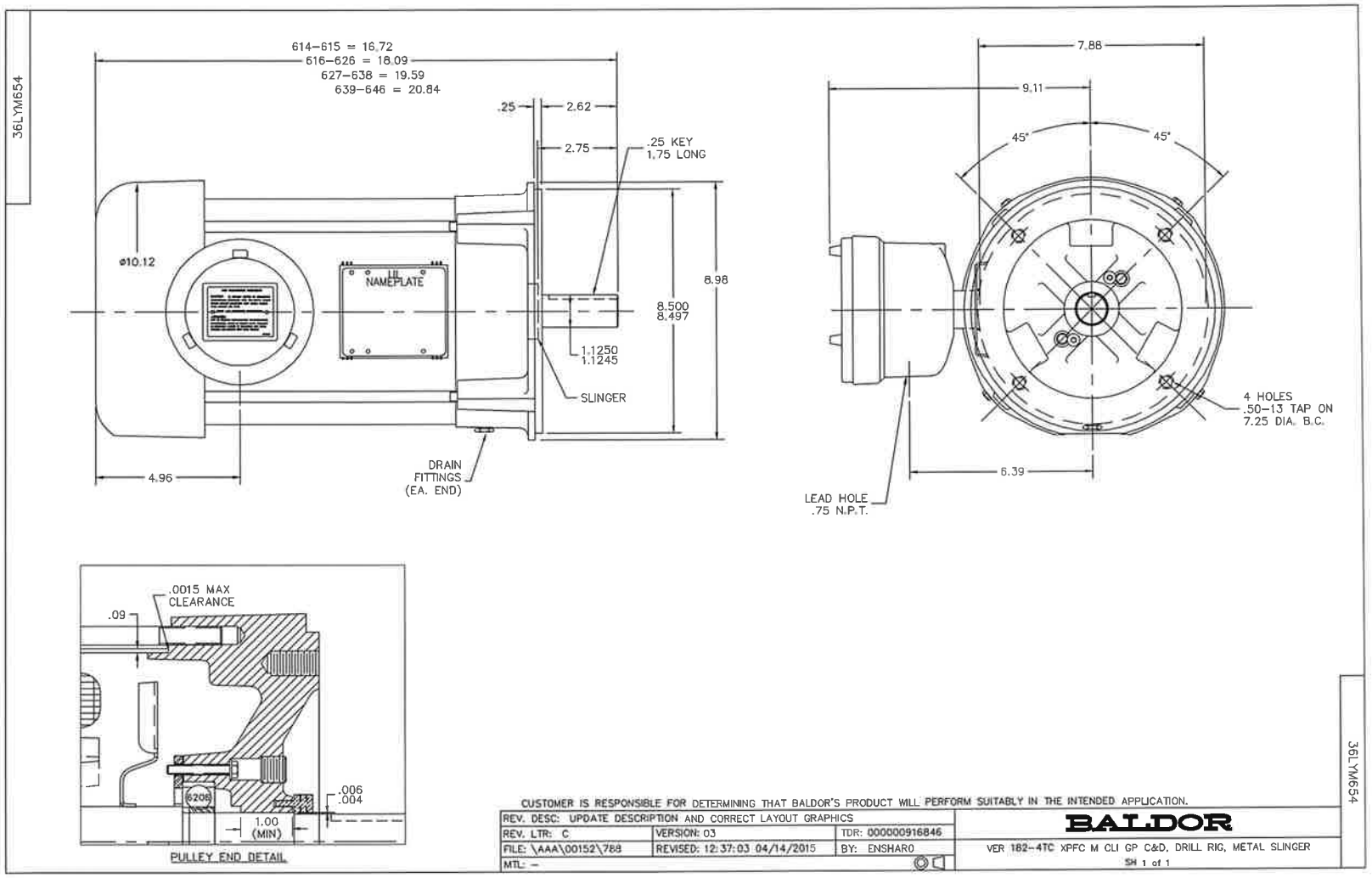
Load Characteristics 460 V, 60 Hz, 5 HP

% of Rated Load	25	50	75	100	125	150	S.F.
Power Factor	39	61	73	80	84	86	82
Efficiency	84.8	89.6	90.3	90.2	88.9	87.7	90
Speed	1790	1779	1767	1755	1742	1725	1746
Line amperes	3.62	4.36	5.37	6.55	7.9	9.67	7.3

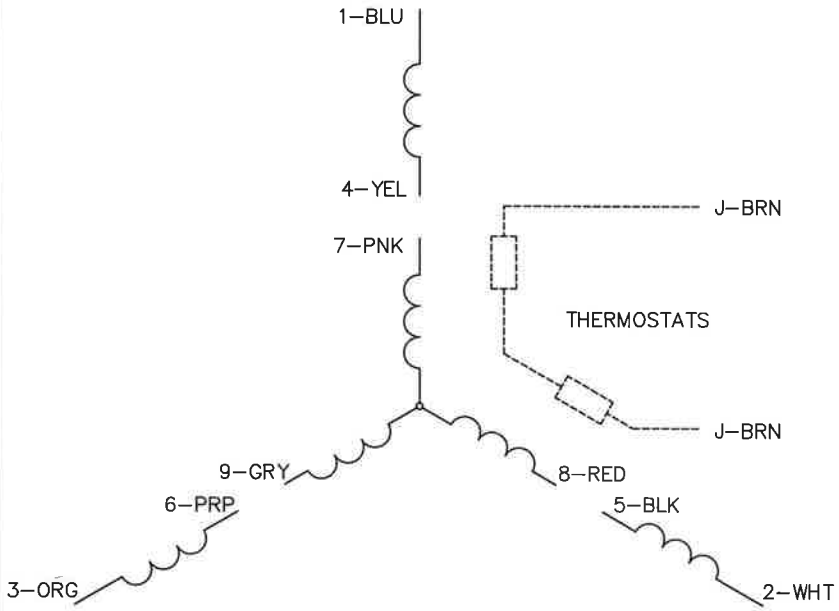
Performance Graph at 460V, 60Hz, 5.0HP Typical performance - Not guaranteed values

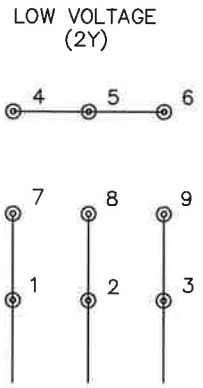


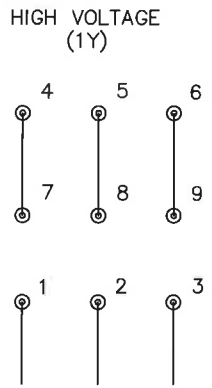
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36LYM654
614–615 = 16.72
616–626 = 18.09
627–638 = 19.59
639–646 = 20.84
.25
2.62
2.75
.25 KEY
1.75 LONG
ø10.12
LH
NAMEPLATE
8.98
8.500
8.497
1.1250
1.1245
SLINGER
4.96
DRAIN
FITTINGS
(EA. END)
7.88
9.11
45°
45°
4 HOLES
.50–13 TAP ON
7.25 DIA. B.C.
6.39
LEAD HOLE
.75 N.P.T.
.0015 MAX
CLEARANCE
.09
6206
.006
.004
1.00
(MIN)
PULLEY END DETAIL
36LYM654
CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT BALDOR'S PRODUCT WILL PERFORM SUITABLY IN THE INTENDED APPLICATION.
REV. DESC: UPDATE DESCRIPTION AND CORRECT LAYOUT GRAPHICS
REV. LTR: C
VERSION: 03
TDR: 000000916846
FILE: \AAA\00152\788
REVISED: 12:37:03 04/14/2015
BY: ENSHARO
MTL: –
BALDOR
VER 182–4TC XPFC M CLI GP C&D, DRILL RIG, METAL SLINGER
SH 1 of 1

CD0005







NOTES:

1. INTERCHANGE ANY TWO LINE LEADS TO REVERSE ROTATION.
2. THERMOSTATS ARE PROVIDED
3. ACTUAL NUMBER OF INTERNAL PARALLEL CIRCUITS MAY BE A MULTIPLE OF THOSE SHOWN ABOVE.
4. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

REV. DESC: REVISE TO SHOW OPTIONAL COLORS			
REV. LTR: E	BY: JLP	REVISED: 01/19/99 10:15	TDR: 0171435
CD0005		FILE: AAA00005140	MDL: –
		MTL: –	

BALDOR ELECTRIC Co.

3PH, DV, 9 LEADS

CD0005

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BALDOR • RELIANCE

Explosion Proof

Installation & Operating Manual

8/12

MN408

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Section 1
General Information

Overview This manual contains general procedures that apply to Baldor Motor products. Be sure to read and understand the Safety Notice statements in this manual. For your protection, do not install, operate or attempt to perform maintenance procedures until you understand the **Warning and Caution** statements.
A **Warning** statement indicates a possible unsafe condition that can cause harm to personnel.
A **Caution** statement indicates a condition that can cause damage to equipment.

Important: **This instruction manual is not intended to include a comprehensive listing of all details for all procedures required for installation, operation and maintenance. This manual describes general guidelines that apply to most of the motor products shipped by Baldor. If you have a question about a procedure or are uncertain about any detail, Do Not Proceed. Please contact your Baldor distributor for more information or clarification.**

Before you install, operate or perform maintenance, become familiar with the following:

- NEMA Publication MG-2, Safety Standard for Construction and guide for Selection, Installation and Use of Electric Motors and Generators.
- IEC 34-1 Electrical and IEC72-1 Mechanical specifications
- ANSI C51.5, the National Electrical Code (NEC) and local codes and practices.

Limited Warranty

www.baldor.com/support/warranty_standard.asp

Safety Notice: This equipment contains high voltage! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation and maintenance of electrical equipment.

Be sure that you are completely familiar with NEMA publication MG-2, safety standards for construction and guide for selection, installation and use of electric motors and generators, the National Electrical Code and local codes and practices. Unsafe installation or use can cause conditions that lead to serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

WARNING: **Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.**

WARNING: **Disconnect all electrical power from the motor windings and accessory devices before disassembly of the motor. Electrical shock can cause serious or fatal injury.**

WARNING: **Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury. National Electrical Code and Local codes must be carefully followed.**

WARNING: **Avoid extended exposure to machinery with high noise levels. Be sure to wear ear protective devices to reduce harmful effects to your hearing.**

WARNING: **Surface temperatures of motor enclosures may reach temperatures which can cause discomfort or injury to personnel accidentally coming into contact with hot surfaces. When installing, protection should be provided by the user to protect against accidental contact with hot surfaces. Failure to observe this precaution could result in bodily injury.**

WARNING: **This equipment may be connected to other machinery that has rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt to install operate or maintain this equipment.**

WARNING: **Do not by-pass or disable protective devices or safety guards. Safety features are designed to prevent damage to personnel or equipment. These devices can only provide protection if they remain operative.**

WARNING: **Avoid the use of automatic reset devices if the automatic restarting of equipment can be hazardous to personnel or equipment.**

WARNING: **Be sure the load is properly coupled to the motor shaft before applying power. The shaft key must be fully captive by the load device. Improper coupling can cause harm to personnel or equipment if the load decouples from the shaft during operation.**

WARNING: **UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.**

WARNING: **Thermostat contacts automatically reset when the motor has slightly cooled down. To prevent injury or damage, the control circuit should be designed so that automatic starting of the motor is not possible when the thermostat resets.**

Safety Notice Continued

WARNING: **Use proper care and procedures that are safe during handling, lifting, installing, operating and maintaining operations. Improper methods may cause muscle strain or other harm.**

WARNING: **Pacemaker danger – Magnetic and electromagnetic fields in the vicinity of current carrying carrying conductors and permanent magnet motors can result result in a serious health hazard to persons with cardiac pacemakers, metal implants, and hearing aids. To avoid risk, stay way from the area surrounding a permanent magnet motor.**

WARNING: **Before performing any motor maintenance procedure, be sure that the equipment connected to the motor shaft cannot cause shaft rotation. If the load can cause shaft rotation, disconnect the load from the motor shaft before maintenance is performed. Unexpected mechanical rotation of the motor parts can cause injury or motor damage.**

WARNING: **Do not use non UL/CSA listed explosion proof motors in the presence of flammable or combustible vapors or dust. These motors are not designed for atmospheric conditions that require explosion proof operation.**

WARNING: **Motors that are to be used in flammable and/or explosive atmospheres must display the UL label on the nameplate along with CSA listed logo. Specific service conditions for these motors are defined in NFPA 70 (NEC) Article 500.**

WARNING: **Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.**

Caution: **To prevent premature equipment failure or damage, only qualified maintenance personnel should perform maintenance.**

Caution: **Do not over tension belts. Excess tension may damage the motor or driven equipment.**

Caution: **Do not over-lubricate motor as this may cause premature bearing failure.**

Caution: **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

Caution: **If eye bolts are used for lifting a motor, be sure they are securely tightened. The lifting direction should not exceed a 20° angle from the shank of the eye bolt or lifting lug. Excessive lifting angles can cause damage.**

Caution: **To prevent equipment damage, be sure that the electrical service is not capable of delivering more than the maximum motor rated amps listed on the rating plate.**

Caution: **If a HI POT test (High Potential Insulation test) must be performed, follow the precautions and procedure in NEMA MG1 and MG2 standards to avoid equipment damage.**

Caution: **The space heaters are designed to operate at or below the maximum surface temperature stated on the nameplate. If the marked ambient and/or voltage are exceeded this maximum surface temperature can be exceeded and can damage the motor windings. If applied in a division 2 or zone 2 environment this excessive temperature may cause ignition of hazardous materials.**

Caution: **Shaker Duty motors must be properly lubricated prior to Start Up to prevent damage. See Section 3.**

If you have any questions or are uncertain about any statement or procedure, or if you require additional information please contact your Baldor distributor or an Authorized Baldor Service Center.

Receiving

Each Baldor Electric Motor is thoroughly tested at the factory and carefully packaged for shipment. When you receive your motor, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your motor.
2. Verify that the part number of the motor you received is the same as the part number listed on your purchase order.

Handling

The motor should be lifted using the lifting lugs or eye bolts provided.

Caution: **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

1. Use the lugs or eye bolts provided to lift the motor. Never attempt to lift the motor and additional equipment connected to the motor by this method. The lugs or eye bolts provided are designed to lift only the motor. Never lift the motor by the motor shaft or the hood of a WPII motor.

2. To avoid condensation inside the motor, do not unpack until the motor has reached room temperature. (Room temperature is the temperature of the room in which it will be installed). The packing provides insulation from temperature changes during transportation.
3. When lifting a WPII (Weather Proof Type 2) motor, do not lift the motor by inserting lifting lugs into holes on top of the cooling hood. These lugs are to be used for hood removal only. A spreader bar should be used to lift the motor by the cast lifting lugs located on the motor frame.
4. If the motor must be mounted to a plate with the driven equipment such as pump, compressor etc., it may not be possible to lift the motor alone. For this case, the assembly should be lifted by a sling around the mounting base. The entire assembly can be lifted as an assembly for installation.

   Do not lift the assembly using the motor lugs or eye bolts provided. Lugs or eye bolts are designed to lift motor only. If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting. If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting.

Storage

Storage requirements for motors and generators that will not be placed in service for at least six months from date of shipment.

Improper motor storage will result in seriously reduced reliability and failure. An electric motor that does not experience regular usage while being exposed to normally humid atmospheric conditions is likely to develop rust in the bearings or rust particles from surrounding surfaces may contaminate the bearings. The electrical insulation may absorb an excessive amount of moisture leading to the motor winding failure.

A wooden crate "shell" should be constructed to secure the motor during storage. This is similar to an export box but the sides & top must be secured to the wooden base with lag bolts (not nailed as export boxes are) to allow opening and reclosing many times without damage to the "shell".

Minimum resistance of motor winding insulation is 5 Meg ohms or the calculated minimum, which ever is greater. Minimum resistance is calculated as follows: **Rm = kV + 1**

where: (Rm is minimum resistance to ground in Meg-Ohms and kV is rated nameplate voltage defined as Kilo-Volts.)

Example: For a 480VAC rated motor Rm =1.48 meg-ohms (use 5 MΩ).
For a 4160VAC rated motor Rm = 5.16 meg-ohms.

Preparation for Storage

1. Some motors have a shipping brace attached to the shaft to prevent damage during transportation. The shipping brace, if provided, must be removed and stored for future use. The brace must be reinstalled to hold the shaft firmly in place against the bearing before the motor is moved.
2. Store in a clean, dry, protected warehouse where control is maintained as follows:
   a. Shock or vibration must not exceed 2 mils maximum at 60 hertz, to prevent the bearings from brinelling. If shock or vibration exceeds this limit vibration isolation pads must be used.
   b. Storage temperatures of 10°C (50°F) to 49°C (120°F) must be maintained.
   c. Relative humidity must not exceed 60%.
   d. Motor space heaters (when present) are to be connected and energized whenever there is a possibility that the storage ambient conditions will reach the dew point. Space heaters are optional.

   Note: Remove motor from containers when heaters are energized, reprotect if necessary.
3. Measure and record the resistance of the winding insulation (dielectric withstand) every 30 days of storage.
   a. If motor insulation resistance decreases below the minimum resistance, contact your Baldor District office.
   b. Place new desiccant inside the vapor bag and re-seal by taping it closed.
   c. If a zipper-closing type bag is used instead of the heat-sealed type bag, zip the bag closed instead of taping it. Be sure to place new desiccant inside bag after each monthly inspection.
   d. Place the shell over the motor and secure with lag bolts.
4. Where motors are mounted to machinery, the mounting must be such that the drains and breathers are fully operable and are at the lowest point of the motor. Vertical motors must be stored in the vertical position. Storage environment must be maintained as stated in step 2.

5. Motors with anti-friction bearings are to be greased at the time of going into extended storage with periodic service as follows:
   a. Motors marked "Do Not Lubricate" on the nameplate do not need to be greased before or during storage.
   b. Ball and roller bearing (anti-friction) motor shafts are to be rotated manually every 3 months and greased every 6 months in accordance with the Maintenance section of this manual.
   c. Sleeve bearing (oil lube) motors are drained of oil prior to shipment. The oil reservoirs must be refilled to the indicated level with the specified lubricant, (see Maintenance). The shaft should be rotated monthly by hand at least 10 to 15 revolutions to distribute oil to bearing surfaces.
   d. "Provisions for oil mist lubrication" – These motors are packed with grease. Storage procedures are the same as paragraph 5b.
   e. "Oil Mist Lubricated" – These bearings are protected for temporary storage by a corrosion inhibitor. If stored for greater than 3 months or outdoor storage is anticipated, connected to the oil mist system while in storage. If this is not possible, add the amount of grease indicated under "Standard Condition" in Section 3, then rotate the shaft 15 times by hand.
6. All breather drains are to be fully operable while in storage (drain plugs removed). The motors must be stored so that the drain is at the lowest point. All breathers and automatic "T" drains must be operable to allow breathing and draining at points other than through the bearings around the shaft. Vertical motors should be stored in a safe stable vertical position.
7. Coat all external machined surfaces with a rust preventing material. An acceptable product for this purpose is Exxon Rust Ban # 392.
8. Carbon brushes should be lifted and held in place in the holders, above the commutator, by the brush holder fingers. The commutator should be wrapped with a suitable material such as cardboard paper as a mechanical protection against damage.

Non-Regreaseable Motors

Non-regreasable motors with "Do Not Lubricate" on the nameplate should have the motor shaft rotated 15 times to redistribute the grease within the bearing every 3 months or more often.

All Other Motor Types

Before storage, the following procedure must be performed.

1. Remove the grease drain plug, if supplied, (opposite the grease fitting) on the bottom of each bracket prior to lubricating the motor.
2. The motor with regreasable bearing must be greased as instructed in Section 3 of this manual.
3. Replace the grease drain plug after greasing.
4. The motor shaft must be rotated a minimum of 15 times after greasing.
5. Motor Shafts are to be rotated at least 15 revolutions manually every 3 months and additional grease added every nine months (see Section 3) to each bearing.
6. Bearings are to be greased at the time of removal from storage.

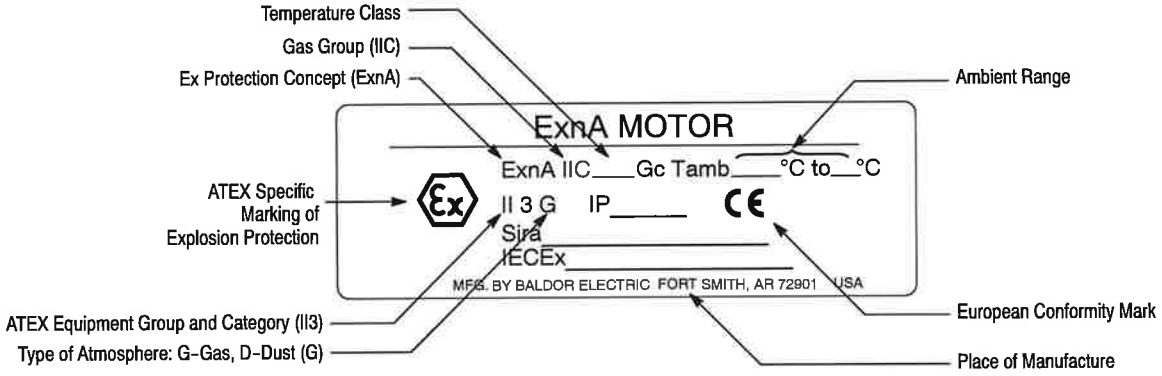
Removal From Storage

1. Remove all packing material.
2. Measure and record the electrical resistance of the winding insulation resistance meter at the time of removal from storage. The insulation resistance must not be less than 50% from the initial reading recorded when the motor was placed into storage. A decrease in resistance indicates moisture in the windings and necessitates electrical or mechanical drying before the motor can be placed into service. If resistance is low, contact your Baldor District office.
3. Regrease the bearings as instructed in Section 3 of this manual.
4. Reinstall the original shipping brace if motor is to be moved. This will hold the shaft firmly against the bearing and prevent damage during movement.

Equipment Marking for IEC Certified Product

IEC certified products have special markings that identify the protection concept and environment requirements. An example is shown in Figure 3-1.

Figure 3-1 IEC Certified Product Markings



Specific Conditions of Use:
If the motor certificate number is followed by the symbol "X", this indicates that the motor has specific conditions of use which are indicated on the certificate. It is necessary to review the product certification certificate in conjunction with this instruction manual.

Operation On Frequency Converters:
If the motor is evaluated for operation with an adjustable speed drive, the type of converter (for example PWM for Pulse Width Modulated) and safe speed ranges (for example 0–120Hz) will be specified in the certification documents or on motor nameplates. It is necessary to consult the adjustable speed drive manual for proper set up. IECEx Certificates are available online at www.iecex.com

Section 2
Installation & Operation

Overview

Installation should conform to the National Electrical Code as well as local codes and practices. When other devices are coupled to the motor shaft, be sure to install protective devices to prevent future accidents. Some protective devices include, coupling, belt guard, chain guard, shaft covers etc. These protect against accidental contact with moving parts. Machinery that is accessible to personnel should provide further protection in the form of guard rails, screening, warning signs etc.

Location

It is important that motors be installed in locations that are compatible with motor enclosure and ambient conditions. Improper selection of the motor enclosure and ambient conditions can lead to reduced operating life of the motor.

Proper ventilation for the motor must be provided. Obstructed airflow can lead to reduction of motor life.

1. **Open Drip-Proof/WPI** motors are intended for use indoors where atmosphere is relatively clean, dry, well ventilated and non-corrosive.
2. **Totally Enclosed and WPII** motors may be installed where dirt, moisture or dust are present and in outdoor locations.

Severe Duty, IEEE 841 and Washdown Duty enclosed motors are designed for installations with high corrosion or excessive moisture conditions. These motors should not be placed into an environment where there is the presence of flammable or combustible vapors, dust or any combustible material, unless specifically designed for this type of service.
IEEE841 motors are suitable for application in Class I Division 2 and Class I Zone 2 areas on sine wave power in accordance with the applicable codes and standards.

Hazardous Locations are those where there is a risk of ignition or explosion due to the presence of combustible gases, vapors, dust, fibers, or flyings. Facilities requiring special equipment for hazardous locations are typically classified in accordance with local requirements. In the US market, guidance is provided by the National Electric Code.

EMC Compliance Statement for European Union
The motors described in this instruction manual are designed to comply 2004/108/EC . These motors are commercial in design and not intended for residential use.

Mounting

Location

The motor should be installed in a location compatible with the motor enclosure and specific ambient. To allow adequate air flow, the following clearances must be maintained between the motor and any obstruction:

Table 2-1 Enclosure Clearance

TEFC / TENV (IC0141) Enclosures	
Fan Cover Air Intake	180 – 210T Frame 1″ (25mm)
Fan Cover Air Intake	250 – 449T Frame 4″ (100mm)
	IEC 112 – 132 1″ (25mm)
	IEC 160 – 280 4″ (100mm)
Exhaust	Envelope equal to the P Dimension on the motor dimension sheet
OPEN/Protected Enclosures	
Bracket Intake	Same as TEFC
Frame Exhaust	Exhaust out the sides envelope A minimum of the P dimension plus 2″ (50mm) Exhaust out the end same as intake.

The motor must be securely installed to a rigid foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage.

Foundation caps and sole plates are designed to act as spacers for the equipment they support. If these devices are used, be sure that they are evenly supported by the foundation or mounting surface.

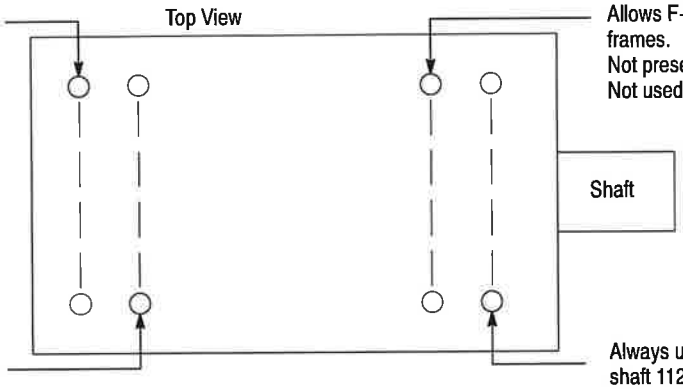
When installation is complete and accurate alignment of the motor and load is accomplished, the base should be grouted to the foundation to maintain this alignment.

The standard motor base is designed for horizontal or vertical mounting. Adjustable or sliding rails are designed for horizontal mounting only. Consult your Baldor distributor or authorized Baldor Service Center for further information.

Frame Mounting Holes

Some motors have standardized frames containing 6 or 8 mounting holes. 6 hole frames are not suitable for field reversal of mounting from F–1 to F–2, etc. Figure 2-2 indicates the proper mounting holes to use.

Figure 2-2 6 & 8 Hole Motor Frame Mounting



For short frame designations 182, 213, 254, 284, 324, 364, 404, 444 (NEMA)

Allows F-1 to F-2 Conversion on 8 hole frames.
Not present on 6 hole frames.
Not used on 8 hole frames.

For long frame designations 184, 215, 256, 286, 326, 365, 405, 445 (NEMA) (IEC) 112M, 132M, 160L, 200L, 225M, 250M, 280M

Always use these holes, closer to the shaft 112S, 132S, 160M, 180M, 200M, 225S, 250S, 280S, (IEC)

Caution: **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

In the case of assemblies on a common base, any lifting means provided on the motor should not be used to lift the assembly and base but, rather, the assembly should be lifted by a sling around the base or by other lifting means provided on the base. Assure lifting in the direction intended in the design of the lifting means. Likewise, precautions should be taken to prevent hazardous overloads due to deceleration, acceleration or shock forces.

Alignment

Accurate alignment of the motor with the driven equipment is extremely important. The pulley, sprocket, or gear used in the drive should be located on the shaft as close to the shaft shoulder as possible. It is recommended to heat the pulley, sprocket, or gear before installing on the motor shaft. Forcibly driving a unit on the motor shaft will damage the bearings.

1. **Direct Coupling**
   For direct drive, use flexible couplings if possible. Consult the drive or equipment manufacturer for more information. Mechanical vibration and roughness during operation may indicate poor alignment. Use dial indicators to check alignment. The space between coupling hubs should be maintained as recommended by the coupling manufacturer.
2. **End-Play Adjustment**
   The axial position of the motor frame with respect to its load is also extremely important. The standard motor bearings are not designed for excessive external axial thrust loads. Improper adjustment will cause failure.
3. **Pulley Ratio**
   The best practice is to not exceed an 8:1 pulley ratio.

Caution: **Do not over tension belts. Excess tension may damage the motor or driven equipment.**

4. **Belt Drive**
   Align sheaves carefully to minimize belt wear and axial bearing loads (see End-Play Adjustment). Belt tension should be sufficient to prevent belt slippage at rated speed and load. However, belt slippage may occur during starting.

Doweling & Bolting After proper alignment is verified, dowel pins should be inserted through the motor feet into the foundation. This will maintain the correct motor position should motor removal be required. (Baldor•Reliance motors are designed for doweling.)

1. Drill dowel holes in diagonally opposite motor feet in the locations provided.
2. Drill corresponding holes in the foundation.
3. Ream all holes.
4. Install proper fitting dowels.
5. Mounting bolts must be carefully tightened to prevent changes in alignment. Use a flat washer and lock washer under each nut or bolt head to hold the motor feet secure. Flanged nuts or bolts may be used as an alternative to washers.

WARNING: **Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.**

Guarding Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions. This is particularly important where the parts have surface irregularities such as keys, key ways or set screws. Some satisfactory methods of guarding are:

1. Covering the machine and associated rotating parts with structural or decorative parts of the driven equipment.
2. Providing covers for the rotating parts. Covers should be sufficiently rigid to maintain adequate guarding during normal service.

Power Connection Motor and control wiring, overload protection, disconnects, accessories and grounding should conform to the National Electrical Code and local codes and practices.

For ExnA hazardous location motors, it is a specific condition of use that all terminations in a conduit box be fully insulated. Fully insulated and lugged terminations must be bolted and provided with lock washer to prevent rotation. Flying leads must be insulated with two full wraps of electrical grade insulating tape or heat shrink tubing.

Grounding In the USA consult the National Electrical Code, Article 430 for information on grounding of motors and generators, and Article 250 for general information on grounding. In making the ground connection, the installer should make certain that there is a solid and permanent metallic connection between the ground point, the motor or generator terminal housing, and the motor or generator frame. In non-USA locations consult the appropriate national or local code applicable.

Motors with resilient cushion rings usually must be provided with a bonding conductor across the resilient member. Some motors are supplied with the bonding conductor on the concealed side of the cushion ring to protect the bond from damage. Motors with bonded cushion rings should usually be grounded at the time of installation in accordance with the above recommendations for making ground connections. When motors with bonded cushion rings are used in multimotor installations employing group fusing or group protection, the bonding of the cushion ring should be checked to determine that it is adequate for the rating of the branch circuit over current protective device being used.

There are applications where grounding the exterior parts of a motor or generator may result in greater hazard by increasing the possibility of a person in the area simultaneously contacting ground and some other nearby live electrical parts of other ungrounded electrical equipment. In portable equipment it is difficult to be sure that a positive ground connection is maintained as the equipment is moved, and providing a grounding conductor may lead to a false sense of security.

Select a motor starter and over current protection suitable for this motor and its application. Consult motor starter application data as well as the National Electric Code and/or other applicable local codes.

For motors installed in compliance with IEC requirements, the following minimum cross sectional area of the protective conductors should be used:

Cross-sectional area of phase conductors, S	Minimum cross-sectional area of the corresponding protective conductor, S_p
mm^2	mm^2
$S < 16$	S
$16 < S \leq 35$	16
$S > 35$	$0{,}5\,S$

Equipotential bonding connection shall made using a conductor with a cross-sectional area of at least 4 mm^2.

Conduit Box For ease of making connections, an oversize conduit box is provided. Most conduit boxes can be rotated 360° in 90° increments. Auxiliary conduit boxes are provided on some motors for accessories such as space heaters, RTD's etc.

AC Power Motors with flying lead construction must be properly terminated and insulated.
Connect the motor leads as shown on the connection diagram located on the name plate or inside the cover on the conduit box. Be sure the following guidelines are met:

1. AC power is within ±10% of rated voltage with rated frequency. (See motor name plate for ratings).
   OR
2. AC power is within ±5% of rated frequency with rated voltage.
   OR
3. A combined variation in voltage and frequency of ±10% (sum of absolute values) of rated values, provided the frequency variation does not exceed ±5% of rated frequency.

Performance within these voltage and frequency variations are shown in Figure 2-4.

Figure 2-3 Accessory Connections

HEATERS H1 —∿∿∿— H2 H1 —∿∿∿— H2	One heater is installed in each end of motor. Leads for each heater are labeled H1 & H2. (Like numbers should be tied together).
THERMISTORS TD1 — TD2	Three thermistors are installed in windings and tied in series. Leads are labeled TD1 & TD2.
WINDING RTDS RED RED WHITE	Winding RTDs are installed in windings (2) per phase. Each set of leads is labeled 1TD1, 1TD2, 1TD3, 2TD1, 2TD2, 2TD3 etc.
BEARING RTD RED RED WHITE	* One bearing RTD is installed in Drive endplate (PUEP), leads are labeled RTDDE. * One bearing RTD is installed in Opposite Drive endplate (FREP), leads are labeled RTDODE. * Note RTD may have 2–Red/1–White leads; or 2–White/1–Red Lead.

Rotation All three phase motors are reversible. To reverse the direction of rotation, disconnect and lock out power and interchange any two of the three line leads for three phase motors. For single phase motors, check the connection diagram to determine if the motor is reversible and follow the connection instructions for lead numbers to be interchanged. Not all single phase motors are reversible.

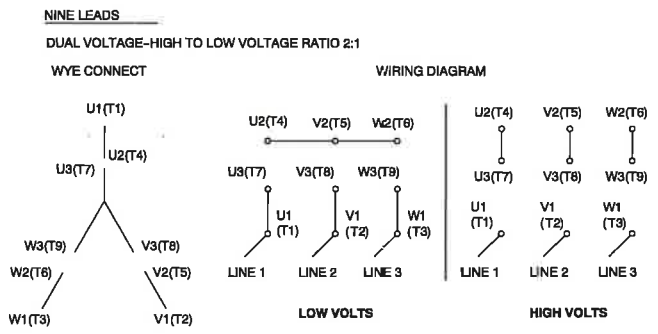
Adjustable Frequency Power Inverters used to supply adjustable frequency power to induction motors produce wave forms with lower order harmonics with voltage spikes superimposed. Turn–to–turn, phase–to–phase, and ground insulation of stator windings are subject to the resulting dielectric stresses. Suitable precautions should be taken in the design of these drive systems to minimize the magnitude of these voltage spikes. Consult the drive instructions for maximum acceptable motor lead lengths, and proper grounding.

Note: Main power leads for CE Marked Motors may be marked U,V,W – for standard configurations, please consult connection diagrams.

Caution: **The space heaters are designed to operate at or below the maximum surface temperature stated on the nameplate. If the marked ambient and/or voltage are exceeded this maximum surface temperature can be exceeded and can damage the motor windings. If applied in a division 2 or zone 2 environment this excessive temperature may cause ignition of hazardous materials.**

Connection Diagrams

AC Motor Connection Diagram



MOTOR WINDING THERMOSTATS

CONTACTS _____ @ _____ °C

FIGURE NUMBER _____

CONTACT RATING

VOLTS	CONTINUOUS AMPERES	INRUSH AMPERES
110 - 120	3.0	30
220 - 240	1.5	15
440 - 480	0.75	7.5
550 - 600	0.60	6.0

THERMOSTATS

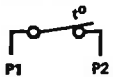
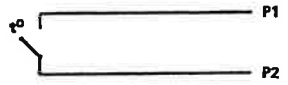
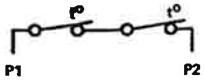
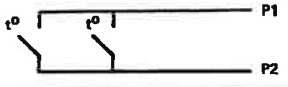
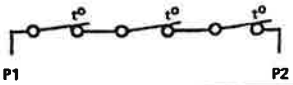
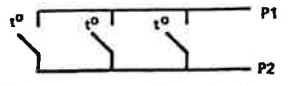
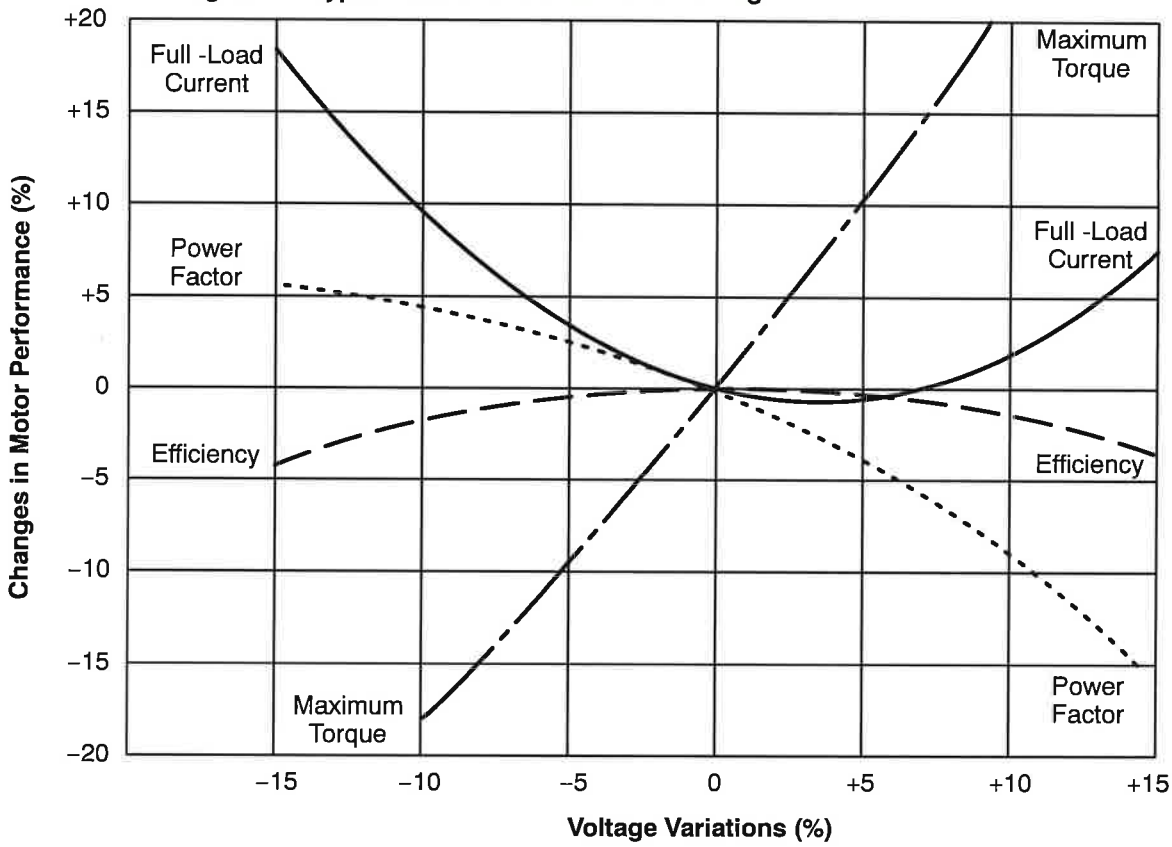
NORMALLY CLOSED	NORMALLY OPEN
FIGURE 1 	FIGURE 4 
FIGURE 2 	FIGURE 5 
FIGURE 3 	FIGURE 6 

Figure 2-4 Typical Motor Performance VS Voltage Variations



Initial Lubrication Baldor•Reliance motors are shipped from the factory with the bearings properly packed with grease and ready to operate. Where the unit has been subjected to extended storage (6 months or more) the bearings should be relubricated (regreasable type) prior to starting. When motors are equipped for oil mist lubrication refer to the instruction manual for installation, operation, and maintenance of oil mist lubrication systems.

Caution: **Shaker Duty motors must be properly lubricated prior to Start Up to prevent damage. See Section 3.**

First Time Start Up Be sure that all power to motor and accessories is off. Be sure the motor shaft is disconnected from the load and will not cause mechanical rotation of the motor shaft.

1. Make sure that the mechanical installation is secure. All bolts and nuts are tightened etc.
2. If motor has been in storage or idle for some time, check winding insulation integrity.
3. Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity.
4. Be sure all shipping materials and braces (if used) are removed from motor shaft.
5. Manually rotate the motor shaft to ensure that it rotates freely.
6. Replace all panels and covers that were removed during installation.
7. Momentarily apply power and check the direction of rotation of the motor shaft.
8. If motor rotation is wrong, be sure power is off and change the motor lead connections. Verify rotation direction before you continue.
9. Start the motor and ensure operation is smooth without excessive vibration or noise. If so, run the motor for 1 hour with no load connected.
10. After 1 hour of operation, disconnect power and connect the load to the motor shaft. Verify all coupling guards and protective devices are installed. Ensure motor is properly ventilated.
11. If motor is totally enclosed fan-cooled or non-ventilated it is recommended that condensation drain plugs, if present, be removed. These are located in the lower portion of the end-shields. Totally enclosed fan-cooled "XT" motors are normally equipped with automatic drains which may be left in place as received.

Coupled Start Up This procedure assumes a coupled start up. Also, that the first time start up procedure was successful.

1. Check the coupling and ensure that all guards and protective devices are installed.
2. Check that the coupling is properly aligned and not binding.
3. The first coupled start up should be with no load. Apply power and verify that the load is not transmitting excessive vibration back to the motor though the coupling or the foundation. Vibration should be at an acceptable level.
4. Run for approximately 1 hour with the driven equipment in an unloaded condition.

The equipment can now be loaded and operated within specified limits. Do not exceed the name plate ratings for amperes for steady continuous loads.

Jogging and Repeated Starts Repeated starts and/or jogs of induction motors generally reduce the life of the motor winding insulation. A much greater amount of heat is produced by each acceleration or jog than by the same motor under full load. If it is necessary to repeatedly start or jog the motor, it is advisable to check the application with your local Baldor distributor or Baldor Service Center.

Heating - Duty rating and maximum ambient temperature are stated on the motor name plate. Do not exceed these values. If there is any question regarding safe operation, contact your local Baldor distributor or Baldor Service Center.

Hazardous Locations

Hazardous locations are those where there is a risk of ignition or explosion due to the presence of combustible gases, vapors, dust, fibers or flyings.

Selection Facilities requiring special equipment for hazardous locations are typically classified in accordance with local requirements. In the US market, guidance is provided by the National Electric Code. In international hazardous location areas, guidance for gas / vapor / mist classification is given in IEC60079-14, or for dust in IEC61241-14. This classification process lets the installer know what equipment is suitable for installation in that environment, and identifies what the maximum safe temperature or temperature class is required. It is the customer or users responsibility to determine the area classification and select proper equipment.

Areas are classified with respect to risk and exposure to the hazard. In the US market, areas are typically classified as follows Class, Division, Group and Temperature Class. In some newer installations in the US and in most international markets, areas are classified in Zones.

Protection Concepts

Class I Division 1 / Zone 1 [Equipment Group I (mining) or II (surface), Equipment Protection Level (EPL) Gb, Mb]

Baldor offers a range of motors suitable for installation in a Division 1 or Zone 1 environment. These motors are known as explosion proof or flameproof.

Motors that are explosion proof or flameproof use specially machined flameproof joints between the end bell or bracket and the frame, as well as along the rotating shaft and at connection box covers and entries. The fit of these flameproof joints are designed to contain the combustion or quench the flame of an explosive gas atmosphere prior to it exiting the motor. These flameproof joints have lengths and widths selected and tested based on the gas group present in the atmosphere. Baldor•Reliance motors are typically designed to meet Class I (Division 1) Group C and D (explosion proof) or Ex d IIB (flameproof).

An application note regarding equipment applied in accordance with the US National Electric Code (NFPA 70-2008) – according to Article 500.8(C) Marking, sub clause (2) in the fine print note, it is noted that Equipment not marked to indicate a division is suitable for both Division 1 and Division 2 locations. These motors are not gas tight. To the contrary, this protection concept assumes that due to the normal heating and cooling cycle of motor operation that any gas present will be drawn into the motor. Since flameproof or explosion proof motors are designed to contain the combustion and extinguish any flame transmission, for this protection concept, only external surface temperatures are of concern. Thermal limiting devices such as thermostats, thermistors or RTDs may be provided on these motors to limit the external surface temperature during overload conditions.

If thermostats are provided as a condition of certification, it is the installer's responsibility to make sure that these devices are properly connected to a suitable switching device. The ATEX directive requires that motor shutdown on thermal trip be accomplished without an intermediate software command. Where intermediate circuitry is involved the circuit shall fall within the scope of a safety, controlling and regulating device as defined in article 1(2) of European Directive 94/9/EC, and shall be covered by an appropriate EC Type Examination Certificate.

Flameproof motors, internationally referred to as Ex d use a protection concept similar to that used in Class I Division 1 motors, with minor differences in the flameproof joints and cable entry designs. Flameproof and explosion proof motors are both type tested. Representative motors are connected to a reference gas and ignited in laboratory conditions to verify that the flame is not transmitted outside the motor enclosure and to determine the maximum internal pressure encountered.

Explosion proof and Flame proof motors shipped without a conduit box require use of a certified box of suitable dimensions and that is appropriate for the classification. Openings in connection boxes must be closed with suitably certified and dimensioned device.

Class I Division 2 / Zone 2 Ex nA, [Equipment Protection Level (EPL) Gc]

This protection concept relies on having no sources of ignition present such as arcing parts or hot surfaces. For this protection concept, internal temperatures as well as external temperatures are considered. In many cases, the internal temperatures are higher than the external temperatures and therefore become the limiting factor in determination of temperature code designation. In these applications, it is very important to use a motor that has been evaluated thermally for use with an inverter or converter, if variable speed operation is desired. Thermostats used for Class I Division 2 and Ex nA motors are used to protect the motor only. For motors using flying lead construction, it is important to use connection lugs and insulate with heat shrink tubing or a double wrap of insulation grade electrical tape to avoid the risk of spark or ignition.

Class II Division 1 / Zone 21 [Equipment Group III, Equipment Protection Level (EPL) Db]

This area classification is one where the risk of ignitable concentrations of dust is present at all or some of the time. The protection concepts used for Class II Division 1 is similar to flamepath, except with additional dust exclusion paths designed for the rotating shaft. In the international designations, this concept is referred to as dust ignition proof or Ex tD. External surface temperature remains the limiting factor. Thermal limiting devices such as thermostats, thermistors or RTDs may be provided on these motors to limit the external surface temperature during overload conditions. If thermostats are provided as a condition of certification, it is the installer's responsibility to make sure that these devices are properly connected to a suitable switching device.

Note: In the North American area classification system, Class III exists for fibers and flyings. In the IEC designation, both dusts and flyings are absorbed into Group III.

Class II Division 2 / Zone 22 [Equipment Group III, Equipment Protection Level (EPL) Dc]

This area classification is one where the risk of exposure to ignitable concentrations of dust are not likely to occur under normal operating conditions and relies heavily on the housekeeping practices within the installation.

Sine Wave Power Operation for Division 1 or 2 and Zone 1 or 2 and Zone 21 or 22 Hazardous Location.

These motors are designed to operate at or below the maximum surface temperature (or T-Code) stated on the nameplate. Failure to operate the motor properly can cause this maximum surface temperature to be exceeded. If applied in a Division 1 or 2 / Zone 1 or 2 and Zone 21 or 22 environment, this excessive temperature may cause ignition of hazardous materials. Operating the motor at any of the following conditions can cause the marked surface temperature to be exceeded.

1. Motor load exceeding service factor nameplate value
2. Ambient temperatures above nameplate value
3. Voltages above or below nameplate value
4. Unbalanced voltages
5. Loss of proper ventilation
6. Altitude above 3300 feet / 1000 meters
7. Severe duty cycles of repeated starts
8. Motor stall
9. Motor reversing
10. Single phase operation of polyphase equipment
11. Variable frequency operation

Variable Frequency Power Operation for Division 1 or 2 and Zone 1 or 2 and Zone 21 or 22 Hazardous Location (motors with maximum surface temperature listed on the nameplate).

Only motors with nameplates marked for use on inverter (variable frequency) power, and labeled for specific hazardous areas may be used in those hazardous areas on inverter power. The motor is designed to operate at or below the maximum surface temperature (or T-Code) stated on the nameplate. Failure to operate the motor properly can cause this maximum surface temperature to be exceeded.

If applied in a Division 1 or 2 / Zone 1 or 2 and Zone 21 or 22 environment, this excessive temperature may cause ignition of hazardous materials. Operating the motor at any of the following conditions can cause the marked surface temperature to be exceeded.

1. Motor load exceeding service factor nameplate value
2. Ambient temperature above nameplate value
3. Voltage (at each operating frequency) above or below rated nameplate value
4. Unbalanced voltages
5. Loss of proper ventilation
6. Operation outside of the nameplate speed / frequency range
7. Altitudes above 3300 feet / 1000 meters
8. Single phase operation of polyphase equipment
9. Unstable current wave forms
10. Lower than name plate minimum carrier frequency

Thermal Limiting

Thermal limiting devices are temperature sensing control components installed inside the motor to limit the internal temperature of the motor frame by interrupting the circuit of the holding coil of the magnetic switch or contactor. They are required for most Division 1 and Zone 1 applications. For Division 2 or Zone 2 applications, motors should be selected that preclude running temperatures from exceeding the ignition temperatures for the designated hazardous material. In Division 2 or Zone 2 classified locations, thermal limiting devices should only be used for winding protection and not considered for limiting all internal motor temperatures to specific ignition temperatures.

Equipotential Bonding and Shaft Current Reduction

Larger motors (ie WP construction) may require proper bonding between motor enclosures and covers to avoid the risk of stray currents during start up. Fastening methods and bonding straps must not be modified.

Bearing currents can exist in some motors for both line-fed and inverter-fed applications. Larger line-fed motors may require at least one insulated bearing to prevent a flow of current through the bearings. Do not defeat such insulation whether the motor is line-fed or inverter-fed applications. Inverter-fed motors may require additional bearing insulation or even a shaft brush. Do not defeat such features. When the motor and the coupled load are not on a common conductive baseplate, it may also be necessary to electrically bond together the stationary parts of the motor and the coupled equipment.

Repair of Motors used in Hazardous Locations

Repair of hazardous certified motors requires additional information, skill, and care. It is the customer's responsibility to select service shops with proper qualifications to repair hazardous location motors. Contact the manufacture for additional repair details. Use only original manufacturer's parts.

Repair of Explosion Proof or Flame Proof Motors Class I Division 1 and Zone 1

In the North American market, recertification programs are offered by Underwriters Laboratories and Canadian Standards Association which allow authorized service shops to mark the rebuilt motors as certified. In the international markets using IEC based requirements, repair should be undertaken only after consulting IEC60079-19 Explosive Atmospheres-Part 19 Equipment repair, overhaul and reclamation. If use of a certified repair facility is desired, consult the IECEX Repair Scheme at

http://www.iecex.com/service_facilities.htm

Explosion proof and flameproof motors achieve their safety based on the mechanical construction – flameproof joints and bearing clearance, and the electrical design including any thermal limiting devices. If it is necessary to repair a flameproof or explosion proof motor, it is critical that the mechanical flameproof joints be maintained. Consult Baldor Electric Company for flameproof joint construction details. Use only Baldor•Reliance supplied parts. Baldor does not recommend reclamation of parts. Since this protection method also relies on temperature being maintained, make sure that any rewinding uses the original electrical designs, including any thermal protection that may be present.

Repair of Dust Ignition Proof Motors – Class II Division 1 and 2, Zone 21 and 22.

For Dust Ignition Proof, proper sealing is required. Do not modify the motor construction to add any additional opening, and ensure that proper sealing is maintained in the connection box and at the shaft seal. Since this protection method also relies on temperature being maintained, make sure that any rewinding uses the original electrical designs, including any thermal protection that may be present

Repair of Class I Division 2 and Zone 2 motors

For Division 2 and Zone 2, the internal and external temperatures are of concern. Since this protection method also relies on temperature being maintained, make sure that any rewinding uses the original electrical designs, including any thermal protection that may be present. Use only Baldor replacement thermostats, if provided.

Section 3
Maintenance & Troubleshooting

WARNING: **UL and EX Listed motors must only be serviced by UL or EX Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.**

General Inspection Inspect the motor at regular intervals, approximately every 500 hours of operation or every 3 months, whichever occurs first. Keep the motor clean and the ventilation openings clear. The following steps should be performed at each inspection:

WARNING: **Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.**

1. Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. Oily vapor, paper pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
2. Perform a dielectric with stand test periodically to ensure that the integrity of the winding insulation has been maintained. Record the readings. Immediately investigate any significant decrease in insulation resistance.
3. Check all electrical connectors to be sure that they are tight.

Relubrication & Bearings Bearing grease will lose its lubricating ability over time, not suddenly. The lubricating ability of a grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Good results can be obtained if the following recommendations are used in your maintenance program.

Type of Grease A high grade ball or roller bearing grease should be used. Recommended grease for standard service conditions is **Polyrex EM (Exxon Mobil)**. Do not mix greases unless compatibility has been checked and verified.

Ball Bearing Motors

Operating Temperature -25°C (-15°F) to 50°C (120°F)

EXXON	POLYREX EM (Standard on Baldor motors)
EXXON	UNIREX N2
EXXON	BEACON 325
CHEVRON OIL	SRI NO. 2 (Compatible with Polyrex EM)
CHEVRON OIL	BLACK PEARL
TEXACO, INC.	PREMIUM RB
TEXACO, INC.	POLYSTAR
AMOCO	RYKON # 2
PENNZOIL	PENNZLUBE EM-2
DARMEX	DARMEX 707
DARMEX	DARMEX 711
PETRO-CANADA	PEERLESS LLG
SHELL OIL	DOLIUM BRB

Minimum Starting Temperature -60°C (-76°F)

SHELL OIL CO.	AEROSHELL 7 (Standard on Baldor motors)
MOBIL	MOBIL 28
MOBIL	MOBILITH SHC 100 (Low Temperature - Arctic Duty)

Roller Bearing Motors

Operating Temperature -25°C (-15°F) to 50°C (120°F)

TEXACO, INC.	PREMIUM RB
MOBIL	MOBILITH SHC 220 (Standard on Baldor motors)
CHEVRON OIL	BLACK PEARL

Relubrication Intervals Recommended relubrication intervals are shown in Table 3-2. It is important to realize that the recommended intervals of Table 3-2 are based on average use.

Refer to additional information contained in Tables 3-3, 3-4 and 3-5.

Table 3-2 Relubrication Intervals *

NEMA / (IEC) Frame Size	Rated Speed - RPM					
	10000	6000	3600	1800	1200	900
Up to 210 incl. (132)	**	2700 Hrs.	5500 Hrs.	12000 Hrs.	18000 Hrs.	22000 Hrs.
Over 210 to 280 incl. (180)		**	3600 Hrs.	9500 Hrs.	15000 Hrs.	18000 Hrs.
Over 280 to 360 incl. (225)		**	* 2200 Hrs.	7400 Hrs.	12000 Hrs.	15000 Hrs.
Over 360 to 449 incl. (315)		**	*2200 Hrs.	3500 Hrs.	7400 Hrs.	10500 Hrs.

* Relubrication intervals are for ball bearings.
For vertically mounted motors and roller bearings, divide the relubrication interval by 2.

** For motors operating at speeds greater than 3600 RPM, contact Baldor for relubrication recommendations.

Table 3-3 Service Conditions

Severity of Service	Hours per day of Operation	Ambient Temperature Maximum	Atmospheric Contamination
Standard	8	40° C	Clean, Little Corrosion
Severe	16 Plus	50° C	Moderate dirt, Corrosion
Extreme	16 Plus	>50° C* or Class H Insulation	Severe dirt, Abrasive dust, Corrosion, Heavy Shock or Vibration
Low Temperature		<-29° C **	

* Special high temperature grease is recommended (Dow Corning DC44). Note that Dow Corning DC44 grease does not mix with other grease types. Thoroughly clean bearing & cavity before adding grease.

** Special low temperature grease is recommended (Aeroshell 7).

Table 3-4 Relubrication Interval Multiplier

Severity of Service	Multiplier
Standard	1.0
Severe	0.5
Extreme	0.1
Low Temperature	1.0

Some motor designs use different bearings on each motor end. This is normally indicated on the motor nameplate. In this case, the larger bearing is installed on the motor Drive endplate. For best relubrication results, only use the appropriate amount of grease for each bearing size (not the same for both).

Table 3-5 Bearings Sizes and Types

Frame Size NEMA (IEC)	Bearing Description (These are the "Large" bearings (Shaft End) in each frame size)			
	Bearing	Weight of Grease to add * oz (Grams)	Volume of grease to be added	
			in^3	teaspoon
56 to 140 (90)	6203	0.08 (2.4)	0.15	0.5
140 (90)	6205	0.15 (3.9)	0.2	0.8
180 (100–112)	6206	0.19 (5.0)	0.3	1.0
210 (132)	6307	0.30 (8.4)	0.6	2.0
250 (160)	6309	0.47 (12.5)	0.7	2.5
280 (180)	6311	0.61 (17)	1.2	3.9
320 (200)	6312	0.76 (20.1)	1.2	4.0
360 (225)	6313	0.81 (23)	1.5	5.2
400 (250)	6316	1.25 (33)	2.0	6.6
440 (280)	6318	1.52(40)	2.5	8.2
440 (280)	6319	2.12 (60)	4.1	13.4
5000 to 5800 (315–355)	6328	4.70 (130)	9.2	30.0
5000 to 5800 (315–355)	NU328	4.70 (130)	9.2	30.0
360 to 449 (225–280)	NU319	2.12 (60)	4.1	13.4
AC Induction Servo				
76 Frame 180 (112)	6207	0.22 (6.1)	0.44	1.4
77 Frame 210 (132)	6210	0.32 (9.0)	0.64	2.1
80 Frame 250(160)	6213	0.49 (14.0)	0.99	3.3

* Weight in grams = .005 DB of grease to be added

Note: Not all bearing sizes are listed.
For intermediate bearing sizes, use the grease volume for the next larger size bearing.

Caution: To avoid damage to motor bearings, grease must be kept free of dirt. For an extremely dirty environment, contact your Baldor distributor or an authorized Baldor Service Center for additional information.

Relubrication Procedure Be sure that the grease you are adding to the motor is compatible with the grease already in the motor. Consult your Baldor distributor or an authorized service center if a grease other than the recommended type is to be used.

Caution: Do not over-lubricate motor as this may cause premature bearing failure.

With Grease Outlet Plug

1. With the motor stopped, clean all grease fittings with a clean cloth.
2. Remove grease outlet plug.

Caution: Over-lubricating can cause excessive bearing temperatures, premature lubrication breakdown and bearing failure.

3. Add the recommended amount of grease.
4. Operate the motor for 15 minutes with grease plug removed. This allows excess grease to purge.
5. Re-install grease outlet plug.

Without Grease Provisions

Note: Only a Baldor authorized and UL or CSA certified service center can disassemble a UL/CSA listed explosion proof motor to maintain it's UL/CSA listing.

1. Disassemble the motor.
2. Add recommended amount of grease to bearing and bearing cavity. (Bearing should be about 1/3 full of grease and outboard bearing cavity should be about 1/2 full of grease.)
3. Assemble the motor.

Sample Relubrication Determination

Assume - NEMA 286T (IEC 180), 1750 RPM motor driving an exhaust fan in an ambient temperature of 43° C and the atmosphere is moderately corrosive.

1. Table 3-2 list 9500 hours for standard conditions.
2. Table 3-3 classifies severity of service as "Severe".
3. Table 3-5 shows that 1.2 in^3 or 3.9 teaspoon of grease is to be added.

Note: Smaller bearings in size category may require reduced amounts of grease.

Table 3-7 Troubleshooting Chart

Symptom	Possible Causes	Possible Solutions
Motor will not start	Usually caused by line trouble, such as, single phasing at the starter.	Check source of power. Check overloads, fuses, controls, etc.
Excessive humming	High Voltage.	Check input line connections.
	Eccentric air gap.	Have motor serviced at local Baldor service center.
Motor Over Heating	Overload. Compare actual amps (measured) with nameplate rating.	Locate and remove source of excessive friction in motor or load. Reduce load or replace with motor of greater capacity.
	Single Phasing.	Check current at all phases (should be approximately equal) to isolate and correct the problem.
	Improper ventilation.	Check external cooling fan to be sure air is moving properly across cooling fins. Excessive dirt build-up on motor. Clean motor.
	Unbalanced voltage.	Check voltage at all phases (should be approximately equal) to isolate and correct the problem.
	Rotor rubbing on stator.	Check air gap clearance and bearings.
		Tighten "Thru Bolts".
	Over voltage or under voltage.	Check input voltage at each phase to motor.
	Open stator winding.	Check stator resistance at all three phases for balance.
	Grounded winding.	Perform dielectric test and repair as required.
	Improper connections.	Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity. Refer to motor lead connection diagram.
Bearing Over Heating	Misalignment.	Check and align motor and driven equipment.
	Excessive belt tension.	Reduce belt tension to proper point for load.
	Excessive end thrust.	Reduce the end thrust from driven machine.
	Excessive grease in bearing.	Remove grease until cavity is approximately $^3/_4$ filled.
	Insufficient grease in bearing.	Add grease until cavity is approximately $^3/_4$ filled.
	Dirt in bearing.	Clean bearing cavity and bearing. Repack with correct grease until cavity is approximately $^3/_4$ filled.
Vibration	Misalignment.	Check and align motor and driven equipment.
	Rubbing between rotating parts and stationary parts.	Isolate and eliminate cause of rubbing.
	Rotor out of balance.	Have rotor balance checked are repaired at your Baldor Service Center.
	Resonance.	Tune system or contact your Baldor Service Center for assistance.
Noise	Foreign material in air gap or ventilation openings.	Remove rotor and foreign material. Reinstall rotor. Check insulation integrity. Clean ventilation openings.
Growling or whining	Bad bearing.	Replace bearing. Clean all grease from cavity and new bearing. Repack with correct grease until cavity is approximately $^3/_4$ filled.

Suggested bearing and winding RTD setting guidelines for Non-Hazardous Locations ONLY

Most large frame AC Baldor motors with a 1.15 service factor are designed to operate below a Class B (80°C) temperature rise at rated load and are built with a Class H winding insulation system. Based on this low temperature rise, RTD (Resistance Temperature Detectors) settings for Class B rise should be used as a starting point. Some motors with 1.0 service factor have Class F temperature rise.

The following tables show the suggested alarm and trip settings for RTDs. Proper bearing and winding RTD alarm and trip settings should be selected based on these tables unless otherwise specified for specific applications.

If the driven load is found to operate well below the initial temperature settings under normal conditions, the alarm and trip settings may be reduced so that an abnormal machine load will be identified.

The temperature limits are based on the installation of the winding RTDs imbedded in the winding as specified by NEMA. Bearing RTDs should be installed so they are in contact with the outer race on ball or roller bearings or in direct contact with the sleeve bearing shell.

Winding RTDs – Temperature Limit In °C (40°C Maximum Ambient)

Motor Load	Class B Temp Rise ≤ 80°C (Typical Design)		Class F Temp Rise ≤ 105°C		Class H Temp Rise ≤ 125°C	
	Alarm	Trip	Alarm	Trip	Alarm	Trip
≤ Rated Load	130	140	155	165	175	185
Rated Load to 1.15 S.F.	140	150	160	165	180	185

Note: • Winding RTDs are factory production installed, not from Mod-Express.
• When Class H temperatures are used, consider bearing temperatures and relubrication requirements.

Bearing RTDs – Temperature Limit In °C (40°C Maximum Ambient)

Bearing Type Oil or Grease	Anti-Friction		Sleeve	
	Alarm	Trip	Alarm	Trip
Standard*	95	100	85	95
High Temperature**	110	115	105	110

Note: * Bearing temperature limits are for standard design motors operating at Class B temperature rise.
** High temperature lubricants include some special synthetic oils and greases.

Greases that may be substituted that are compatible with Polyrex EM (but considered as "standard" lubricants) include the following:

- Texaco Polystar
- Rykon Premium #2
- Chevron SRI #2
- Mobilith SHC-100
- Pennzoil Pennzlube EM-2
- Chevron Black Pearl
- Darmex 707
- Darmex 711
- Petro-Canada Peerless LLG

See the motor nameplate for replacement grease or oil recommendation.
Contact Baldor application engineering for special lubricants or further clarifications.

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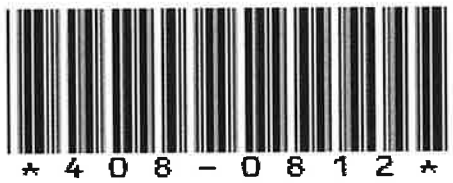
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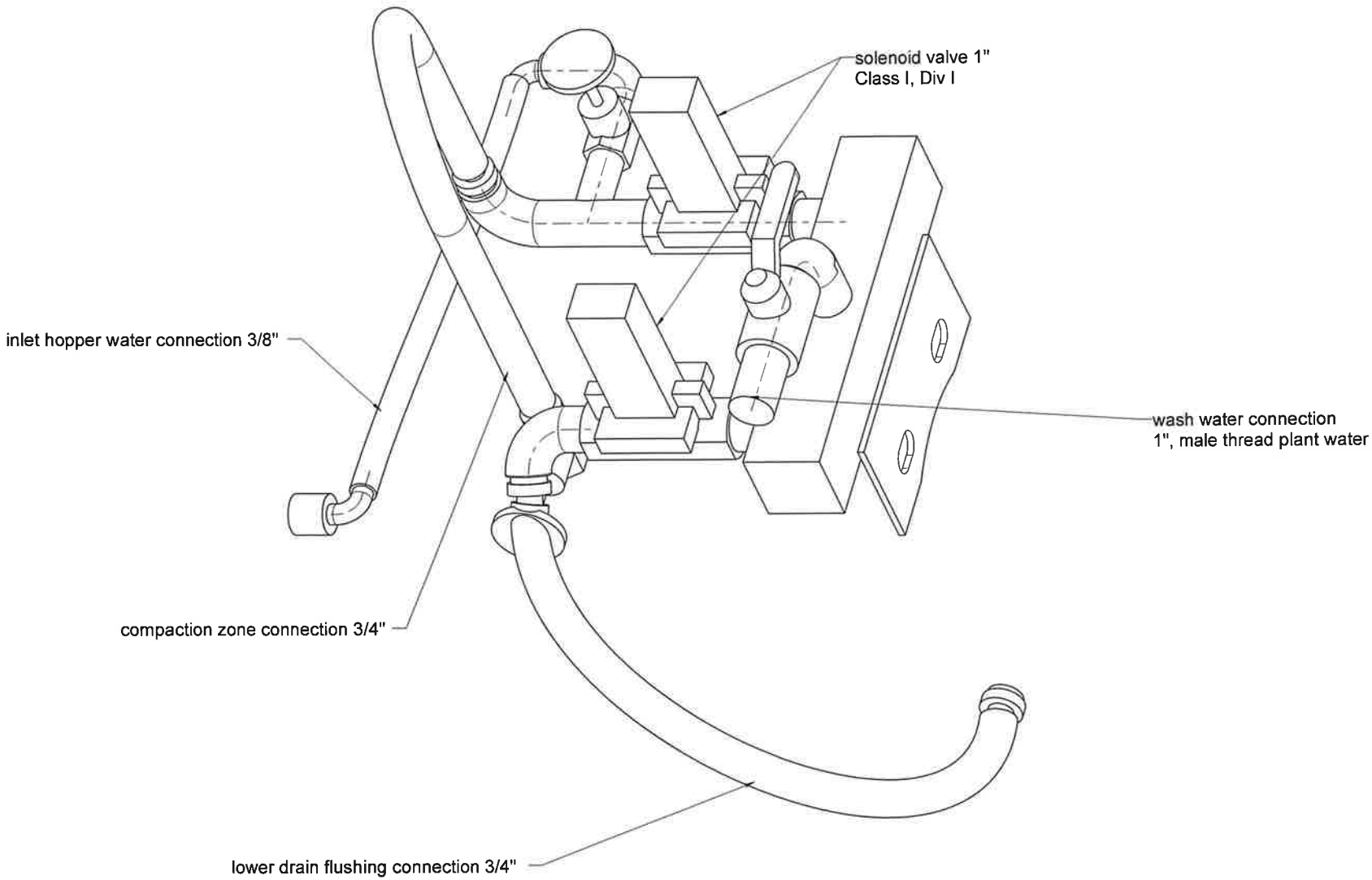
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WASH PRESS WASH WATER MANIFOLD SOLENOID VALVES APPENDIX INFORMATION

(1x) INLET HOPPER & COMPACTION ZONE
(1x) LOWER DRAIN PAN

TYPE: (2x) 1" BURKERT 5282


solenoid valve 1"
Class I, Div I
inlet hopper water connection 3/8"
wash water connection
1", male thread plant water
compaction zone connection 3/4"
lower drain flushing connection 3/4"

Solenoid Valve – Aggressive Fluids

Type 5282

General Purpose

2/2-Way; 1/2"NPT-2"NPT; 2.8-140 PSI



Advantages/Benefits

- **Less sensitive to dirty fluids and more corrosion resistant due to isolating diaphragm**
- **Long-life solenoid system**
- **High reliability**
- **Opening and closing times controlled by integrated flow control**
- **Lockable manual override is standard**
- **Wide range of cable plug options Type 2508**

Design/Function

This valve offers a unique solution in brass or stainless steel for slightly contaminated, dirty and aggressive fluids.

This internally piloted solenoid valve incorporates a pivoting armature pilot. The pivoting armature, exclusive to Burkert valves, isolates the actuator from the fluid while providing increased system reliability.

To simplify ordering, a wide selection of standard combinations can be ordered with one Item Number.

Cable plug options of Type 2508 are available to suit special electrical application requirements.

Options:
- **Normally open (N.O.)**
- **Diagnosis:**
  Electrical feedback signaller

Applications

Fluids

- Neutral liquids up to 230 PSI
- Slightly contaminated and aggressive liquids

Applications

- Water/ sewage treatment
- Chemical processing
- Shipbuilding (centralized lubrication systems)
- Pollution control (filter systems)
- Drinking water systems
- Ceramic industry
- Offshore technology

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bürkert
Easy Fluid Control Solutions

Solenoid Valve – Aggressive Fluids

Type 5282

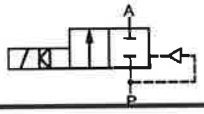
General Purpose

Technical Data

Circuit Function – A

A – 2/2-way, normally closed, with 3-way pilot control

Symbol



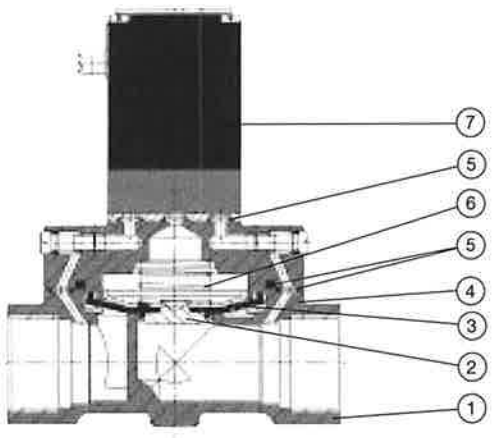
Operating Data (Valve)

Pressure range	2.8-140 PSI
Port connection	1" NPT
Fluid	NBR (32°F to 194°F): Neutral fluids e.g. compressed air, water, oils and fat without additives.
Max. ambient temperature	131°F
Max. viscosity	21 cSt
Response times	opening: 0.1-0.8 s[1)] closing: 1.0-4.0 s[1)] [1)]Depends on orifice, fluid pressure and viscosity.
Installation	As required, but preferably with solenoid system upright.

Operating Data (Actuator)

Operating voltages	AC 120V/60 Hz
Voltages tolerance	±10%
Power consumption Voltage (AC)	Inrush: 21 VA Hold: 12 VA/8 W
Voltage (DC)	Inrush and hold: 8 W
Duty cycle	100% continuously rated
Cycling rate	10-50 c.p.m.
Coil insulation class U.L. Recognized, or U.L. Listed:	Class H - Molded
Rating with cable plug	NEMA 4, IP 65
Electrical connection	Delivery standard: Cable plug DIN 43 650 A, 0-250 V (Other versions see accessories).
Agency approval	U.L. Recognized, U.L. Listed FM Class I, Div 1, Group A, B, C, D

Materials



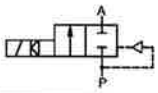
1	Valve body:	Brass
2	Diaphragm support:	Brass
3	Diaphragm:	NBR
4	Cover:	Brass
5	O-rings:	NBR
6	Spring:	301 Stainless Steel
7	Coil:	Epoxy

Solenoid Valve – Aggressive Fluids

Type 5282

General Purpose

Specifications - Ordering Chart (Other Versions on Request)



(N.C.)

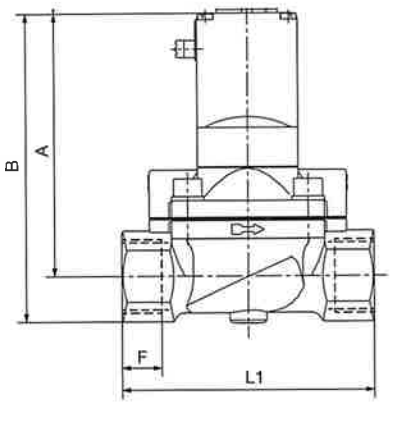
U.L. Recognized
with standard-cable plug
0–250 V AC/DC

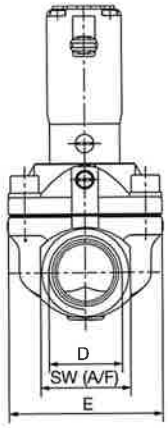
Brass Body; NBR Seal; Temperature Range 32°F to 194°F

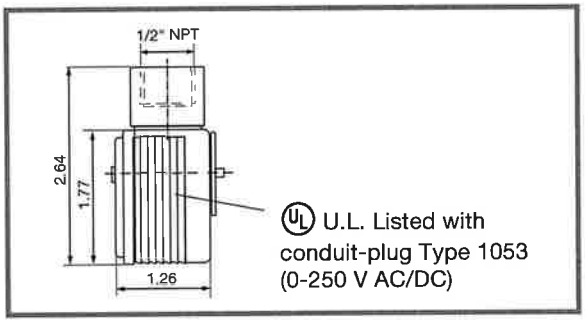
Port connection [Inch]	Orifice [inch]	Cv-value	Pressure Range [PSI]	Seal material	Weight [lbs.]	Item Number Voltage / Frequency [V/Hz] 24/DC	24/60	120/60	240/60
1/2" NPT	1/2	4.66	2.8- 140	NBR	2.1	456 890 U	456 891 R	456 892 J	456 893 K
3/4" NPT	3/4	5.83	2.8- 140	NBR	3.1	456 894 L	456 895 M	456 896 N	456 897 P
1" NPT	1	11.65	2.8- 140	NBR	4.1	456 898 Y	456 899 Z	456 900 E	456 901 T
1 1/4" NPT	1 1/4	23.30	2.8- 140	NBR	5.7	456 902 U	456 903 V	456 904 W	456 905 X
1 1/2" NPT	1 1/2	23.30	2.8- 140	NBR	6.7	456 906 Y	456 907 Z	456 908 A	456 909 B
2" NPT	2	46.60	2.8- 140	NBR	11.3	456 910 X	456 911 L	456 912 M	456 913 N

Note:
U.L. Listed
FM approval available on request

Dimensions [inch]







Variable Dimensions [inch]

Port-connection D	Orifice [inch]	A	B	F	E	L1	SW (A/F)
1/2" [1]NPT	1/2	4.29	4.85	0.53	1.58	2.56	1.06
1/2" [2]NPT	3/4	4.53	5.16	0.53	2.36	3.94	1.26
3/4" NPT	3/4	4.53	5.16	0.55	2.36	3.94	1.26
1" NPT	1	4.75	5.56	0.66	2.76	4.53	1.62
1 1/4"NPT	1 1/4	4.81	5.79	0.68	3.35	4.96	1.97
1 1/2"NPT	1 1/2	4.96	6.15	0.68	3.35	4.96	2.36
2" NPT	2	5.61	6.99	0.69	4.53	6.46	2.76

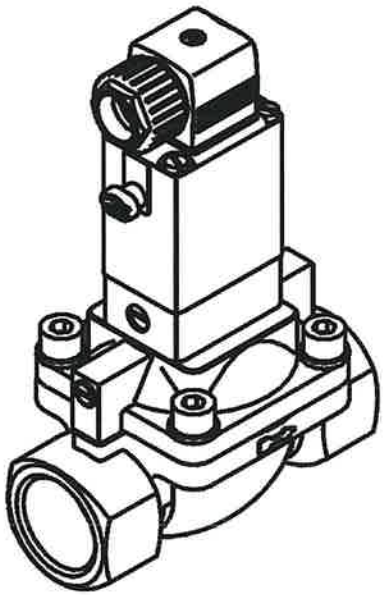
[1]Only brass [2]Only stainless steel

Transparent cap, when wired with LED.

Operating instructions

Type 5282

2/2-way solenoid valve with servo-membrane



bürkert
Fluid Control Systems

Safety (GB)

Proper Usage

To ensure the proper function of the device and promote long service lift, you must comply with the information in these Operating Instructions and the application conditions and specifications provided in the Type 5282 Data Sheet. Usage of the device in a manner that is contrary to these Operating Instructions or the application conditions and specifications provided in the Type 5282 Data Sheet is improper and will void your warranty. This device serves exclusively as a 2/2-way solenoid valve for the media stated to be permissible on the data sheet. Any other use is considered improper use. ***Bürkert will not be responsible for any improper use of the device.***

ATTENTION!

- **Be sure to observe generally accepted safety rules when planning, installing and using this device. For example, take suitable measures to prevent unintentional operations of the device.**
- **Do not impair the operation of the device.**
- **Do not attemp to detach or unscrew any lines or valves in the system that are under pressure, and always be sure to switch off the voltage supply before working on the system.**
- **When attaching the coil to the plug socket, be sure the seal is properly seated.**
- **Never adjust the screws which are sealed with red paint, for any reason!**
- **For explosion-proof models, data from the conformity certificate PTB No. Ex-89.C.1041 must also be complied with!**

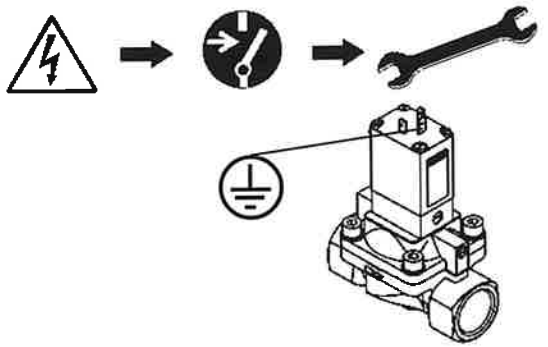
WARNING!

- **Do not touch the coil during use as it becomes very hot.**

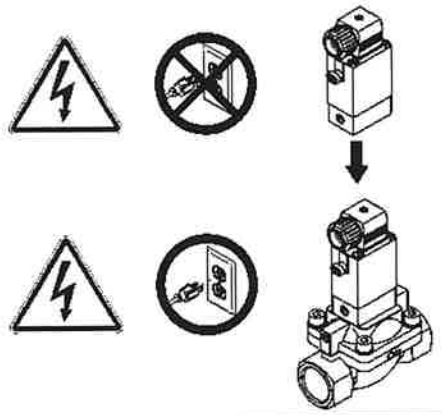
D GB F E

Safety

① Voltage-free assembly



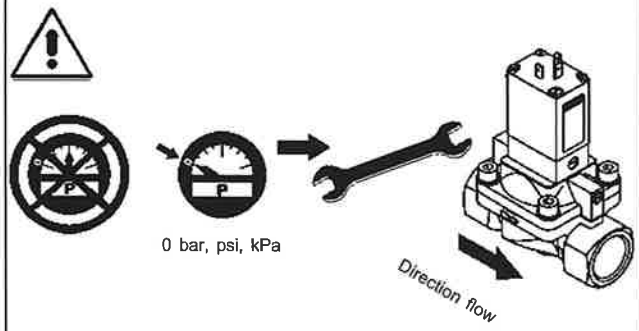
② Electrical connection



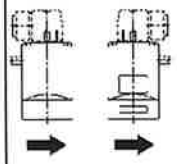
(D) (GB) (F) (E)

Safety

③ Fluid connection



④ Conversion from Function A to Function B

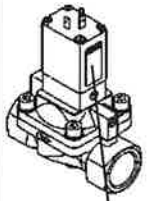


Direction of flow

After carrying out to conversion to circuit function B, re-label the unit.

(D) (GB)

Technical Data



Temperature



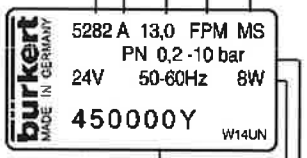
Messing/brass

Sealing material	Temp. Medium
NBR	0 .. +80 °C
EPDM	-30 .. +90 °C
FPM	-10 .. + 50 °C

Nominal size

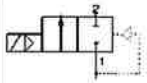
Circuit function

Type

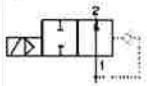


Example

A



B



Id. No.

Voltage (±10 %) - Frequency - Power

Nominal pressure

We reserve the right to make technical changes without notice

D GB F E

Assembly

① Instrument socket

1 Nm

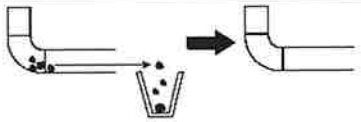
Type 2508

Seal

Joint

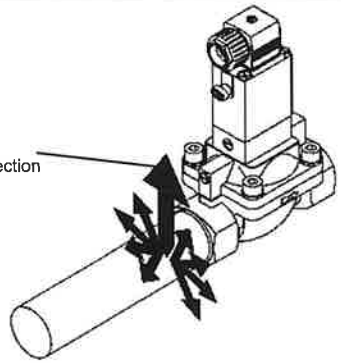
⏚ **Always** connect the protective

② Cleaning the piperuns



③ Any assembly position

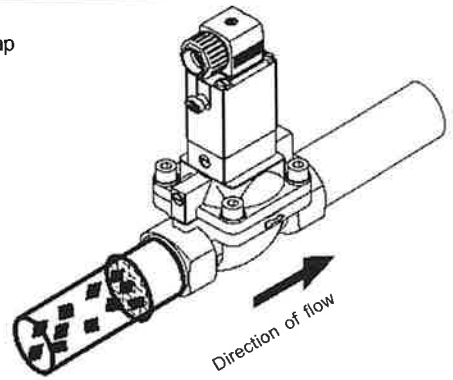
Preffered direction



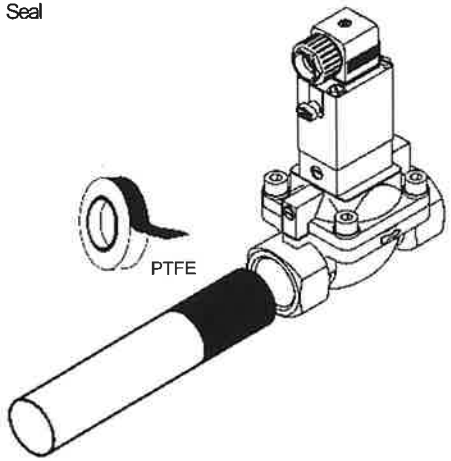
D GB F E

Assembly

④ Dirt trap



⑤ Seal

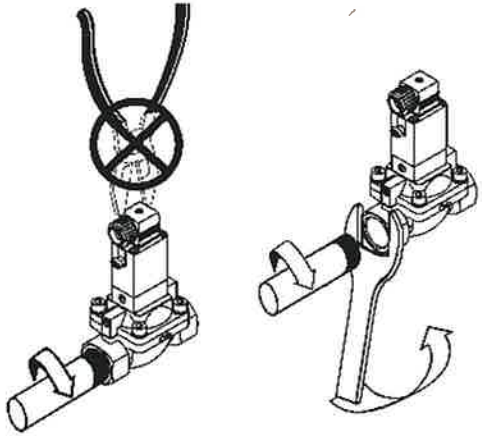


e

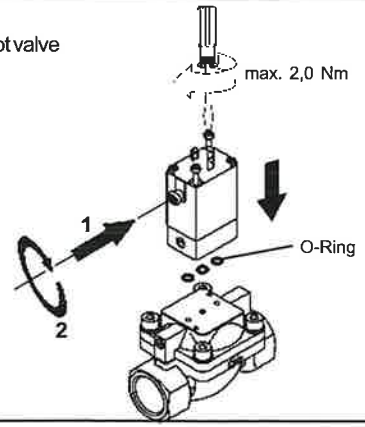
D GB F E

Assembly

⑥ Screwing in the pipe connections



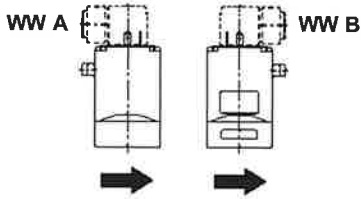
⑦ Assembly of pilot valve



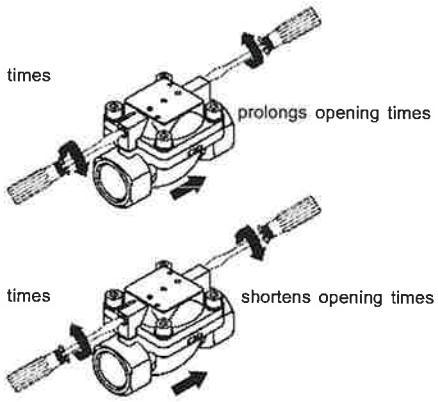
D GB F E

Assembly

⑧ Configuration of the pilot control



⑧ Opening and closing times



Do not move screws that are locked with red paint!

D GB F E

Troubleshooting

Check the voltage!

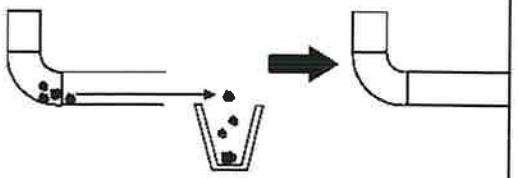


Check the pressure!



bar, psi, kPa

Check the piperun!

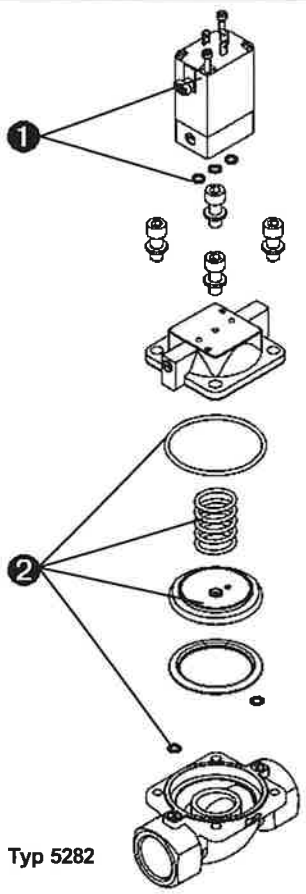


(D) (GB) (F) (E)

Spare parts

❶ (D) (GB) Set of pilot controls (F) (E)

❷ (D) (GB) Set of Wearing Parts (F) (E)



Typ 5282

(D) (GB)

Spare parts

❶ Set of pilot controls

Sealing material	Voltage	Order no.	
NBR	24 V/DC	138 109 A	138 117 R
NBR	24 V/56 Hz	138 112 L	138 114 N
NBR	110 V/56 Hz	138 111 K	138 115 P
NBR	230 V/56 Hz	138 110 W	138 116 Q
FPM	24 V/DC	138 120 Y	138 129 V
FPM	24 V/56 Hz	138 122 N	138 124 Q
FPM	110 V/56 Hz	138 123 P	138 126 J
FPM	230 V/56 Hz	138 118 S	138 125 R
EPDM	24 V/DC	138 100 D	138 106 X
EPDM	24 V/56 Hz	138 095 P	138 104 V
EPDM	110 V/56 Hz	138 096 Q	138 103 U
EPDM	230 V/56 Hz	138 097 R	138 101 S

❶ Set of pilot controls

NBR	24 V/DC	138 109 A	-
NBR	24 V/56 Hz	138 112 L	-
NBR	100 V/56 Hz	138 108 H	-
NBR	110 V/56 Hz	138 111 K	-
NBR	200 V/56 Hz	138 107 Y	-
NBR	230 V/56 Hz	138 110 W	-
FPM	24 V/DC	-	138 129 V
FPM	24 V/56 Hz	-	138 124 Q
FPM	100 V/56 Hz	-	138 128 U
FPM	110 V/56 Hz	-	138 126 J
FPM	200 V/56 Hz	-	138 127 K
FPM	230 V/56 Hz	-	138 125 R

(F) (E)

❷ Set ofWearing Parts

DN	Sealing material	Order no.	
13	NBR	624 031 M	-
13	FPM	624 032 N	-
13	EPDM	624 033 P	-
20	NBR	624 034 Q	624 037 K
20	FPM	624 035 R	624 038 U
20	EPDM	624 036 J	624 039 V
25	NBR	624 040 A	624 043 Z
25	FPM	624 041 X	624 044 S
25	EPDM	624 042 Y	624 045 T
32, 40	NBR	624 046 U	624 049 F
32, 40	FPM	624 047 V	624 050 C
32, 40	EPDM	624 048 E	624 051 Z
50, 65	NBR	624 052 S	624 055 V
50, 65	FPM	624 053 T	624 056 W
50, 65	EPDM	624 054 U	624 057 X

WASH PRESS WASH WATER MANIFOLD ISOLATION BALL VALVES APPENDIX INFORMATION

TYPE: 1" WESA 604

WESA-Armaturen GmbH
Werner Schmidt

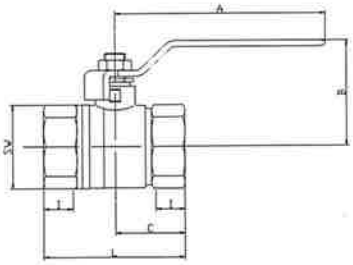
Kugelhähne, Rohrleitungs- und Industrie-Armaturen

DATA SHEET

WESA-Art.-No.: 604

WESA-UNIVERSAL-BRASS-BALL-VALVE
nickelplated, normal modell, full bore,
marked with TÜV-guidlines, DIN 228 thread





materials		technical features		
body:	brass MS58 nickelplated	**nominal pressure:**	PN 40 according to size and temperature	
ball:	brass MS58 chromed	**compressed air:**	max. 10 bar	
spindle:	brass MS58	**temperature:**	-20°C to +150°C according to pressure	
lever:	stainless steel-lever encased with red plastics	**thread:**	female / female DIN 228	
seats		**vakuum density:**	-	
seats:	PTFE/teflon	**DIN-DVGW-permissance:**	**Gas:**	-
spindle packing:	PTFE/teflon with packing gland and O-ring FKM/FPM		**Water:**	-
			drinking water:	-
application field:	water, oils and petrochemical fields, colours, varnishes, solvents, dilute lyes and acids, gases, liquid gases as well as natural gases			

inch	1/4"	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"
EDV-No.	604-202	604-203	604-204	604-205	604-206	604-207	604-208	604-209	604-210	604-211
DN [mm]	8	10	15	20	25	32	40	50	65	80
L [mm]	42	42	50	55	68	76	84	106	130	146
PN [bar]	40	40	40	40	32	25	20	20	16	16
A [mm]	91	91	91	91	100	130	130	154	224	224
B [mm]	42	42	46	50	64	73	78	95	117	125
C [mm]	21	21	25	27	34	38	42	53	65	73
SW [mm]	20	20	26	32	40	48	54	68	80	98
l [mm]	10	10	12	12	16	14	15	19	25	26
weight [g]	141	128	200	273	485	698	933	1644	2461	3734

measurements in mm / measurements and illustrations are without obligation, alterations provided 08/2010

Postadresse
Postfach 13 40
73645 Winterbach

Lieferadresse
Spanninger Straße 1-3
73650 Winterbach

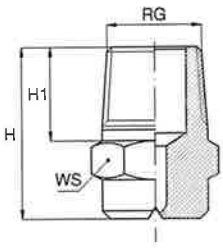
Tel.: ++49 71 81/ 4 04 - 0
Fax: ++49 71 81/ 4 04 - 33
email: info@wesa-armaturen.de

COLLECTION HOPPER SPRAY NOZZLE APPENDIX INFORMATION

TYPE: (1x) PNR SERIES J JCQ2310 3/8" 60

J





STANDARD CAPACITY TYPES

The standard model flat jet nozzles are available in a very wide range of capacities, spray angles and materials. The connection thread is tapered in order to easily allow for both a tight connection and a correct spray pattern orientation. Nozzles shown on this page cover the standard capacity range from 1.5 to 47 litres per minute, delivering high impact jets with small/medium size droplets for the flat spray patterns. Capacity tables also include straight jet types, with spray angle value shown as 0° They can be made on request out of any machineable material, in addition to the standard materials shown below.

Materials		
	B1	AISI 303 Stainless steel
	B3	AISI 316 Stainless steel
	T1	Brass

Spray angle codes

JBA	JBC	JBF	JBM	JBQ	JBU	JBW
0°	20°	30°	45°	60°	90°	120°

Thread size code (RG)

JA	JB	JC
1/8"	1/4"	3/8"

How to compose the nozzle code

The nozzles shown on this page can be supplied with seven different spray angles, whose value is indicated by the third digit in the nozzle code. Therefore, the nozzle tip code has to be identified as in the following example.

JBQ 1780 B3

60°

Codes for the different spray angles are listed in the table adjacent.

Dimensions and weights

Code	Size	H	H1	WS	W
	inch	mm	mm	mm	gram
JA	1/8	19.5	11	12	9
JB	1/4	22	12	14	18
JC	3/8	25	14	17	34

J

How to compose the nozzle code

The nozzles shown on this page can be supplied with seven different spray angles, whose value is indicated by the third digit in the nozzle code.
Therefore, the nozzle tip code has to be identified as in the following example.

JBQ 1780 B3

60°

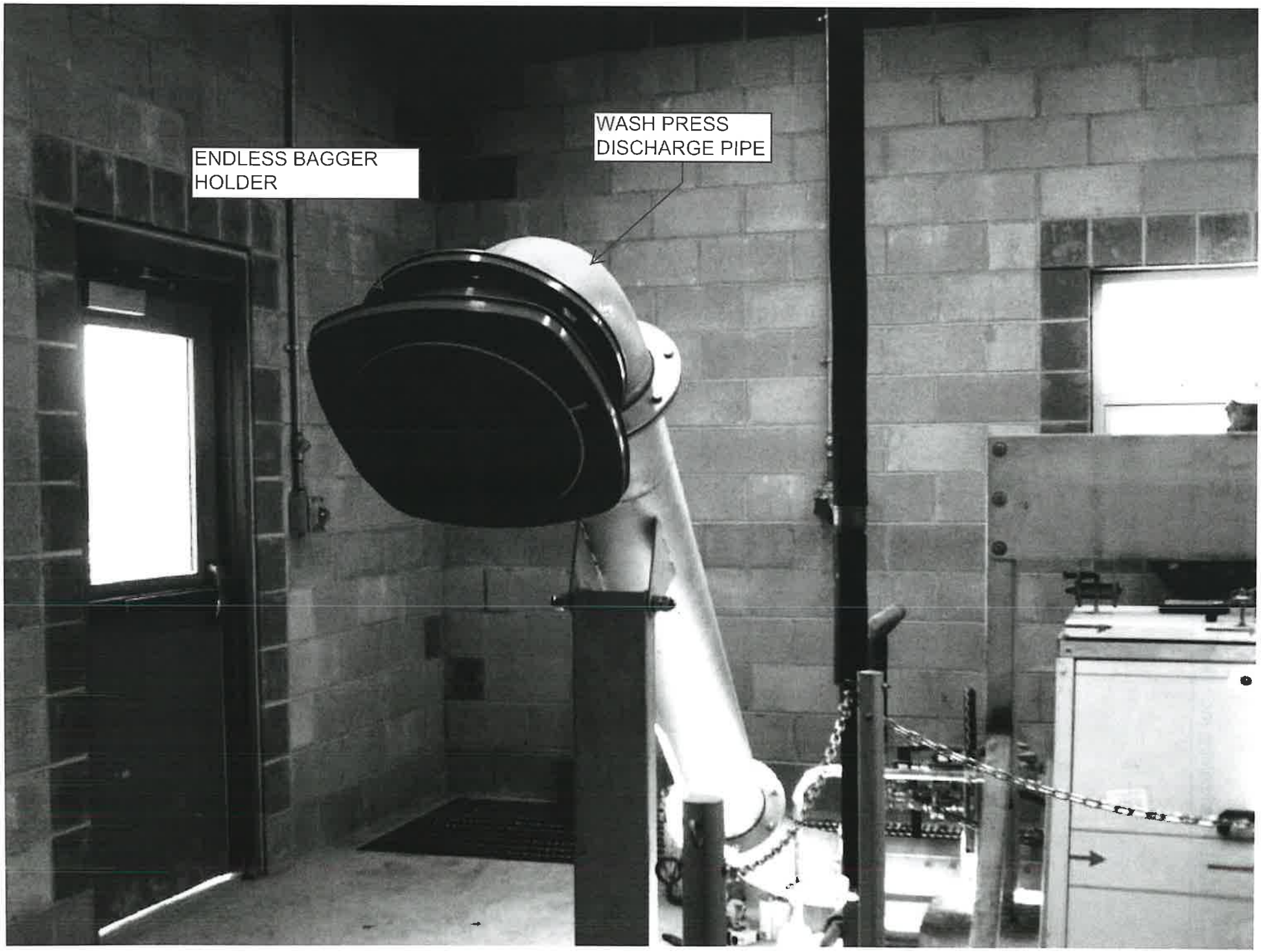
Codes for the different spray angles are listed in the table at the bottom of the page.

STANDARD CAPACITY TYPES

	JAQ	JBQ	JCQ	Code	Capacity at different pressure values (lpm) (bar)								
					0.5	1.0	2.0	3.0	4.0	5.0	7.0	10	20
60°	•	•		**1153**	0.62	0.88	1.25	1.53	1.77	1.98	2.34	2.79	3.95
	•	•		**1190**	0.78	1.10	1.55	1.90	2.19	2.45	2.90	3.47	4.91
	•	•		**1233**	0.95	1.35	1.90	2.33	2.69	3.01	3.56	4.25	6.02
	•	•		**1310**	1.27	1.79	2.53	3.10	3.58	4.00	4.74	5.66	8.00
	•	•		**1385**	1.57	2.22	3.14	3.85	4.45	4.97	5.88	7.03	9.94
	•	•	•	**1490**	2.00	2.83	4.00	4.90	5.66	6.33	7.48	8.95	12.6
	•	•	•	**1581**	2.37	3.35	4.74	5.81	6.71	7.50	8.87	10.6	15.0
		•	•	**1780**	3.18	4.50	6.37	7.80	9.01	10.1	11.9	14.2	20.1
		•	•	**1980**	4.00	5.66	8.00	9.80	11.3	12.7	15.0	17.9	25.3
		•	•	**2124**	5.06	7.16	10.1	12.4	14.3	16.0	18.9	22.6	32.0
		•	•	**2153**	6.25	8.83	12.5	15.3	17.7	19.8	23.4	27.9	39.5
		•	•	**2195**	7.96	11.3	15.9	19.5	22.5	25.2	29.8	35.6	50.3
		•	•	**2245**	10.0	14.1	20.0	24.5	28.3	31.6	37.4	44.7	63.3
		•	•	**2274**	11.2	15.8	22.4	27.4	31.6	35.4	41.8	50.0	70.7
			•	**2310**	12.7	17.9	25.3	31.0	35.8	40.0	47.4	56.6	80.0
			•	**2390**	15.9	22.5	31.8	39.0	45.0	50.3	59.5	71.2	100
			•	**2470**	19.2	27.1	38.4	47.0	54.3	60.7	71.8	85.8	121

HUBER TECHNOLOGY
WASTE WATER Solutions

ENDLESS BAGGING UNIT
APPENDIX INFORMATION


ENDLESS BAGGER HOLDER
WASH PRESS DISCHARGE PIPE

Product data sheet

Longopac Maxi

Application: Unique endless waste bag system which allows the user to continuously make their own bags. This gives substantial advantages in handling and low transport costs.

Specifications

Material	3-layer coextruded polyethylene (PE).
Size of Packaging	1 pc per box.
Diameter	570 mm
Color	Transparent, black, blue, red, yellow and green
Others	The material is SVHC free

	Dart drop*	Length	Thickness (micrometer/mil thou)
Longopac Maxi X-Strong	820g	70m	45my/1.8 mil

*Dart drop is measured according to ASTM D-1709. The value is an average measured end of shelf life. See link for more information
http://www.astm.org/Standards/D1709.htm

Disposal
Complete incineration of polyethylene yields nothing but water, carbon dioxide (CO_2) and energy.

Storage
Shelf life is guaranteed for 2 years.
Storage conditions: Indoor (protect from UV light and sun light)
Storage temperature (-10°C) – (+50°C)

Quality Management systems
PAXXO's quality system is certified in accordance with ISO 9001 and our environmental management system is certified in accordance with ISO 14001.

PAXXO AB • Bjurögatan 35 • SE-211 24 MALMÖ • SWEDEN
TEL +46 (0)40 186025 • FAX +46 (0)40 183736
PAXXO Inc • 1924 Millard Farmer Road • GA. 30263 • Newnan • USA
TEL +1 770 502 0055 • FAX +1 770 502 0088
www.paxxo.com • E-mail: info@paxxo.com

Product data sheet

Longopac Maxi

Reach Compliance

1. PAXXO has secured that our suppliers have pre-registered the chemical substances during 2012 that occur in our products (dependent on volume) and that are subject to registration with the European Chemical Authority (ECHA) in accordance with REACH.

2. None of the articles supplied contain substances under Annex XIV of REACH or the candidate list (SVHC – substances).

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HUBER TECHNOLOGY

HUBER Technology, Inc., Huntersville / NC

LONGOFILL BAGGING SYSTEM FOR ENDLESS BAGS

The handling of screenings is a well known environmental and health problem in small and medium sized sewage treatment plants. Even with improved ventilation in most screening and press buildings, a high concentration of bacteria and fungus spores can develop. These factors can produce poor air quality; this can lead to chronic asthma, allergies and pulmonary and intestinal tract diseases.

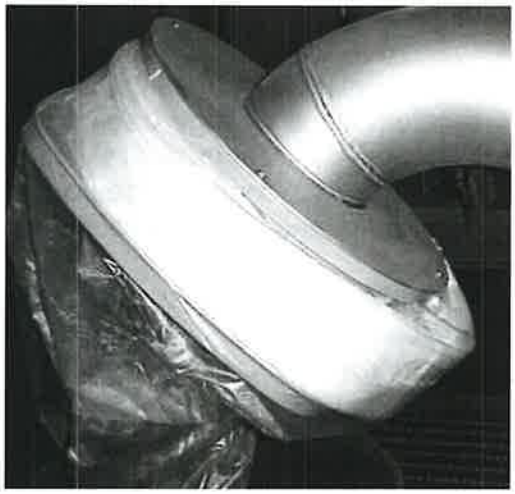
Longofill solves this problem in a practical and efficient way. Longofill consists of an enclosed bagging system, which can be easily connected to the discharge pipe of your machine. The screenings are deposited into the continuous bag, which will also provide odour containment with the Longofill it is easy to seal and trap screenings and odours inside the bag, and can then be safely handled for disposal. One sausage type bag is approx. 262 ft long and has a capacity of approx 582 cu ft. It is constructed of 3 ply low pressure polyethylene.

Technical data of the system parts: Longofill: The sleeve from ABS plastic in combination with an adapter from stainless steel can be mounted on ejection pipes with an external diameter from 150 to 400mm. Longopac: The folded bag cartridge has a length of 80 m and a diameter of 570 mm. It is made from environment friendly polyethylene which burns without residue.

We stock the replacement bags in our warehouse for you and we will ship it overnight, if necessary. Please ask for pricing:

Huber Technology, Inc.
Phone: (704) 949-1010
Fax: (704) 949-1020
e-mail: parts@hhusa.net

Installation see next page.



The picture on the left shows an installed bagging system on a wash press (yours might look a little different).

1.1. INSTALLATION:

1. Remove the white rubber O-ring
2. Remove bottom plastic cover
3. Put plastic bag over the upper plastic cover, which is attached to the discharge of unit.
   ATTENTION:
   Do not remove straps!
4. Attach lower plastic cover
5. Secure it with O-ring





7. Remove straps and pull bag down
8. Fasten bag with knot

ATTENTION:

For outside installations:
Secure bag by securing the bag underneath the white rubber O-ring.

TAB 7

HUBER TECHNOLOGY
WASTE WATER Solutions

RAKEMAX ANCHOR
APPENDIX INFORMATION

TYPE: Hilti HAS-RTZ M20

HVZ adhesive anchor

Features:	
	- foil capsule vs. glass
	- flexibly to fit in irregular holes
	- marking for identification after setting
	- test reports: fire, dynamic (fatigue, shock), water tightness
Material:	
HVU-(E-)TZ:	- urethane methacrylate resin – styrene free, hardener, quartz sand, foil tubes
HAS-(E-)TZ:	- grade 8.8; EN ISO 20898-1; coating: DIN 50968-FE/Cu 3 Ni 10
HAS-(E-)RTZ:	- stainless steel; A4-80; 1.4401; 14571; EN 10088
HAS-(E-)HCR-TZ:	- stainless steel; 1.4529; 1.4547; EN 10088-3



HVU-TZ capsule



HAS-TZ, HAS-RTZ and HAS-HCR-TZ anchor rod



Concrete | Tensile zone | Close edge distance/ spacing | Fatigue | Shock



Corrosion resistance | High corrosion resistance | Fire resistance | Hilti Anchor programme

Basic loading data (for a single anchor): HAS-(E-)TZ

All data on this page applies to

- concrete: See table below.
- correct setting (See setting operations page 183)
- no edge distance and spacing influence
- *steel* failure

For detailed design method, see pages 184 – 189.





Mean ultimate resistance $R_{u,m}$ [kN]: concrete ≡ C20/25

Anchor size	M10	M12	M16	M16L	M20
Tensile $N_{Ru,m}$	*38.2*	*49.0*	*82.1*	*82.1*	*132.9*
Shear $V_{Ru,m}$	*20.1*	*29.2*	*54.2*	*54.2*	*93.3*

M10	M12	M16	M16L	M20
38.2	*49.0*	68.7	72.0	*132.9*
20.1	*29.2*	*54.2*	*54.2*	*93.3*

Characteristic resistance, R_k [kN]: concrete ≡ C20/25

Anchor size	M10	M12	M16	M16L	M20
Tensile N_{Rk}	32.7	40.0	54.3	70.5	111.8
Shear V_{Rk}	*18.0*	*27.0*	*51.0*	*51.0*	*88.0*

M10	M12	M16	M16L	M20
20.0	33.3	38.7	50.3	79.8
18.0	*27.0*	*51.0*	*51.0*	*88.0*

Following values according to the:

Concrete Capacity Method

Design resistance, R_d [kN]: concrete $f_{ck,cube}$ = 25 N/mm²

Anchor size	M10	M12	M16	M16L	M20
Tensile N_{Rd}	21.8	26.7	36.2	47.0	74.5
Shear V_{Rd}	14.4	21.6	40.8	40.8	70.4

M10	M12	M16	M16L	M20
13.3	22.2	25. 8	33.5	53.2
14.4	21.6	40.8	40.8	70.4

Recommended load, L_{rec} [kN]: concrete $f_{ck,cube}$ = 25 N/mm²

Anchor size	M10	M12	M16	M16L	M20
Tensile N_{Rec}	15.6	19.1	25.8	33.6	53.2
Shear V_{Rec}	10.3	15.4	29.1	29.1	50.3

M10	M12	M16	M16L	M20
9.5	15.9	18.4	23.9	38.0
10.3	15.4	29.1	29.1	50.3

Basic loading data (for a single anchor): HAS-(E-)RTZ

All data on this section applies to

- concrete: See table below.
- correct setting (See setting operations page 183)
- no edge distance and spacing influence
- *steel* failure

For detailed design method, see pages 184 – 189.

CONC **non-cracked concrete**

cracked concrete

Mean ultimate resistance, $R_{u,m}$ [kN]: concrete ≡ C20/25

Anchor size	M10	M12	M16	M16L	M20
Tensile $N_{Ru,m}$	*38.2*	*49.0*	*82.1*	*82.1*	*132.9*
Shear $V_{Ru,m}$	*22.6*	*32.7*	*61.0*	*61.0*	*103.9*

M10	M12	M16	M16L	M20
38.2	*49.0*	68.7	72.0	*132.9*
22.6	*32.7*	*61.0*	*61.0*	*103.8*

Characteristic resistance, R_k [kN]: concrete ≡ C20/25

Anchor size	M10	M12	M16	M16L	M20
Tensile N_{Rk}	32.7	40.0	54.3	70.5	111.8
Shear V_{Rk}	*20.0*	*30.0*	*56.0*	*56.0*	*98.0*

M10	M12	M16	M16L	M20
20.0	33.3	38.7	50.3	79.8
20.0	*30.0*	*56.0*	*56.0*	*98.0*

Following values according to the:

Concrete Capacity Method

Design resistance, R_d [kN]: concrete $f_{ck,cube}$ = 25 N/mm²

Anchor size	M10	M12	M16	M16L	M20
Tensile N_{Rd}	21.8	26.7	36.2	47.0	74.5
Shear V_{Rd}	16.0	24.0	44.8	44.8	78.4

M10	M12	M16	M16L	M20
13.3	22.2	25..8	33.5	53.2
16.0	24.0	44.8	44.8	78.4

Recommended load, L_{rec} [kN]: concrete $f_{ck,cube}$ = 25 N/mm²

Anchor size	M10	M12	M16	M16L	M20
Tensile N_{Rec}	15.6	19.1	25.8	33.6	53.2
Shear V_{Rec}	11.4	17.1	32.0	32.0	56.0

M10	M12	M16	M16L	M20
9.5	15.9	18.4	23.9	38.0
11.4	17.1	32.0	32.0	56.0

Basic loading data (for a single anchor): HAS-(E-)HCR-TZ

All data on this section applies to

- concrete: See table below.
- correct setting (See setting operations page 183)
- no edge distance and edge influence
- *steel* failure

For detailed design method, see pages 184 – 189.

CONC **non-cracked concrete**

cracked concrete

Mean ultimate resistance, $R_{u,m}$ [kN]: concrete ≡ C20/25

Anchor size	M10	M12	M16	M16L	M20
Tensile $N_{Ru,m}$	*38.2*	*49.0*	*82.1*	*82.1*	*132.9*
Shear $V_{Ru,m}$	*25.1*	*36.4*	*61.0*	*61.0*	*105.8*

M10	M12	M16	M16L	M20
38.2	*49.0*	68.7	72.0	*132.9*
25.1	*36.4*	*61.0*	*61.0*	*105.8*

HVZ adhesive anchor

Characteristic resistance R_k [kN]: concrete ≡ C20/25

Anchor size	M10	M12	M16	M16L	M20
Tensile N_{Rk}	32.7	40.0	54.3	70.5	111.8
Shear V_{Rk}	*20.0*	*30.0*	*56.0*	*56.0*	*98.0*

M10	M12	M16	M16L	M20
20.0	33.3	38.7	50.3	79.8
20.0	*30.0*	*56.0*	*56.0*	*98.0*

Following values according to the:

Concrete Capacity Method

Design resistance R_d [kN]: concrete $f_{ck,cube}$ = 25 N/mm²

Anchor size	M10	M12	M16	M16L	M20
Tensile N_{Rd}	21.8	26.7	36.2	47.0	74.5
Shear V_{Rd}	16.0	24.0	44.8	44.8	78.4

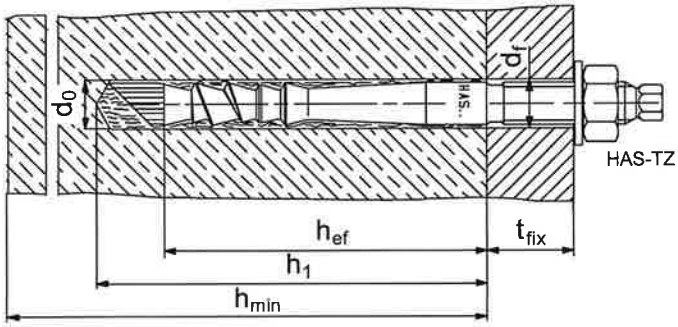
M10	M12	M16	M16L	M20
13.3	22.2	25..8	33.5	53.2
16.0	24.0	44.8	44.8	78.4

Recommended load, L_{rec} [kN]: concrete $f_{ck,cube}$ = 25 N/mm²

Anchor size	M10	M12	M16	M16L	M20
Tensile N_{Rec}	15.6	19.1	25.8	33.6	53.2
Shear V_{Rec}	11.4	17.1	32.0	32.0	56.0

M10	M12	M16	M16L	M20
9.5	15.9	18.4	23.9	38.0
11.4	17.1	32.0	32.0	56.0

Setting details



HAS-TZ



HAS-E-TZ

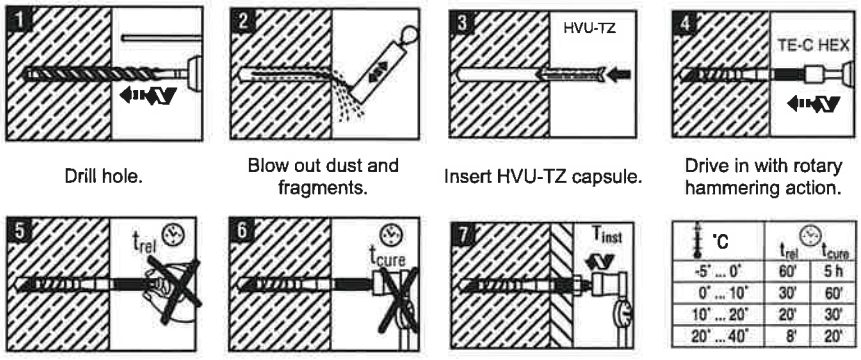
Anchor size				M10x75	M12x95	M16x105	M16x125	M20x170
		Foil capsule	HVU-TZ M..	10x90	12x110	16x125		20x190
		Anchor rod	HAS-(E-)TZ M..	10x75/ t_{fix}	12x95/ t_{fix}	16x105/ t_{fix}	16Lx125/t_{fix}	20x170/ 40
d_0	[mm]	Drill bit diameter		12	14	18		25
h_1	[mm]	Hole depth		90	110	125	145	195
h_{min}	[mm]	Min. thickness of base material		150	190	210	250	340
t_{fix}	[mm]	Max. fixture thickness		15 / 30 / 50	25 / 50 / 100 (and 40 for HAS-RTZ)	30 / 60 / 100		40
d_f	[mm]	Clearance hole (without bending verification)	rec. max.	12 13	14 15	18 19		22
T_{inst}	[Nm]	Tightening Torque	HAS-TZ HAS-R/HCR-TZ	40 50	50 70	90 100		150
Drill bit				TE–CX 12/22 TE-TX 12/32	TE–CX 14/22 TE-TX 14/32	TE–C 18/32S TE-T 18/32		TE–C 25/27S TE-T 25/32

Base material temperature	Min. time to wait before removing **SCREWED-ON** setting tool (not applicable for TE-C HEX): t_{rel}	Curing time: t_{cure}
20°C and higher	8 min.	20 min.
10°C to 20°C	20 min.	30 min.
0°C to 10°C	30 min.	1 hour
-5°C to 0°C	1 hour	5 hours
less than -5°C	Please consult your Hilti technical service.	

Installation equipment

A rotary hammer (TE5, TE6, TE15, TE-15C, TE-18M, TE35, TE55, TE76); max. setting speed of 850 r.p.m (rotary hammering action); a drill bit, a blow out pump and a setting tool: TE-C HEX (M10-M16), TE-Y HEX (M20);

Setting operations

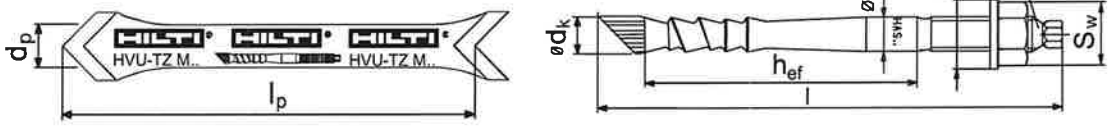


Drill hole. | Blow out dust and fragments. | Insert HVU-TZ capsule. | Drive in with rotary hammering action.

Allow rel time to pass | Wait for curing | Apply tightening torque.

Anchor geometry and mechanical properties

Marking of material and anchorage depth
for HAS-TZ: HVZ...
for HAS-RTZ: HVZ R...
for HAS-HCR: HVZ HCR...



Anchor size				M10	M12	M16x105	M16x125	M20
HVU-TZ capsule:								
l_p	[mm]	HVU-TZ foil capsule length		110	127	140		200
d_p	[mm]	HVU-TZ foil capsule diameter		11.0	13.0	17.0		23.0
HAS-(E-)TZ/-RTZ/-HCR-TZ:								
A_s	[mm²]	Stressed cross-sectional area under tensile loading:		44.2	56.7	95.0		153.9
		Stressed cross-sectional area under shear loading in thread:		58.0	84.3	157.0		245.0
f_{uk}	[N/mm²]	Nominal tensile strength (point)	HAS-TZ 8.8	800				
			HAS-RTZ	800				
			HAS-HCR-TZ	800				
f_{yk}	[N/mm²]	Nominal yield strength (point)	HAS-TZ 8.8	640				
			HAS-RTZ	600				
			HAS-HCR-TZ	600				
W	[mm³]	Section modulus		62.3	109.0	277.0		541
$M_{Rd,s}$	[Nm]	Design bending resistance	HAS-TZ 8.8	38.4	68.8	181.6		415.2
			HAS-RTZ and HAS-HCR-TZ					
d	[mm]	Shank diameter		10	12	16		20
d_k	[mm]	Anchor end diameter		10.8	12.8	16.8		22.7
h_{ef}	[mm]	Actual anchorage depth		75	95	105	125	170
l	[mm]	Anchor length		124/139/159	158/183/233	181/211/251	201/231/271	269
S_w	[mm]	Width across flats		17	19	24		30
d_w	[mm]	Washer outside diameter		20	24	30		37

[1] The design bending resistance of the anchor rod was calculated using $M_{Rd,s} = M_{Rk,s}/\gamma_{Ms,b}$, where the partial safety factor $\gamma_{Ms,b}$ is 1.25.

Detailed design method - Hilti CC

(The Hilti CC-Method is a simplified Version of ETAG Annex C)

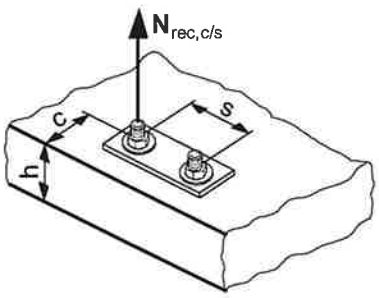
Caution: In view of the high loads transferable with HVZ, it must be verified by the user that the load on the concrete structure including the loads introduced by the anchorage do not cause failure (e.g. cracking) of the concrete structure.

TENSION

The tensile **design resistance** of a single anchor is the lower of,

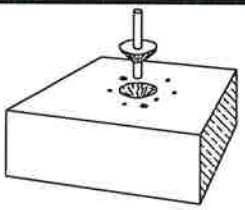
$N_{Rd,c}$: concrete cone/pull-out resistance

$N_{Rd,s}$: steel resistance



$N_{Rd,c}$: Concrete cone/pull-out resistance

$$N_{Rd,c} = N^{o}_{Rd,c} \cdot f_{B,N} \cdot f_{A,N} \cdot f_{R,N}$$



$N^{0}_{Rd,c}$: Concrete cone/pull-out design resistance

- Concrete compressive strength $f_{ck,cube(150)}$ = 25 N/mm²

Anchor size			M10	M12	M16	M16L	M20
$N^{0}_{Rd,c}$ [1]	[kN]	in non-cracked concrete	21.8	26.7	36.2	47.0	74.5
$N^{0}_{Rd,c}$ [1]	[kN]	in cracked concrete	13.3	22.2	25.8	33.5	53.2
h_{ef}	[mm]	Actual anchorage depth	75	95	105	125	170

[1] The design tensile resistance is calculated from the characteristic tensile resistance $N^{o}_{Rk,c}$ by $N^{o}_{Rd,c} = N^{o}_{Rk,c}/\gamma_{Mc,N}$, where the partial safety factor $\gamma_{Mc,N}$ is 1.5.

$f_{B,N}$: Influence of concrete strength

Concrete strength designation (ENV 206)	Cylinder compressive strength $f_{ck,cyl}$ [N/mm²]	**Cube compressive strength $f_{ck,cube}$ [N/mm²]**	$f_{B,N}$
C20/25	20	**25**	**1**
C25/30	25	**30**	**1.1**
C30/37	30	**37**	**1.22**
C35/45	35	**45**	**1.34**
C40/50	40	**50**	**1.41**
C45/55	45	**55**	**1.48**
C50/60	50	**60**	**1.55**

Concrete cylinder: height 30cm, 15cm diameter	Concrete cube: side length 15cm
Concrete test specimen geometry	

$$f_{B,N} = \sqrt{\frac{f_{ck,cube}}{25}}$$

Limits: 25 N/mm² ≤ $f_{ck,cube}$ ≤ 60 N/mm²

$f_{A,N}$: Influence of spacing

Spacing, s [mm]	Anchor size M10	M12	M16	M16L	M20
50	0.61				
60	0.63	0.60			
65	0.64	0.61			
70	0.66	0.62	0.61	0.59	
75	0.67	0.63	0.62	0.60	
80	0.68	0.64	0.63	0.61	0.58
85	0.69	0.65	0.63	0.61	0.58
90	0.70	0.66	0.64	0.62	0.59
100	0.72	0.68	0.66	0.63	0.60
120	0.77	0.71	0.69	0.66	0.62
135	0.80	0.74	0.71	0.68	0.63
140	0.81	0.75	0.72	0.69	0.64
160	0.86	0.78	0.75	0.71	0.66
180	0.90	0.82	0.79	0.74	0.68
200	0.94	0.85	0.82	0.77	0.70
220	1.00	0.89	0.85	0.79	0.72
240		0.92	0.88	0.82	0.74

$f_{A,N}$: Influence of spacing

Spacing, s [mm]	Anchor size				
	M10	M12	M16	M16L	M20
270		0.97	0.93	0.86	0.76
300		1.00	0.98	0.90	0.79
330			1.00	0.94	0.82
360				0.98	0.85
390				1.00	0.88
420					0.91
450					0.94
480					0.97
510					1.00

$$f_{A,N} = 0.5 + \frac{s}{6h_{ef}}$$ Limits: $s_{min} \le s \le s_{cr,N}$

Anchor size	M10	M12	M16	M16L	M20
s_{min} [mm]	50	60	70		80
$s_{cr,N}$ [mm]	225	285	315	375	510

$f_{R,N}$: Influence of edge distance

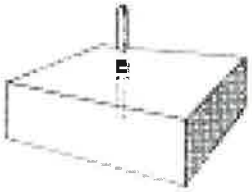
Edge distance c [mm]	Anchor size				
	M10	M12	M16	M16L	M20
50	0.58				
60	0.65				
65	0.68				
70	0.72	0.62			
75	0.75	0.64			
80	0.78	0.67			0.49
85	0.82	0.70	0.65	0.59	0.50
90	0.85	0.72	0.68	0.61	0.51
95	0.88	0.75	0.70	0.63	0.53
100	0.92	0.78	0.73	0.65	0.54
105	0.95	0.80	0.75	0.67	0.56
110	0.98	0.83	0.77	0.69	0.57
115	1.00	0.86	0.80	0.71	0.59
125		0.91	0.85	0.75	0.62
135		0.96	0.89	0.79	0.65
145		1.00	0.94	0.83	0.68
155			1.00	0.87	0.71
165				0.91	0.74
175				0.95	0.76
185				1.00	0.79
205					0.85
230					0.93
255					1.00

$$f_{R,N} = 0.25 + 0.50\frac{c}{h_{ef}}$$ Limits: $c_{min} \le c \le c_{cr,N}$

Anchor size	M10	M12	M16	M16L	M20
c_{min} [mm]	50	70	85		80
$c_{cr,N}$ [mm]	113	143	158	188	255

Note: If more than 3 edge distances are smaller than $c_{cr,N}$, please contact your Hilti technical service.

$N_{Rd,s}$: Steel design tensile resistance



Anchor size	M10	M12	M16	M16L	M20
$N_{Rd,s}$ [1)] [kN]	23.3	34.0	60.0		121.3

1) The design value is calculated using $N_{Rd,s} = N_{Rk,s} / \gamma_{Ms,N}$, where the partial safety factor, $\gamma_{Ms,N}$, is 1.5.

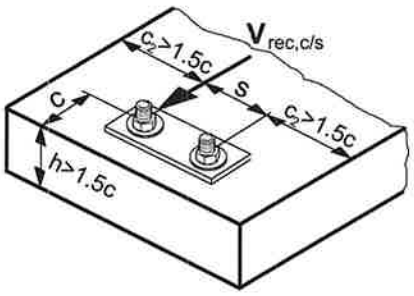
N_{Rd} : System design tensile resistance

N_{Rd} = lower of $N_{Rd,c}$ and $N_{Rd,s}$

Combined loading: Only if tensile load and shear load applied (See page 31 and section 4 "Examples").

Detailed design method – Hilti CC

(The Hilti CC-Method is a simplified Version of ETAG Annex C)



Note: If the conditions shown for h and c_2 cannot be observed, please contact your Hilti sales representative.

SHEAR

The design shear resistance of a single anchor is the lower of,

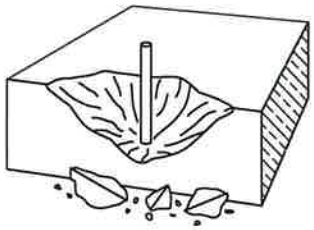
$V_{Rd,c}$: concrete edge resistance

$V_{Rd,s}$: steel resistance

$V_{Rd,c}$: Concrete edge design resistance

The lowest concrete edge resistance must be calculated. All near edges must be checked, (not only the edge in the direction of shear). The direction of shear is accounted by the factor $f_{\beta,V}$.

$$V_{Rd,c} = V^0_{Rd,c} \cdot f_{B,V} \cdot f_{\beta,V} \cdot f_{AR,V}$$



$V^0_{Rd,c}$: Concrete edge design resistance

- Concrete compressive strength $f_{ck,cube(150)} = 25$ N/mm^2
- at a minimum edge distance c_{min}

HVZ adhesive anchor

Anchor size		M10	M12	M16	M16L	M20
$V^0_{Rd,c}$ [1] [kN]	non-cracked concrete	3.5	6.4	9.6	9.9	10.3
$V^0_{Rd,c}$ [1] [kN]	cracked concrete	2.5	4.6	6.9	7.1	7.4
c_{min} [mm]	min. edge distance	50	70	85		80

[1] The design value of the ultimate state in shear is calculated from the characteristic anchor shear resistance, $V^0_{Rk,c}$, divided by $V^0_{Rd,c} = V^0_{Rk,c}/\gamma_{Mc,V}$, where the partial safety factor, $\gamma_{Mc,V}$, is 1.5.

$f_{B,V}$: Influence of concrete strength

Concrete strength designation (ENV 206)	Cylinder compressive strength $f_{ck,cyl}$ [N/mm²]	**Cube compressive strength $f_{ck,cube}$ [N/mm²]**	$f_{B,V}$
C20/25	20	**25**	**1**
C25/30	25	**30**	**1.1**
C30/37	30	**37**	**1.22**
C35/45	35	**45**	**1.34**
C40/50	40	**50**	**1.41**
C45/55	45	**55**	**1.48**
C50/60	50	**60**	**1.55**

Concrete cylinder: height 30cm, 15cm diameter	Concrete cube: side length 15cm
Concrete test specimen geometry	

$$f_{B,V} = \sqrt{\frac{f_{ck,cube}}{25}}$$

Limits: 25 N/mm² ≤ $f_{ck,cube}$ ≤ 60 N/mm²

$f_{\beta,V}$: Influence of shear load direction

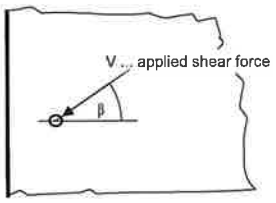
Angle β [°]	$f_{\beta,V}$
0 to 55	**1**
60	**1.1**
70	**1.2**
80	**1.5**
90 to 180	**2**

Formulae:

$f_{\beta,V} = 1$ for $0° \le \beta \le 55°$

$f_{\beta,V} = \frac{1}{\cos\beta + 0.5\sin\beta}$ for $55° < \beta \le 90°$

$f_{\beta,V} = 2$ for $90° < \beta \le 180°$



$f_{AR,V}$: Influence of edge distance and spacing

Formula for **single**-anchor fastening
Influenced only by edge

$$f_{AR,V} = \frac{c}{c_{min}}\sqrt{\frac{c}{c_{min}}}$$

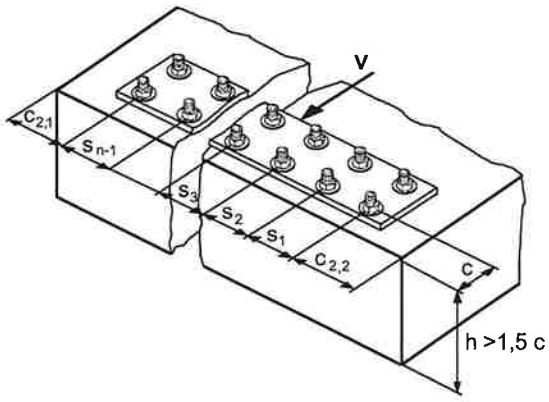
Formula for a **two**-anchor fastening valid for s < 3c

$$f_{AR,V} = \frac{3c + s}{6c_{min}}\sqrt{\frac{c}{c_{min}}}$$

results tabulated below

General formula for **n**-anchor fastening (edge plus n-1 spacing) only valid where s_1 to s_{n-1} are all < 3c and c_2 > 1.5c

$$f_{AR,V} = \frac{3c + s_1 + s_2 + \ldots + s_{n-1}}{3nc_{min}} \cdot \sqrt{\frac{c}{c_{min}}}$$



Note: It is assumed that only the row of anchors closest to the free concrete edge carries the centric shear load

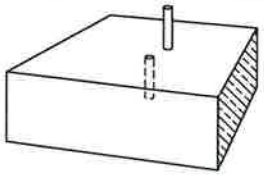
$f_{AR,V}$		c/c_{min} →															
		1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0
Single anchor with edge influence		1.00	1.31	1.66	2.02	2.41	2.83	3.26	3.72	4.19	4.69	5.20	5.72	6.27	6.83	7.41	8.00
s/c_{min} ↓	1.0	0.67	0.84	1.03	1.22	1.43	1.65	1.88	2.12	2.36	2.62	2.89	3.16	3.44	3.73	4.03	4.33
	1.5	0.75	0.93	1.12	1.33	1.54	1.77	2.00	2.25	2.50	2.76	3.03	3.31	3.60	3.89	4.19	4.50
	2.0	0.83	1.02	1.22	1.43	1.65	1.89	2.13	2.38	2.63	2.90	3.18	3.46	3.75	4.05	4.35	4.67
	2.5	0.92	1.11	1.32	1.54	1.77	2.00	2.25	2.50	2.77	3.04	3.32	3.61	3.90	4.21	4.52	4.83
	3.0	1.00	1.20	1.42	1.64	1.88	2.12	2.37	2.63	2.90	3.18	3.46	3.76	4.06	4.36	4.68	5.00
	3.5		1.30	1.52	1.75	1.99	2.24	2.50	2.76	3.04	3.32	3.61	3.91	4.21	4.52	4.84	5.17
	4.0			1.62	1.86	2.10	2.36	2.62	2.89	3.17	3.46	3.75	4.05	4.36	4.68	5.00	5.33
	4.5				1.96	2.21	2.47	2.74	3.02	3.31	3.60	3.90	4.20	4.52	4.84	5.17	5.50
	5.0					2.33	2.59	2.87	3.15	3.44	3.74	4.04	4.35	4.67	5.00	5.33	5.67
	5.5						2.71	2.99	3.28	3.57	3.88	4.19	4.50	4.82	5.15	5.49	5.83
	6.0						2.83	3.11	3.41	3.71	4.02	4.33	4.65	4.98	5.31	5.65	6.00
	6.5							3.24	3.54	3.84	4.16	4.47	4.80	5.13	5.47	5.82	6.17
	7.0								3.67	3.98	4.29	4.62	4.95	5.29	5.63	5.98	6.33
	7.5									4.11	4.43	4.76	5.10	5.44	5.79	6.14	6.50
	8.0										4.57	4.91	5.25	5.59	5.95	6.30	6.67
	8.5											5.05	5.40	5.75	6.10	6.47	6.83
	9.0											5.20	5.55	5.90	6.26	6.63	7.00
	9.5												5.69	6.05	6.42	6.79	7.17
	10.0													6.21	6.58	6.95	7.33
	10.5														6.74	7.12	7.50
	11.0															7.28	7.67
	11.5																7.83
	12.0																8.00

These results are for a two-. Anchor fastening.

For fastening made with more than 2 anchors, use the general formulae for n anchors.

3

$V_{Rd,s}$: Steel design shear resistance



Anchor size		M10	M12	M16	M16L	M20
$V_{Rd,s}$ [1)][kN]	HAS-(E-)TZ	14.4	21.6	40.8		70.4
$V_{Rd,s}$ [1)][kN	HAS-(E-)RTZ, HAS-(E-)HCR	16.0	24.0	44.8		78.4

[1)] The design shear resistance is calculated using $V_{Rd,s} = V_{Rk,s}/\gamma_{Ms,V}$. The values for the stressed cross section A_s and the nominal tensile strength of steel, f_{uk}, are given in the table „Anchor mechanical properties and geometry". The partial safety factor, $\gamma_{Ms,V}$ is 1.25.

V_{Rd} : System shear design resistance

V_{Rd} = lower of $V_{Rd,c}$ and $V_{Rd,s}$

Combined loading: Only if tensile load and shear load applied (See page 31 and section 4 "Examples").

HUBER TECHNOLOGY
WASTE WATER Solutions

WAP ANCHOR
APPENDIX INFORMATION

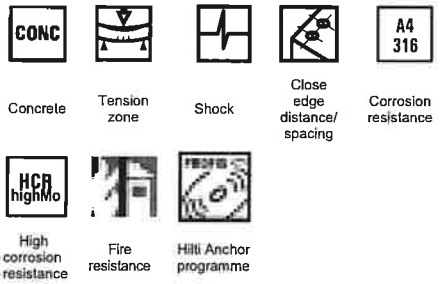
TYPE: Hilti HST-R M20

HST stud anchor

Features:	
	- high loading capacity
	- force- controlled expansion
	- suitable for tension zone
	- suitable for shock loading
	- fire prevention assessment
	- pre-assembled with nut and washer → time saving
	- cold formed
Material:	
HST:	- carbon steel, zinc plated to min. 5 µm
HST-R:	- stainless steel; A4; 1.4401; EN 10088
HST-HCR:	- stainless steel; 1.4529



HST / HST-R / HST-HCR



Concrete | Tension zone | Shock | Close edge distance/ spacing | Corrosion resistance

High corrosion resistance | Fire resistance | Hilti Anchor programme

Basic loading data (for a single anchor): HST

All data on this page applies to

- concrete: as specified in the table
- no edge distance and spacing influence
- correct setting (See setting operations page 85)
- *steel* failure

For detailed design method, see pages 86 - 91.

CONC non-cracked concrete

cracked concrete

Mean ultimate resistance, $R_{u,m}$ [kN]: concrete ≅ C20/25

Anchor size	M8	M10	M12	M16	M20	M24
Tensile $N_{Ru,m}$	16.6	22.3	35.2	48.7	76.0	86.1
Shear $V_{Ru,m}$	*23.0*	*26.5*	*44.2*	*72.2*	*119.1*	*125.0*

M8	M10	M12	M16	M20	M24
10.3	11.6	21.9	31.1	44.9	60.2
22.8	*24.4*	*47.5*	*67.6*	*107.4*	*116.4*

Characteristic resistance, R_k [kN]: concrete ≅ C20/25

Anchor size	M8	M10	M12	M16	M20	M24
Tensile N_{Rk}	9.0	16.0	20.0	35.0	50.0	60.0
Shear V_{Rk}	*13.0*	*20.0*	*30.0*	*50.0*	*55.0*	*94.0*

M8	M10	M12	M16	M20	M24
5.0	9.0	12.0	20.0	30.0	40.0
13.0	*20.0*	*30.0*	*50.0*	*55.0*	*94.0*

Following values according to the:

Concrete Capacity Method

Design resistance, R_d [kN]: concrete $f_{ck,cube}$ = 25 N/mm^2

Anchor size	M8	M10	M12	M16	M20	M24
Tensile N_{Rd}	5.0	10.7	13.3	23.3	33.3	40.0
Shear V_{Rd}	10.4	16.0	24.0	40.0	41.4	62.7

M8	M10	M12	M16	M20	M24
2.8	6.0	8.0	13.3	20.0	26.7
10.4	16.0	24.0	40.0	41.4	62.7

Recommended load, L_{rec} [kN]: concrete $f_{ck,cube}$ = 25 N/mm^2

Anchor size	M8	M10	M12	M16	M20	M24
Tensile N_{Rec}	3.6	7.6	9.5	16.7	23.8	28.6
Shear V_{Rec}	7.4	11.4	17.1	28.6	29.6	44.8

M8	M10	M12	M16	M20	M24
2.0	4.3	5.7	9.5	14.3	19.0
7.4	11.4	17.1	28.6	29.6	44.8

Basic loading data (for a single anchor): HST-R

All data on this section applies to

- concrete: as specified in the table
- no edge distance and spacing influence
- correct setting (See setting operations page 85)
- *steel* failure

For detailed design method, see pages 86 – 91.

CONC **non-cracked concrete**

cracked concrete

Mean ultimate resistance, $R_{u,m}$ [kN]: concrete ≡ C20/25

Anchor size	M8	M10	M12	M16	M20	M24
Tensile $N_{Ru,m}$	18.1	26.7	35.1	49.8	77.4	79.1
Shear $V_{Ru,m}$	*22.8*	*31.9*	*50.3*	*84.0*	136.0	*151.4*

M8	M10	M12	M16	M20	M24
12.7	18.4	20.1	36.0	55.1	70.5
20.6	*31.9*	45.5	*84.0*	106.6	*151.4*

Characteristic resistance, R_k [kN]: concrete ≡ C20/25

Anchor size	M8	M10	M12	M16	M20	M24
Tensile N_{Rk}	9.0	16.0	20.0	35.0	50.0	60.0
Shear V_{Rk}	*13.0*	*20.0*	*30.0*	*50.0*	*80.0*	*115.0*

M8	M10	M12	M16	M20	M24
5.0	9.0	12.0	25.0	30.0	40.0
13.0	*20.0*	*30.0*	*50.0*	*80.0*	*115.0*

Following values according to the:

Concrete Capacity Method

Design resistance, R_d [kN]: concrete $f_{ck,cube}$ = 25 N/mm²

Anchor size	M8	M10	M12	M16	M20	M24
Tensile N_{Rd}	6.0	10.7	13.3	23.3	33.3	40.0
Shear V_{Rd}	10.4	16.0	24.0	38.5	55.6	79.9

M8	M10	M12	M16	M20	M24
3.3	6.0	8.0	16.7	20.0	26.7
10.4	16.0	24.0	38.5	55.6	79.9

Recommended load, L_{rec} [kN]: concrete $f_{ck,cube}$ = 25 N/mm²

Anchor size	M8	M10	M12	M16	M20	M24
Tensile N_{Rec}	4.3	7.6	9.5	16.6	23.8	28.6
Shear V_{Rec}	7.4	11.4	17.1	27.5	39.7	57.1

M8	M10	M12	M16	M20	M24
2.4	4.3	5.7	11.9	14.2	19.0
7.4	11.4	17.1	27.5	39.7	57.1

Basic loading data (for a single anchor): HST-HCR

All data on this section applies to

- concrete: as specified in the table
- no edge distance and spacing influence
- correct setting (See setting operations page 85)
- *steel* failure

For detailed design method, see pages 86 - 91.

CONC **non-cracked concrete**

cracked concrete

Mean ultimate resistance, $R_{u,m}$ [kN]: concrete ≡ C20/25

Anchor size	M8	M10	M12	M16
Tensile $N_{Ru,m}$	15.2	22.7	32.4	45.5
Shear $V_{Ru,m}$	*14.0*	*21.6*	*32.4*	*59.4*

M8	M10	M12	M16
13.8	16.2	21.5	32.4
14.0	*21.6*	*32.4*	*59.4*

Setting Details \ Anchor size			M20	M24
d_o	[mm]	Nominal dia. of drill bit	20	24
T_{inst}	[Nm]	Rec.tightening torque	240	300
SW	[mm]	Width across nut flats	30	36
d_f	[mm]	Clearance hole diameter	22	26
h_1	[mm]	Min. depth of drill hole	140	170
h_{ef}	[mm]	Effective embed. depth	101	125
t_{fix}	[mm]	Min. fasten. thickness	2	2
		Max. fasten. thickness	305	330
h_{min}	[mm]	Min. concrete thickness	200	250
Drill bit			TE-C-S 20 TE-Y 20	TE-C-S 24 TE-Y 24

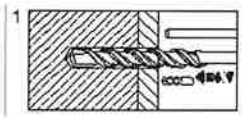
HST-HCR is available up to M16.

2

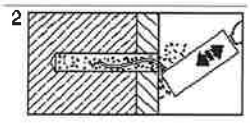
Installation equipment

Rotary hammer (TE1, TE 2, TE5, TE6, TE6A, TE15, TE15-C, TE18-M, TE 35, TE 55, TE 76), drill bit, blow-out pump, torque wrench, appropriate size hexagon drive socket for correct setting.

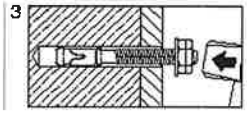
Setting operations



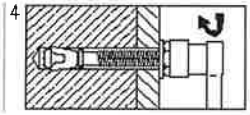
Drill hole with drill bit.



Blow out dust and fragments.



Install anchor.



Apply tightening torque.

Mechanical properties of anchor bolt

Anchor size				M8	M10	M12	M16	M20	M24
f_{uk}	[N/mm^2]	Nominal tensile strength	HST	800	800	800	680	550	530
			HST-R	700	700	700	650	700	700
			HST-HCR	700	700	700	700	-	-
f_{yk}	[N/mm^2]	min. Yield strength	HST	640	640	640	480	400	450
			HST-R	500	500	500	500	500	500
			HST-HCR	450	450	450	450	-	-
A_s	[mm^2]	Stressed cross-section in taper		24.2	41.3	57.4	105.7	167.4	240.5
A_s	[mm^2]	Stressed cross-section in thread		36.6	58	84.3	157	245	353
W_{el}	[mm^3]	Elastic moment of resistance		31.2	62.3	109	277	541	935
$M_{Rd,s}$	[Nm]	Design bending moment [1]	HST	24.0	47.8	83.7	159.6	259.7	475.7
			HST-R	18.7	37.4	65.4	166.2	324.6	561
			HST-HCR	16.8	33.5	58.7	161.1	-	-

[1] The design bending moment is calculated from $M_{Rd,s} = 1.2 \cdot W_{el} \cdot f_{uk} / \gamma_{Ms}$ where the partial safety factor γ_{Ms} varies with anchor type and size.

Detailed design method - Hilti CC

(The Hilti CC-Method is a simplified Version of ETAG Annex C)

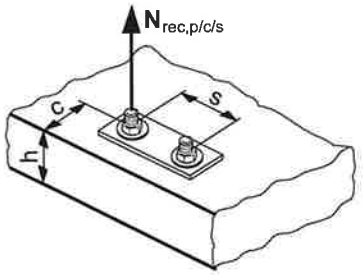
TENSION

The tensile design resistance of a single anchor is the lower of,

$N_{Rd,p}$: concrete pull-out resistance

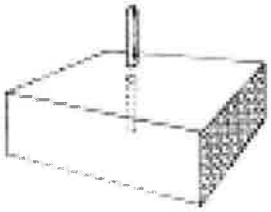
$N_{Rd,c}$: concrete cone resistance

$N_{Rd,s}$: steel resistance



$N_{Rd,p}$: Pull-out resistance

$$N_{Rd,p} = N^{o}_{Rd,p} \cdot f_B$$



$N^0_{Rd,p}$: Design pull-out resistance

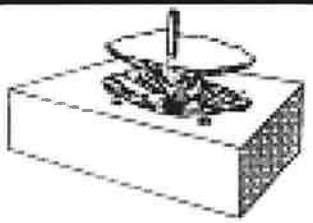
- Concrete compressive strength $f_{ck,cube(150)}$ = 25 N/mm²

Anchor size			M8	M10	M12	M16	M20	M24
$N^0_{Rd,p}$ [1] [kN]	non-cracked concrete	HST	5.0	10.7	13.3	23.3	33.3	40.0
		HST-R	6.0	10.7	13.3	23.3	33.3	40.0
		HST-HCR	5.0	8.9	11.1	19.4	-	-
$N^0_{Rd,p}$ [1] [kN]	cracked concrete	HST	2.8	6.0	8.0	13.3	20.0	26.7
		HST-R	3.3	6.0	8.0	16.7	20.0	26.7
		HST-HCR	2.8	5.0	6.7	13.8	-	-

[1] The tensile design resistance is calculated from the tensile characteristic resistance $N^{o}_{Rk,p}$ by $N^{o}_{Rd,p} = N^{o}_{Rk,p}/\gamma_{Mp}$ where the partial safety factor γ_{Mp} varies with anchor type and size (as per relevant approval).

$N_{Rd,c}$: Concrete cone resistance

$$N_{Rd,c} = N^{o}_{Rd,c} \cdot f_B \cdot f_{AN} \cdot f_{RN}$$



$N^0_{Rd,c}$: Design concrete cone resistance

- Concrete compressive strength $f_{ck,cube(150)}$ = 25 N/mm²

Anchor size			M8	M10	M12	M16	M20	M24
$N^0_{Rd,c}$ [1] [kN]	non-cracked concrete		9.0	15.6	19.7	24.9	34.1	47.0
$N^0_{Rd,c}$ [1] [kN]	cracked concrete		6.4	11.2	14.1	17.8	24.4	33.5
h_{ef} [mm]	effective embedment depth		47	60	70	82	101	125

[1] The tensile design resistance is calculated from the tensile characteristic resistance $N^{o}_{Rk,c}$ by $N^{o}_{Rd,c} = N^{o}_{Rk,c}/\gamma_{Mc,N}$, where the partial safety factor $\gamma_{Mc,N}$ varies with anchor type and size (as per relevant approval).

f_B :Influence of concrete strength

Concrete strength designation (ENV 206)	Cylinder compressive strength $f_{ck,cyl}$ [N/mm²]	**Cube compressive strength $f_{ck,cube}$ [N/mm²]**	f_B
C20/25	20	**25**	**1.0**
C25/30	25	**30**	**1.1**
C30/37	30	**37**	**1.22**
C35/45	35	**45**	**1.34**
C40/50	40	**50**	**1.41**
C45/55	45	**55**	**1.48**
C50/60	50	**60**	**1.55**

Concrete cylinder: height 30cm, 15cm diameter	Concrete cube: side length 15cm
Concrete test specimen geometry	

$$f_B = \sqrt{\frac{f_{ck,cube}}{25}}$$

Limits:
$25\ N/mm^2 \le f_{ck,cube(150)} \le 60\ N/mm^2$

2

f_{AN} :Influence of anchor spacing

Anchor spacing	anchor size					
s [mm]	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
60	0.71		0.64			
70	0.75	0.69	0.67	0.64		
90	0.82	0.75	0.71	0.68		
110	0.89	0.81	0.76	0.72	0.68	
130	0.96	0.86	0.81	0.76	0.71	0.67
150		0.92	0.86	0.80	0.75	0.70
170		0.97	0.90	0.85	0.78	0.73
190			0.95	0.89	0.81	0.75
210			1.00	0.93	0.85	0.78
230				0.97	0.88	0.81
250				1.00	0.91	0.83
270					0.95	0.86
290					0.98	0.89
310					1.00	0.91
330						0.94
350						0.97
380						1.00

$$f_{AN} = 0.5 + \frac{s}{6 \cdot h_{ef}}$$

Limits:
$s_{min} \le s \le s_{cr,N}$
s_{min} varies with edge distance, see table "minimum spacing & minimum edge distance", next page
$s_{cr,N} = 3 \cdot h_{ef}$

f_{RN} :Influence of edge distance

Edge distance	anchor size					
c [mm]	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
55	0.84	0.71	0.64			
60	0.89	0.75	0.68			
70	0.99	0.83	0.75	0.68		
80		0.92	0.82	0.74		
90		1.00	0.89	0.80		
100			0.96	0.86		
110				0.92		
120				0.98		
130						
140					0.94	
150					0.99	0.85
160						0.89
170						0.93
180						0.97

$$f_{RN} = 0.25 + 0.5 \cdot \frac{c}{h_{ef}}$$

Limits:
$c_{min} \le c \le c_{cr,N}$
c_{min} varies with spacing, see table "minimum spacing & minimum edge distance", next page
$c_{cr,N} = 1.5 \cdot h_{ef}$

Note:
If more than 3 edges are smaller than $c_{cr,N}$ consult the Hilti Technical Advisory Service

HST stud anchor

HST			M8	M10	M12	M16	M20	M24
Minimum spacing	s_{min}	[mm]	60	55	60	70	100	125
	for c ≥	[mm]	50	80	85	110	225	255
Minimum edge distance	c_{min}	[mm]	50	55	55	85	140	170
	for s ≥	[mm]	60	115	145	150	270	295

HST-R			M8	M10	M12	M16	M20	M24
Minimum spacing	s_{min}	[mm]	60	55	60	70	100	125
	for c ≥	[mm]	60	70	80	110	195	205
Minimum edge distance	c_{min}	[mm]	60	50	55	70	140	150
	for s ≥	[mm]	60	115	145	160	210	235

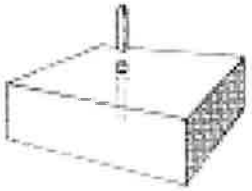
HST-HCR			M8	M10	M12	M16
Minimum spacing	s_{min}	[mm]	60	55	60	70
	for c ≥	[mm]	60	70	80	110
Minimum edge distance	c_{min}	[mm]	60	55	55	70
	for s ≥	[mm]	60	115	145	160

Intermediatate values by interpolation.

$N_{Rd,s}$: Steel design tensile resistance

Anchor size		M8	M10	M12	M16	M20	M24
$N_{Rd,s}$ [1] [kN]	HST	12.8	21.3	28.7	50.0	46.9	90.1
	HST-R	11.3	18.7	26.7	44.2	63.0	90.2
	HST-HCR	12.9	21.5	30.5	56.3	-	-

[1] The design tensile resistance is calculated from the characteristic tensile resistance, $N_{Rk,s}$, using $N_{Rd,s} = N_{Rk,s} / \gamma_{Ms}$, where the partial safety factor γ_{Ms} varies with anchor type and size (as per relevant approval).



N_{Rd} : System design tensile resistance

N_{Rd} = lower of $N_{Rd,p}$, $N_{Rd,c}$ and $N_{Rd,s}$

Combined loading: Only if tensile load and shear load applied (See page 31 and section 4 "Examples").

Detailed design method – Hilti CC

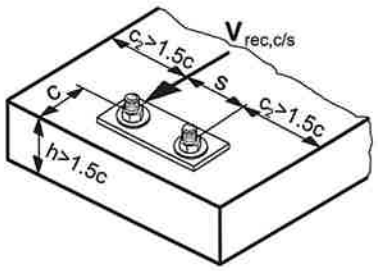
(The Hilti CC-Method is a simplified Version of ETAG Annex C)

SHEAR

The design shear resistance of a single anchor is the lower of,

$V_{Rd,c}$: concrete edge resistance

$V_{Rd,s}$: steel resistance

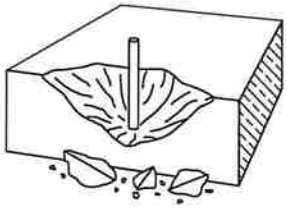


Note: If the conditions regarding h and c_2 are not met, consult your **Hilti technical advisory service.**

$V_{Rd,c}$: Concrete edge design resistance

The lowest concrete edge resistance must be calculated. All nearby edges must be checked, (not only the edge in the direction of shear). Shear direction is accounted for by the factor $f_{\beta,V}$.

$$V_{Rd,c} = V^{o}_{Rd,c} \cdot f_B \cdot f_{\beta,V} \cdot f_{AR,V}$$



$V^{0}_{Rd,c}$: Concrete edge design resistance

- Concrete compressive strength $f_{ck,cube(150)}$ = 25 N/mm²
- at a minimum edge distance c_{min}

HST		Anchor size	M8	M10	M12	M16	M20	M24
$V^{0}_{Rd,c}$ [1]	[kN]	non-cracked concrete	3.0	3.9	4.2	9.1	21.5	31.7
$V^{0}_{Rd,c}$ [1]	[kN]	cracked concrete	2.1	2.8	3.0	6.5	15.4	22.7
c_{min}	[mm]	min. edge distance	50	55	55	85	140	170
for s≥	[mm]	min. spacing distance	60	115	145	150	270	295

HST-R / HCR		Anchor size	M8	M10	M12	M16	M20	M24
$V^{0}_{Rd,c}$ [1]	[kN]	non-cracked concrete	3.9	3.4	4.2	6.8	21.5	26.3
$V^{0}_{Rd,c}$ [1]	[kN]	cracked concrete	2.8	2.4	3.0	4.9	15.4	18.8
c_{min}	[mm]	min. edge distance	60	50	55	70	140	150
for s≥	[mm]	min. spacing distance	60	115	145	160	210	235

HST-R / HCR		Anchor size	M8	M10	M12	M16
$V^{0}_{Rd,c}$ [1]	[kN]	non-cracked concrete	3.9	3.9	4.2	6.8
$V^{0}_{Rd,c}$ [1]	[kN]	cracked concrete	2.8	2.8	3.0	4.9
c_{min}	[mm]	min. edge distance	60	55	55	70
for s≥	[mm]	min. spacing distance	60	115	145	160

[1] The shear design resistance is calculated from the shear characteristic resistance $V^{o}_{Rk,c}$ by $V^{o}_{Rd,c} = V^{o}_{Rk,c}/\gamma_{Mc,V}$, where the partial safety factor $\gamma_{Mc,V}$ is equal to 1.5.

f_B : Influence of concrete strength

Concrete strength designation (ENV 206)	Cylinder compressive strength $f_{ck,cyl}$ [N/mm²]	**Cube compressive strength $f_{ck,cube}$ [N/mm²]**	f_B
C20/25	20	**25**	**1.0**
C25/30	25	**30**	**1.1**
C30/37	30	**37**	**1.22**
C35/45	35	**45**	**1.34**
C40/50	40	**50**	**1.41**
C45/55	45	**55**	**1.48**
C50/60	50	**60**	**1.55**

Concrete cylinder: height 30cm, 15cm diameter	Concrete cube: side length 15cm
Concrete test specimen geometry	

$$f_B = \sqrt{\frac{f_{ck,cube}}{25}}$$

Limits:
25 N/mm² ≤ $f_{ck,cube(150)}$ ≤ 60 N/mm²

2

$f_{\beta,V}$: Influence of shear load direction

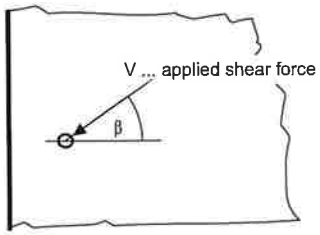
Angle β [°]	$f_{\beta,V}$
0 to 55	1
60	1.1
70	1.2
80	1.5
90 to 180	2

Formulae:

$$f_{\beta,V} = 1 \qquad \text{for } 0° \le \beta \le 55°$$

$$f_{\beta,V} = \frac{1}{\cos\beta + 0.5\sin\beta} \qquad \text{for } 55° < \beta \le 90°$$

$$f_{\beta,V} = 2 \qquad \text{for } 90° < \beta \le 180°$$



$f_{AR,V}$: Influence of spacing and edge distance

Formula for **single** anchor fastening influenced only by edge

$$f_{AR,V} = \frac{c}{c_{min}}\sqrt{\frac{c}{c_{min}}}$$

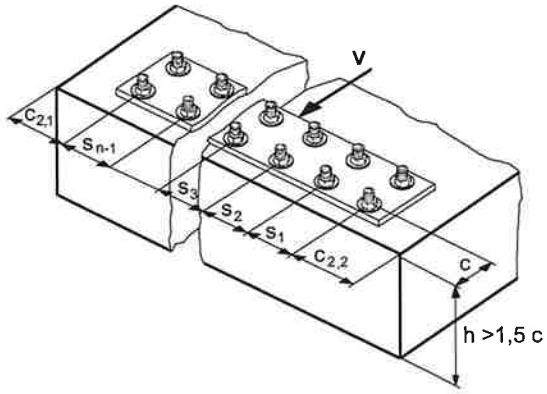
Formula for anchor **pair** valid for s < 3c

$$f_{AR,V} = \frac{3c + s}{6c_{min}}\sqrt{\frac{c}{c_{min}}}$$

results tabulated below

General formula for **n** anchors (edge plus n-1 spacing) only valid where s_1 to s_{n-1} are all < 3c and $c_2 > 1.5c$

$$f_{AR,V} = \frac{3c + s_1 + s_2 + \ldots + s_{n-1}}{3nc_{min}} \cdot \sqrt{\frac{c}{c_{min}}}$$



Note: It is assumed that only the row of anchors closest to the free concrete edge carries the centric shear load

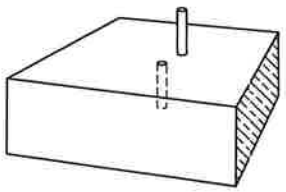
$f_{AR,V}$		c/c_{min} →															
		1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0
Single anchor with edge influence		1.00	1.31	1.66	2.02	2.41	2.83	3.26	3.72	4.19	4.69	5.20	5.72	6.27	6.83	7.41	8.00
s/c_{min} ↓	1.0	0.67	0.84	1.03	1.22	1.43	1.65	1.88	2.12	2.36	2.62	2.89	3.16	3.44	3.73	4.03	4.33
	1.5	0.75	0.93	1.12	1.33	1.54	1.77	2.00	2.25	2.50	2.76	3.03	3.31	3.60	3.89	4.19	4.50
	2.0	0.83	1.02	1.22	1.43	1.65	1.89	2.13	2.38	2.63	2.90	3.18	3.46	3.75	4.05	4.35	4.67
	2.5	0.92	1.11	1.32	1.54	1.77	2.00	2.25	2.50	2.77	3.04	3.32	3.61	3.90	4.21	4.52	4.83
	3.0	1.00	1.20	1.42	1.64	1.88	2.12	2.37	2.63	2.90	3.18	3.46	3.76	4.06	4.36	4.68	5.00
	3.5		1.30	1.52	1.75	1.99	2.24	2.50	2.76	3.04	3.32	3.61	3.91	4.21	4.52	4.84	5.17
	4.0			1.62	1.86	2.10	2.36	2.62	2.89	3.17	3.46	3.75	4.05	4.36	4.68	5.00	5.33
	4.5				1.96	2.21	2.47	2.74	3.02	3.31	3.60	3.90	4.20	4.52	4.84	5.17	5.50
	5.0					2.33	2.59	2.87	3.15	3.44	3.74	4.04	4.35	4.67	5.00	5.33	5.67
	5.5						2.71	2.99	3.28	3.57	3.88	4.19	4.50	4.82	5.15	5.49	5.83
	6.0						2.83	3.11	3.41	3.71	4.02	4.33	4.65	4.98	5.31	5.65	6.00
	6.5							3.24	3.54	3.84	4.16	4.47	4.80	5.13	5.47	5.82	6.17
	7.0								3.67	3.98	4.29	4.62	4.95	5.29	5.63	5.98	6.33
	7.5									4.11	4.43	4.76	5.10	5.44	5.79	6.14	6.50
	8.0										4.57	4.91	5.25	5.59	5.95	6.30	6.67
	8.5											5.05	5.40	5.75	6.10	6.47	6.83
	9.0											5.20	5.55	5.90	6.26	6.63	7.00
	9.5												5.69	6.05	6.42	6.79	7.17
	10.0													6.21	6.58	6.95	7.33
	10.5														6.74	7.12	7.50
	11.0															7.28	7.67
	11.5																7.83
	12.0																8.00

These results are for a two-. Anchor fastening.

For fastening made with more than 2 anchors, use the general formulae for n anchors at the top of the page.

Anchor size		M8	M10	M12	M16	M20	M24
$V_{Rd,s}$ [kN]	HST	10.4	16.0	24.0	40.0	41.4	62.7
	HST-R	10.4	16.0	24.0	38.5	55.6	79.9
	HST-HCR	10.4	16.0	24.0	44.0	-	-

*) The design shear resistance is calculated from the characteristic shear resistance, $V_{Rk,s}$, using $V_{Rd,s} = V_{Rk,s} / \gamma_{Ms}$, where the partial safety factor γ_{Ms} varies with anchor type and size (as per relevant approval).



V_{Rd} : System design shear resistance

V_{Rd} = lower of $V_{Rd,c}$ and $V_{Rd,s}$

Combined loading: Only if tensile load and shear load applied (See page 31 and section 4 "Examples").

2

TAB 8

EQUIPMENT PARTS DRAWING & LIST

Spare parts and service are also available through the following location:

Huber Technology, Inc.
9735 NorthCross Center Court, Suite A
Huntersville, NC 28078
Ph: 877-874-8237
Fax: 704-949-1020
Contact: parts@hhusa.net or service@hhusa.net

LIST OF SPARE PARTS SUPPLIED WITH THE EQUIPMENT

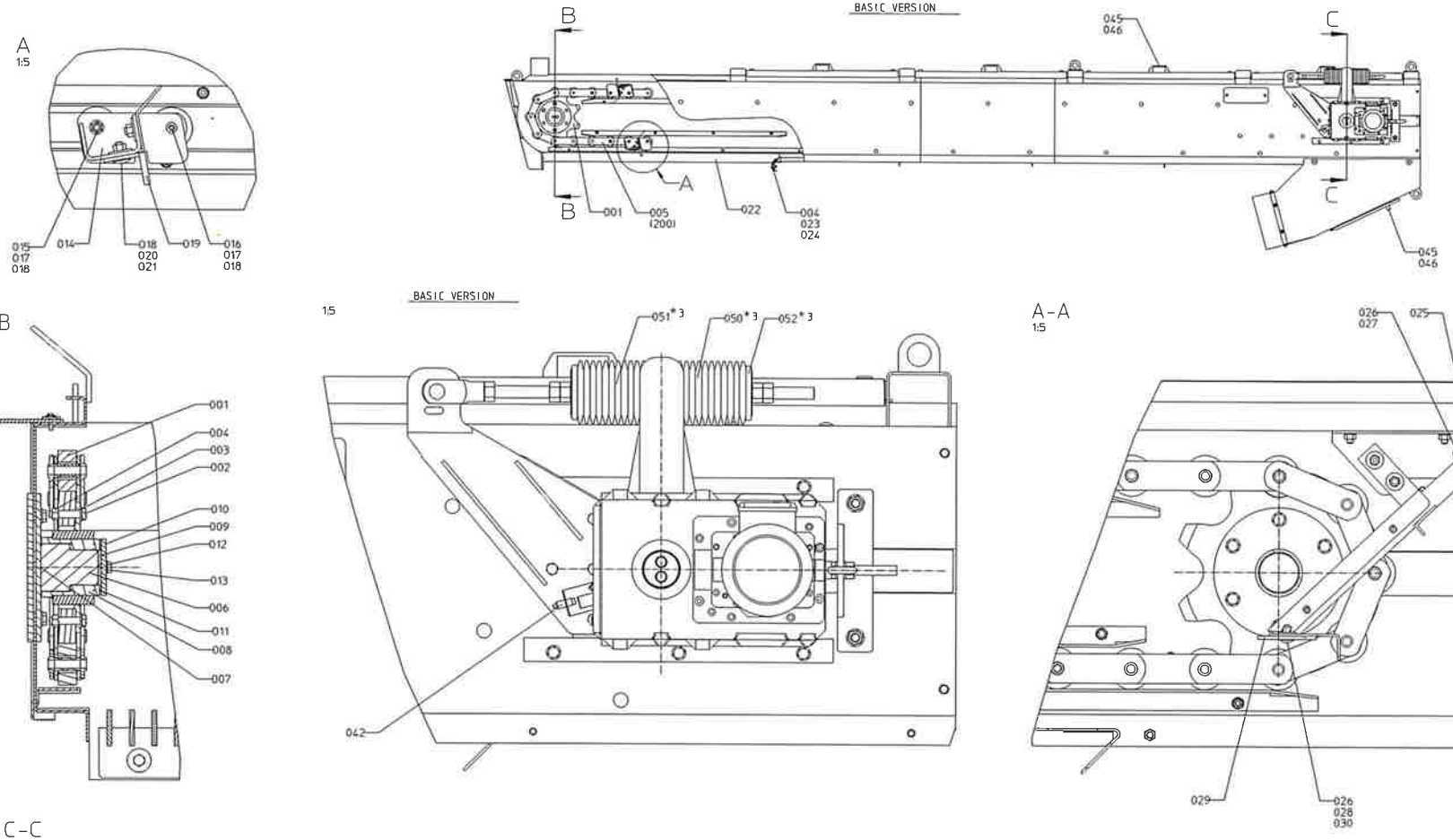
City of Lexington, KY
East Hickman Wet Weather Storage Facility and Pump Stations
in accordance with Specification Section 11420
Mechanical Screens

1. Two (2) Sets of Rake Bars
2. Two (2) Sets of Rake Plates
3. Four (4) Scraper/Wiper Pads
4. Two (2) 5 Foot Chain Segments

City of Lexington, KY
East Hickman Wet Weather Storage Facility and Pump Stations
in accordance with Specification Section 11420
Screenings Compactors

1. Two (2) Sets of Wear Bars
2. Two (2) Brush

****TYPE & QUANTITY OF CONTROLS SPARE PARTS TO BE SUPPLIED ARE LISTED IN TAB 2 BOM ITEMS 127 – 138****



Pos.	Item	Quantity	Specification	Material/Supplier	Annotations

This is a copyrighted drawing which is the intellectual property of Huber Huber AG. Any contravening offender will be held liable for payment of damages.

Subject to modification | ISO 2768-mK

HUBER TECHNOLOGY

						Drawn/Rev.	Date/Date	Name
						Drawn/Rev.	02.09.2005	cbr
ID	dd/mm/yy	EDCN	Nr.			Check/Appr.		
Version	Modified	Date	Name			Norm.		

Scale: 1:1

RakeMax

Project Name: spare parl drawing

Standard Item Code	Family	Project	Item Code	Sheet
-	-		011_000075	-/1

spare and wear parts

HUBER RakeMax® Screen

Wearing parts are parts that are subject to increased wear due to their specific function. Such wear depends to a great extent on:

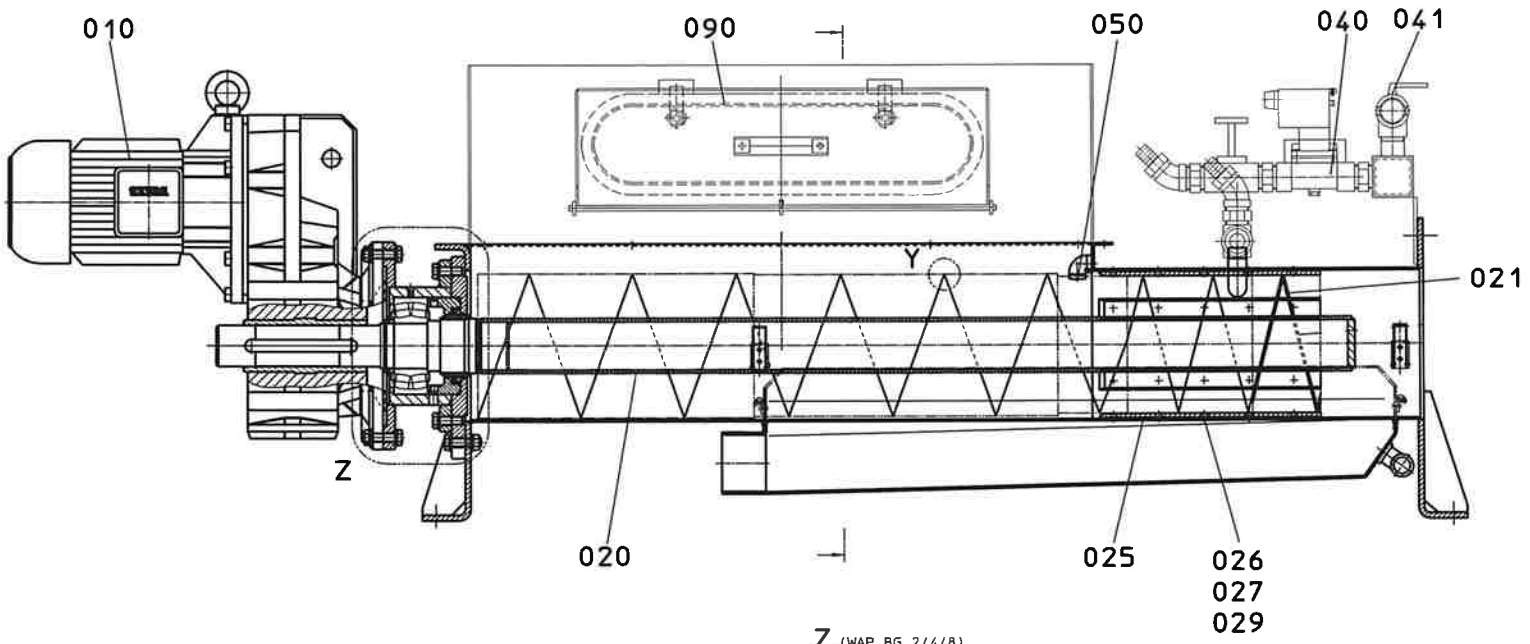
- Application conditions (such as an increased grit rate, or abrasive materials)
- Running hours
- Maintenance

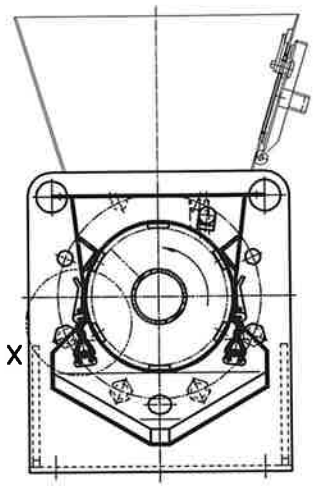
spare part: s
wear part: w

recommended 2 years	recommended 5 years	Pos Item	description			operating time (Std / hours)
		001		sprocket wheel	w	
		002		hexagon head screw	s	
		003		washer	s	
		004		hexagonal nut	s	
		005		chain	w	
		006		journal pin	w	10000
		007		cylinder head screw	s	
		008		shell case	w	10000
		009		disc	s	
		010		disc	s	
		011		guard ring PE	w	10000
		012		hexagon head screw	s	
		013		washer	s	
		014		beam for rake	s	
		015		hexagon head screw	s	
		016		cylinder head screw	s	
		017		washer	s	
		018		hexagonal nut	s	
	X	019		rake	w	
		020		truss head screw	s	
		021		washer	s	
		022		rack screen field	s	
		023		hexagon head screw	s	
		024		washer	s	
		025		journal pin for scraper	s	
		026		washer	s	
		027		hexagon head screw	s	
		028		hexagonal nut	s	
X		029		scraper plate	w	
		030		truss head screw	s	
		032		geared engine	s	

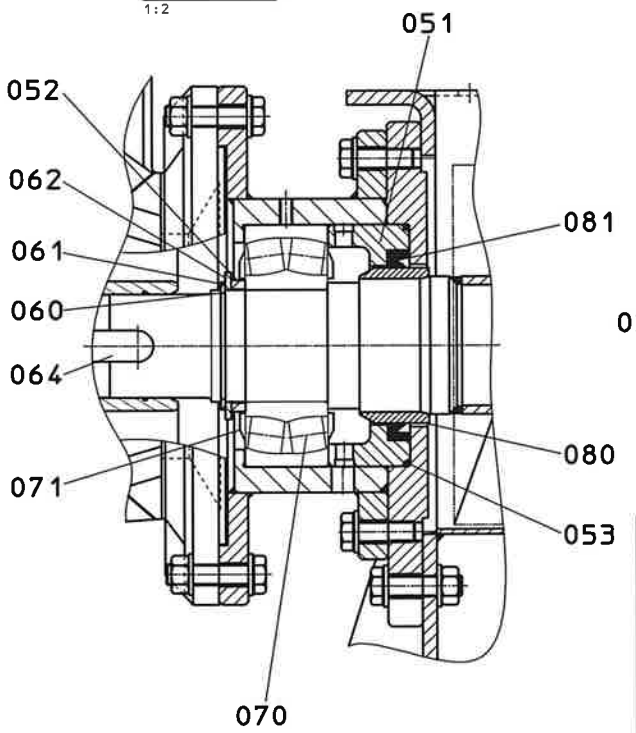
recommended 2 years	recommended 5 years	Pos item	description			operating time (Std / hours)
		033		adjusting spring	s	
		035		flange bearing	s	
		042		proximity switch	s	
		045		handle	s	
		046		cover for handle	s	
		047		hasp	s	
		048		key for hasp	s	
		049		sealing strip	s	
		050*2		cup spring	s	
		051*2		bellows	s	
		052*2		hose clip	s	
		200		additional chain (depending on the size)	w	

*2 spare parts only for basic version

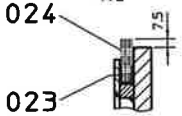




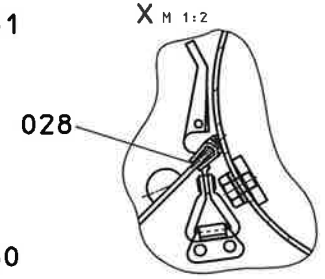
Z (WAP BG 2/4/8)
1:2



Y
1:2



X M 1:2



Pos. Item	Quantity	Specification	Material/Supplier	Annotations

This is a copyrighted drawing which is the intellectual property of Hans Huber AG. Any contravening offender will be held liable for payment of damages.

Subject to modification | ISO 2768-mk

HUBER TECHNOLOGY

				Date	Name
			Rev.	18.10.2002	esc.
0	Aend. 2039	12.12.2001	ch	Appr.		
Version	Modified	Date	Name	Norm.		

Scale: 1:5

WAP 1.2.4.8

Project Name: spare part drawing

Standard Item Code	Family	Project	Item Code	Sheet
-	-		011_000003	427

spare and wear parts

Screenings Wash Press WAP®

Wearing parts are parts that are subject to increased wear due to their specific function. Such wear depends to a great extent on:

- Application conditions (such as an increased grit rate, or abrasive materials)
- Running hours
- Maintenance

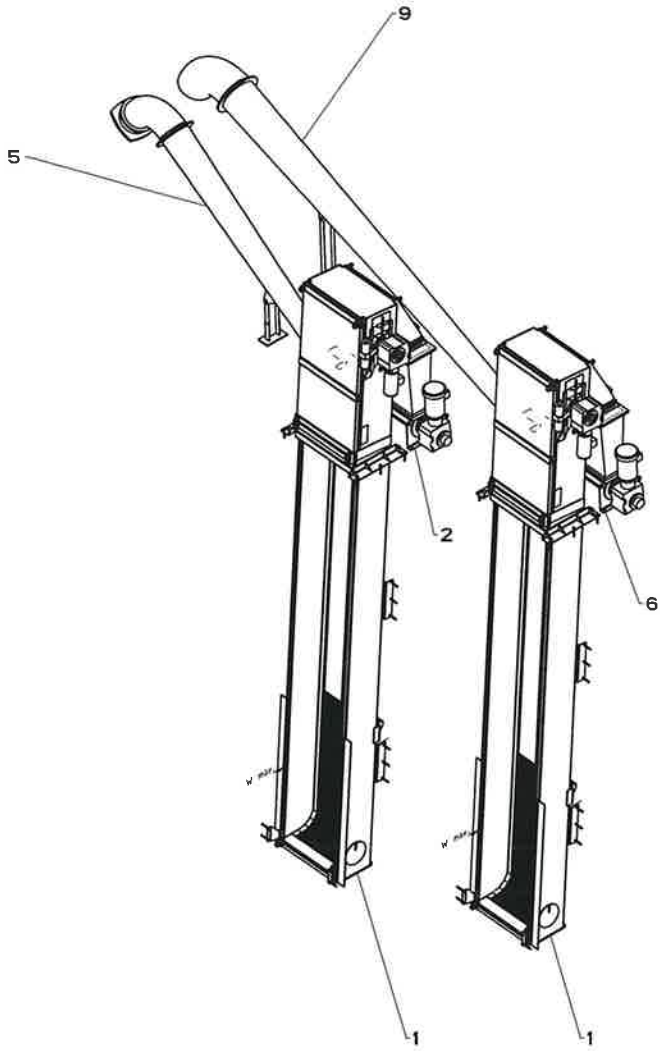
BG 1, 2, 4, 8

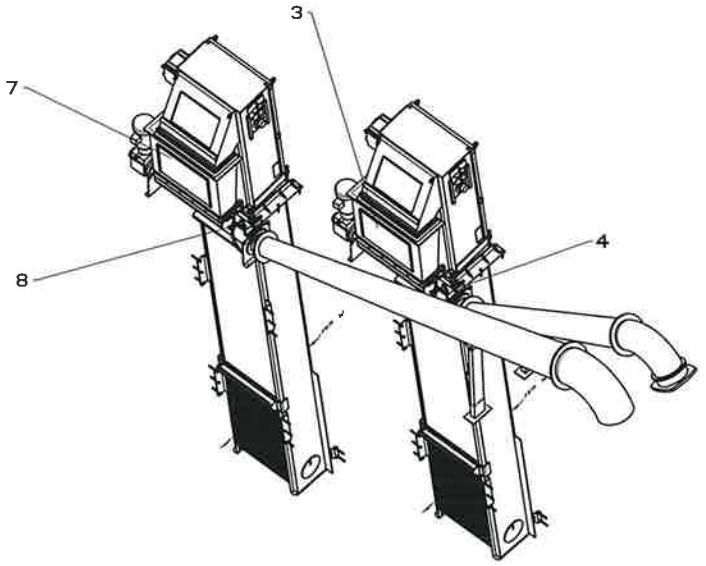
spare part: s
wear part: w

recommended 2 years	recommended 5 years	Pos item	description			operating time (Std / hours)
		010		geared motor	s	
		020		conveyor screw	w	
x	x	021		last screw flight	w	1000
x	x	023		grub screw	s	
x	x	024		auger brush	w	800
x	x	025		wear bar	w	1000
x	x	026		hexagon head screw	w	1000
x	x	027		washer	w	1000
		028		edge protection rubber profile	s	
x	x	029		rubber gasket	w	1000
		041		ball valve	s	
		050		flat jet nozzle 3/8"	s	
		051		bush	s	
		052		ring bearing	s	
x	x	053		rubber gasket	s	
		060		circlips	s	
		061		thrust washer	s	
		062		support disc	s	
		064		woodruft key	s	
		070		self aligning roller bearing	s	
		071		sealing ring nilos	s	
x	x	080		bush	w	4000
x	x	081		packing ring	w	2000
		090		edge protection rubber profile	s	

PROJECT INSTALLATION DRAWINGS

Pos. No.	Quantity	Description
1	2	HUBER Multi-Rake Bar Screen RakeMax® 8320x975/6 85°
2	1	Screenings Wash Press WAP 4
3	1	feed hopper
4	1	distributor
5	1	discharge pipe L = 3500, w/ bagger
6	1	Screenings Wash Press WAP 4
7	1	feed hopper
8	1	distributor
9	1	discharge pipe L = 6000





- CHANNEL WALLS MUST BE ABSOLUTELY VERTICAL IN THE AREA OF THE SCREEN. IN THE AREA OF THE SCREEN BOTTOM PLATE THE CHANNEL SURFACE MUST BE PLANE WITH A MAX. TOLERANCE OF +/-3 mm.
- THESE ANCHOR BOLTS ARE ONLY PERMISSIBLE IN CONCRETE WITH A SUFFICIENT RESISTANCE!
- PROVIDE SUFFICIENT LIFTING DEVICE (CRANE RAIL WITH MOVABLE HOIST ABOVE THE AXLE OF THE MACHINE) / AN INSTALLATION OPENING BY OTHERS.
- PROVIDE HANDRAIL / GRATING COVER ABOVE THE CHANNEL IN THE SCREEN AREA BY OTHERS.
- WASHING MEDIUM: SERVICE WATER / WATER FROM SECONDARY CLARIFICATION TANK (grain <= 0.3mm). WATER PRESSURE ~ 75-110 psi.

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Technical information subject to change.

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Approved:	us-nm-pdm	24.01.2018
Modified:	mn	04/16/18
3	bagger	
Rev.	Modification	

HUBER TECHNOLOGY
WASTE WATER Solutions
9725-A Northcross Center Ct. Huntersville, NC

Mechanical Wastewater Screening

2x RakeMax® 8320x975/6 85°; 2x WAP 4

Scale:	Fig No.:	Installation drawing	Size:
1:48	1/6		C

73002974 - Lexington,KY-EastHickman-RM

Drawing No.: 51182477

GENERAL INSTALLATION NOTES:

1.	EQUIPMENT MUST BE LEVEL IN ALL PLANES.
2.	AUTHORIZATION REQUIRED FOR FIELD MODIFICATIONS TO HUBER EQUIPMENT DUE TO SITE INCONSISTANCIES -CONTACT HUBER TECHNOLGY.
3.	REFUSE CONTAINERS SHOWN ON DRAWINGS (IF ANY) ARE FOR REFERENCE ONLY AND ARE SUPPLIED BY OTHERS (UNLESS SPECIFIC TO HUBER's SCOPE OF SUPPLY.)
4.	WELDING: DO NOT WELD UNTIL TEMPORARY MOCK-UP IS VERIFIED AGAINST THE INSTALLATION DRAWINGS AND ALL LEVEL, SQUARENESS, AND/OR ANGLES HAVE BEEN ACHIEVED -REFER TO WELD SPECIFICATIONS THIS DRAWING.
5.	INSTALLATION CONTRACTOR TO VERIFY ALL EXISTING STRUCTURAL DIMENSIONS BEFORE COMMENCEMENT OF WORK. CONTACT ENGINEER AND/OR HUBER IF FIELD DISCREPANCIES PREVENT PROPER INSTALLATION AS SHOWN ON THE INSTALLATION DRAWINGS, AND/OR OPERATIONS AND MAINTENANCE MANUAL.
6.	FIELD VERIFY ALL EXISTING SITE DIMENSIONS AND ELEVATIONS. DIMENSIONS AND ELEVATIONS SHOWN ARE BASED ON ENGINEERING DRAWINGS AVAILABLE AT THE TIME OF DESIGN OR AS BASED ON AVAILABLE PLANT RECORD DRAWINGS -ALL SITE DIMENSIONS SHOWN ON HUBER DRAWINGS ARE FOR "REFERENCE" ONLY. HUBER NOT RESPONSIBLE FOR DISCREPANCIES IN THE FIELD.
7.	INSTALLATION IS BY OTHERS.
8.	ALL REQUIRED ELECTRICAL, FITTINGS, CONDUIT, HAZARDOUS AREA CONDUIT SEALS, WIRING, AND/OR JUNCTION BOXES - ARE SUPPLIED BY OTHERS.
9.	REFER TO PROJECT DRAWINGS OR CONSULT ENGINEER FOR EQUIPMENT CONDUIT RUNS, CONTROL STATION LOCATION, AND FLOOR STUB UPS.
10.	VALVES SUPPLIED SEPARATE (IF ANY) MUST BE FIELD INSTALLED BY INSTALLING CONTRACTOR. ALL PIPE RUNS AND REQUIRED PIPING ARE SUPPLIED BY OTHERS. SEE ENGINEER FOR PIPE LAYOUT/ROUTING.
11.	FLANGE GASKETS, HARDWARE, AUXILLARY PIPING, FITTINGS, OR OTHER RELATED ARE SUPPLIED BY OTHERS (UNLESS SPECIFICALLY INCLUDED AS PART OF HUBER'S EQUIPMENT SUPPLY).
12.	EQUIPMENT ANCHORS AND HARDWARE SUPPLIED BY HUBER ARE METRIC.
13.	REFER TO EQUIPMENT OPERATIONS AND MAINTENANCE MANUAL FOR DETAILED INSTALLATION INSTRUCTIONS AND/OR EQUIPMENT SPECIFIC INFORMATION.

WELDING SPECIFICATIONS:

1.	NO AREA GRINDING OF NON-STAINLESS METALS OR IRON WELDS PERMITTED NEAR HUBER EQUIPMENT. CONTRACTOR TO INSPECT HUBER EQUIPMENT FOR "RUST SPECKS" IF IRON DUST IS SUSPECT. ALL "RUST SPECKS" MUST BE EXPEDIENTLY AND PROPERLY CLEANED.
2.	WELD ELECTRODES (USED ON HUBER EQUIPMENT) MUST BE AS FOLLOWS:
2. a	304L EQUIPMENT USE 308L ELECTRODE OR BETTER.
2. b	316L EQUIPMENT USE 316L ELECTRODE OR BETTER.
3.	REMOVE ALL BURRS AND SHARP EDGES FROM FIELD WELDS.
4.	ALL WELD AREAS TO BE CLEANED WITH SOLVENT MEK OR EQUIVALENT.
5.	WELDING PER AWS & ASME STANDARDS.

ELECTRICAL NOTES:

1.	ELECTRICAL FITTINGS, WIRING, FLEX CONDUIT/POWER CABLE, SO-CORD, JUNCTION BOXES, REQUIRED FOR MOTOR POWER ARE SUPPLIED BY OTHERS AND NOT PROVIDED BY HUBER.
2.	EQUIPMENT MOTORS SHOULD BE DIRECT WIRED UTILIZING CLASS 1, DIVISION 1 APPROVED FLEX CONDUIT OR OTHER AS APPROVED BY THE ENGINEER.
3.	EQUIPMENT MOTORS DO NOT COME PREWIRED AND REQUIRE CLASS 1, DIVISION 1 PROCEDURES.
4.	CONTRACTOR IS RESPONSIBLE FOR ALL APPLICABLE ELECTRICAL CODE PROCEDURES AND STANDARDS GOVERNING THE PROJECT LOCAL. FOR HAZARDOUS AREA ELECTRICAL CLASS 1, DIVISION 1, GROUP D, NEC ARTICLE 501 SHALL GOVERN.

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Technical information subject to change.

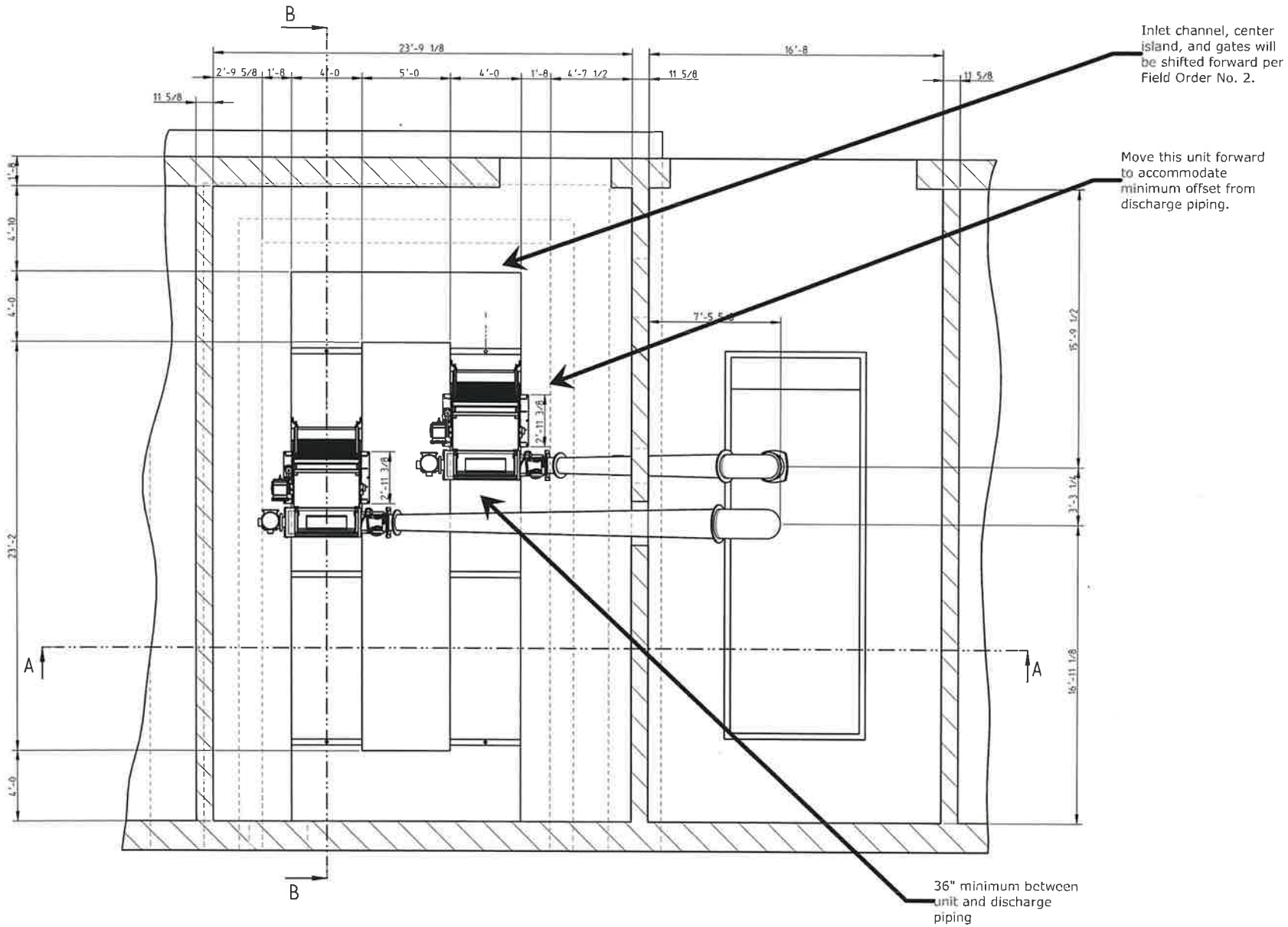
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Designed:	mn	01/24/2018
Approved:	us-nm-pdm	24.01.2018
Modified:	mn	04/16/18
3	bagger	
Rev.	Modification	

HUBER TECHNOLOGY
WASTE WATER Solutions
4725-A Northpoint Center Ct. Huntersville, NC

Mechanical Wastewater Screening

2x RakeMax® 8320x975/6 85°; 2x WAP 4

Scale:	Fig. No.:		Size:
1:288	2/6	Installation drawing	C
73002974 - Lexington.KY-EastHickman-RM			Drawing No.: 51182477



WARNING:
Moving machine parts. Protection against accidental contact to be supplied by client according to country specific regulations.

Fall protection to be supplied by client (type of protection acc. to country specific regulations). (also valid for planned or existing covers of channel > 3' - 7 1/4'' height)

Weight (empty) appr.:

RakeMax	5450 Lbs
WAP	850 Lbs

- material of construction = 304 stainless steel
- motor and solenoids = Class 1, Division 1

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Technical information subject to change.

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Modified:	mn	04/16/18
2	bagger	
Rev.	Modification	

HUBER TECHNOLOGY
WASTE WATER Solutions
9725-A Northcross Center Ct. Huntersville, NC

Mechanical Wastewater Screening

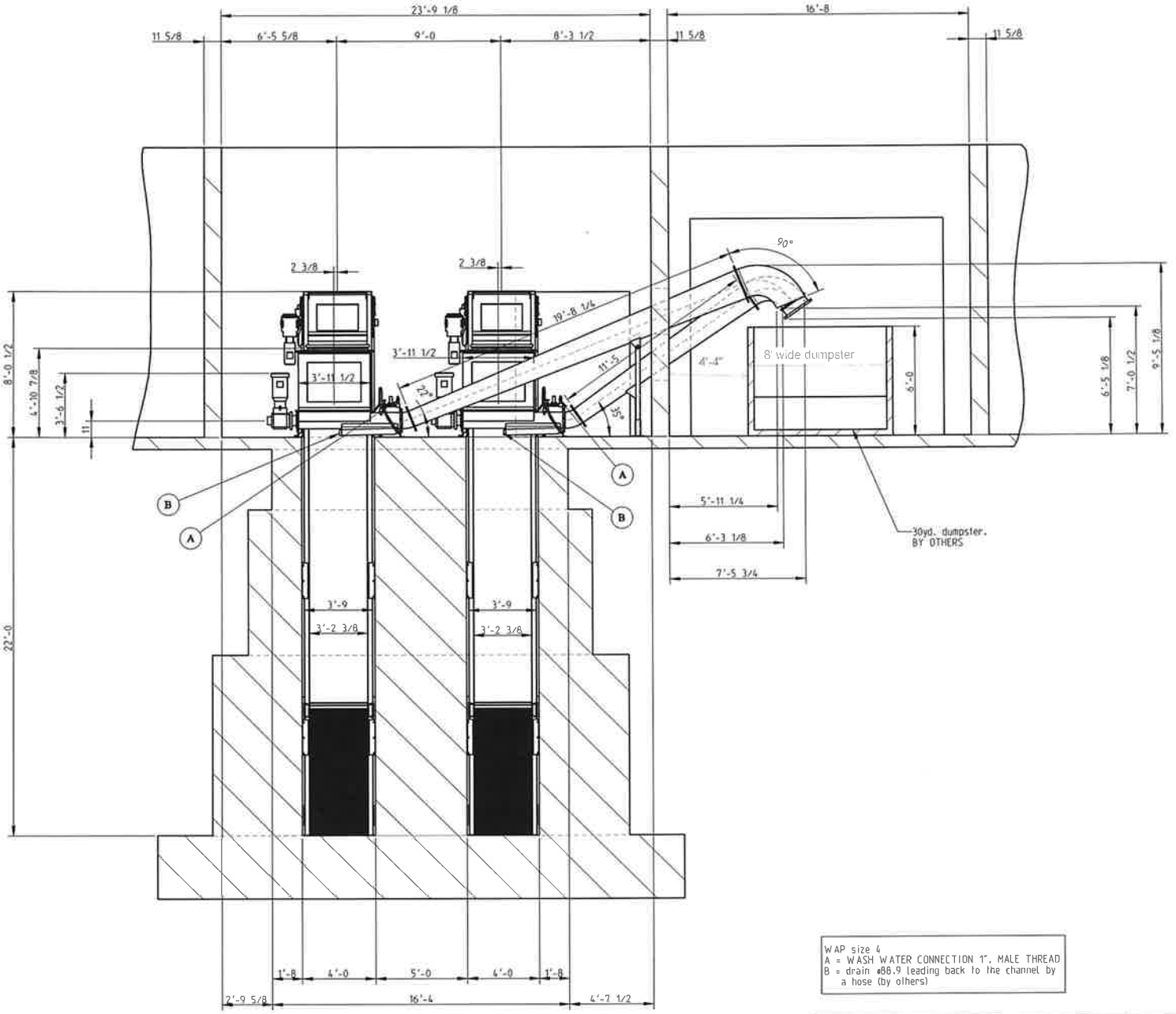
2x RakeMax® 8320x975/6 85°; 2x WAP 4

Scale:	Fig. No.:		Size:
1:48	3/6	Installation drawing	C

73002974 - Lexington,KY-EastHickman-RM

Drawing No.: 51182477

A-A



WAP size 4
A = WASH WATER CONNECTION 1", MALE THREAD
B = drain ø88.9 leading back to the channel by a hose (by others)

Weight (empty) appr.:

RakeMax	5450 Lbs
WAP	850 Lbs

WARNING:
Moving machine parts. Protection against accidental contact to be supplied by client according to country specific regulations.

Fall protection to be supplied by client (type of protection acc. to country specific regulations). (also valid for planned or existing covers of channel > 3' - 7 1/4'' height)

- material of construction = 304 stainless steel
- motor and solenoids = Class 1, Division 1

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WASTE WATER Solutions
9211-A Northcross Center Ct. Huntersville, NC

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Rev.	Modification	

Mechanical Wastewater Screening

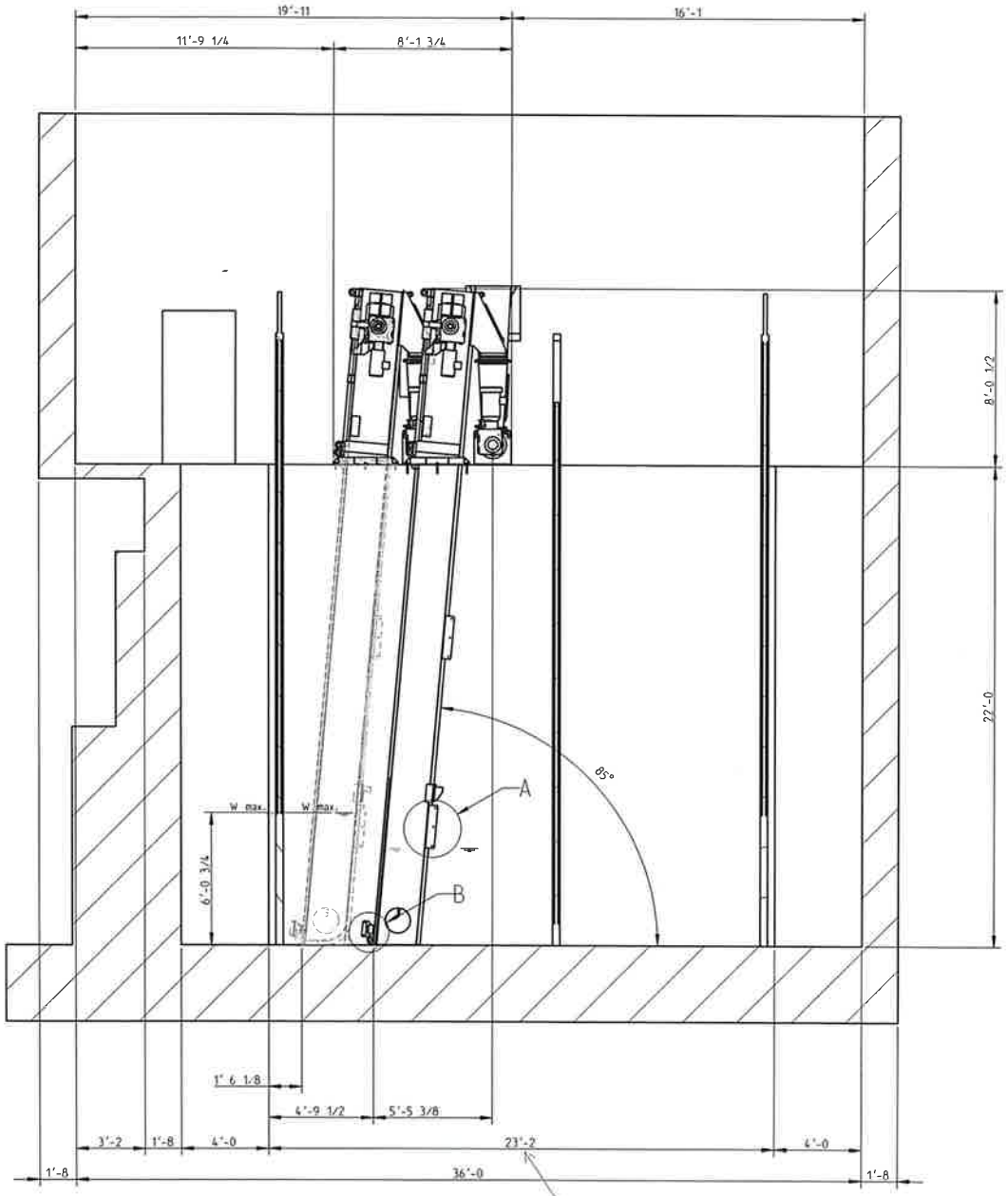
2x RakeMax® 8320x975/6 85°; 2x WAP 4

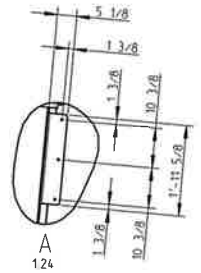
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73002974 - Lexington.KY-EastHickman-RM

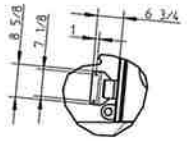
Drawing No.: 51182477

B-B





A
1:24



B
1:24

See Field Order No. 2 for distance between gates.

Engineer Please verify gate to gate dimension

Weight (empty) appr.:

RakeMax	5450 Lbs
WAP	850 Lbs

WARNING:
Moving machine parts. Protection against accidental contact to be supplied by client according to country specific regulations.

Fall protection to be supplied by client (type of protection acc. to country specific regulations). (also valid for planned or existing covers of channel > 3' - 7 1/4'' height)

- material of construction = 304 stainless steel
- motor and solenoids = Class 1, Division 1

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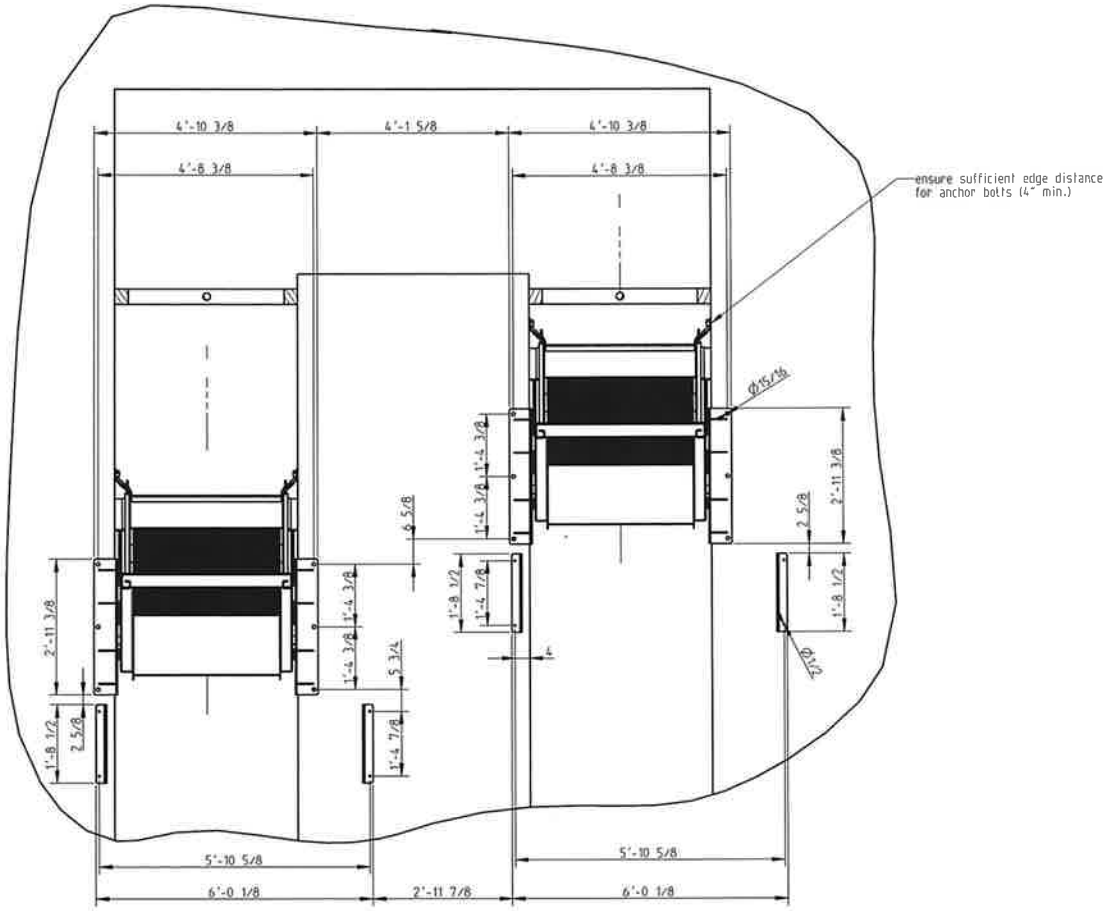
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a	bagger	
Rev.	Modification	

HUBER TECHNOLOGY
WASTE WATER Solutions
8725-A Northcross Center Ct. Huntersville, NC

Mechanical Wastewater Screening			
2x RakeMax® B320x975/6 85°; 2x WAP 4			
Scale: 1:48	Fig. No: 5/6	Installation drawing	Size: C
73002974 - Lexington.KY-EastHickman-RM			Drawing No: 51182477

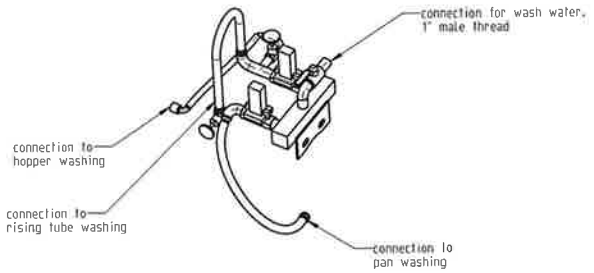
Detail: Drilling Points

1:24



Detail: Wash water distributer

1:12



Weight (empty) appr.:

RakeMax 5450 Lbs
WAP 850 Lbs

WARNING:
Moving machine parts. Protection against accidental contact to be supplied by client according to country specific regulations.

Fall protection to be supplied by client (type of protection acc. to country specific regulations). (also valid for planned or existing covers of channel > 3' - 7 1/4'' height)

- material of construction = 304 stainless steel
- motor and solenoids = Class 1, Division 1

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a	bagger	
Rev.	Modification	

Mechanical Wastewater Screening

2x RakeMax® 8320x975/6 85°; 2x WAP 4

Scale: 1:24 | Fig. No.: 6/6 | Installation drawing | Size: C

73002974 - Lexington,KY-EastHickman-RM | Drawing No.: 51182477

CONTRACT DOCUMENTS AND SPECIFICATIONS

FOR

East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2

Wastewater System Improvements
Division of Water Quality
Lexington Fayette Urban County Government

Remedial Measures Plan ID No. EH-02

Volume 2 of 2

LFUCG Bid No.65-2025

Date: May 2025

PREPARED BY:

Hazen and Sawyer
220 Lexington Green Circle, Suite 200
Lexington, KY 40503
859.219.1126

Edition: Conformance Documents

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APPENDICES

1 Existing Variable Frequency Drive Shop Drawings

SECTION 01010
SUMMARY OF WORK

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Work to be done under this Contract and in accordance with these Specifications consists of furnishing all equipment, supervision, labor, skill, material and all other items necessary for the construction of the East Hickman Pump Station Expansion and Rehabilitation Design – Phase 2 project as shown on the Contract Documents.

B. The Contractor shall perform all work required for such construction in accordance with the Contract Documents and subject to the terms and conditions of the Contract, complete and ready for use.

C. The principal features of the Work to be performed under this Contract includes, but is not limited to:

1. Demolition of existing dry weather pumps and appurtenances, mechanical screens, grating, gates, walls, dumpster room miscellaneous materials and equipment and select electrical equipment.

2. Installation of new dry weather pumps, channel grinders, grating, site work, access doors, and grinder hoist system, and wet well connection piping, valves, etc.

3. Maintenance of existing sanitary sewer flows, screening or grinder, and pumping throughout construction.

4. Maintaining a minimum pumping capacity of 2 dry weather pumps and one screen or grinder during construction.

5. Electrical and Control modifications including but not limited to updated pumping sequence to all dry weather and wet weather pumps within the dual wet wells. A flushing sequence of operations to fill the WWST partially with wastewater and then flush the length of the new 36-inch force main.

6. Other modifications and additions to floats and level controls related to the work above.

D. The foregoing description(s) shall not be construed as a complete description of all work required.

1.02 CONTRACT DOCUMENTS

A. Work to be done is shown on the set of Drawings entitled: East Hickman PS Expansion and Rehabilitation Design – Phase 2. The numbers and titles of all Drawings appear on the index sheet of the Drawings. All drawings so enumerated shall be considered an integral part of the Contract Documents as defined herein.

1.03 GENERAL ARRANGEMENT

A. Drawings indicate the extent and general arrangement of the work. If any departures from the Drawings are deemed necessary by the Contractor to accommodate the materials and equipment he proposes to furnish, details of such departures and reasons therefore shall be submitted as soon as practicable to the Engineer for approval. No such departures shall be made without the prior written approval of the Engineer. Approved changes shall be made without additional cost to the Owner for this work or related work under other Contracts of the Project.

B. The Engineer shall not provide direction to the Contractor prior to receiving approval from the Owner (LFUCG-DWQ).

1.04 CONSTRUCTION PERMITS, EASEMENTS AND ENCROACHMENTS

A. The Owner shall obtain or cause to be obtained all permanent and temporary construction easements as shown on the Drawings or required for completion of the Work. The Contractor shall verify that these easements have been obtained and shall comply with the conditions set forth in each easement.

B. The Contractor shall obtain, keep current and pay all fees for any necessary construction permits from those authorities, agencies, or municipalities having jurisdiction over land areas, utilities, or structures which are located within the Contract limits and which will be occupied, encountered, used, or temporarily interrupted by the Contractor's operations unless otherwise stated. Record copies of all permits shall be furnished to the Engineer.

C. When construction permits are accompanied by regulations or requirements issued by a particular authority, agency or municipality, it shall be the Contractor's responsibility to familiarize himself and comply with such regulations or requirements as they apply to his operations on this Project.

1.05 ADDITIONAL ENGINEERING SERVICES

A. In the event that the Engineer is required to provide additional engineering services as a result of substitution of materials or equipment by the Contractor which are not "or equal", or changes by the Contractor in dimension, weight, power requirements, etc., of the equipment and accessories furnished, or if the Engineer is required to examine and evaluate any changes proposed by the Contractor for the convenience of the Contractor, then the Engineer's charges in connection with such additional services shall be charged to the Contractor by the Owner.

B. In the event that the Engineer is required to provide additional engineering services as a result of Contractor's errors, omissions, or failure to conform to the requirements of the Contract Documents, or if the Engineer is required to examine and evaluate any changes proposed by the Contractor solely for the convenience of the Contractor, then the Engineer's charges in connection with such additional services shall be charged to the Contractor by the Owner.

1.06 ADDITIONAL OWNER'S EXPENSES

A. In the event the Work of this Contract is not completed within the time set forth in the Contract or within the time to which such completion may have been extended in accordance with the Contract Documents, the additional engineering or inspection charges incurred by the Owner may be charged to the Contractor and deducted from the monies due him. Extra work or supplemental Contract work added to the original Contract, as well as extenuating circumstances beyond the control of the Contractor, will be given due consideration by the Owner before assessing engineering and inspection charges against the Contractor.

B. Unless otherwise specifically permitted, the normal time of work under this Contract is limited to 40 hours per week, Monday through Friday. Work beyond these hours will result in additional expense to the Owner. Any expenses and/or damages, including the cost of the Engineer's on site personnel, arising from the Contractor's operations beyond the hours and days specified above shall be borne by the Contractor.

C. Charges assessed to the Contractor for additional engineering and inspection costs will be determined based on actual hours charged to the job by the Engineer. Daily rates will depend on the number and classifications of employees involved, but in no case shall such charges exceed $500 per day for field personnel based on an eight hour workday. Additional charges will apply if multiple personnel are needed or if engineering time is required as part of the work outside the contract times.

D. Charges for additional Owner's expenses shall be in addition to any liquidated damages assessed in accordance with the Contract.

1.07 TIME OF WORK

A. The normal time of work for this Contract is limited to 40 hours per week and shall generally be between the hours of **7:00 a.m. and 6:00 p.m., Monday through Friday**. The Contractor may work beyond these hours or on weekends with written approval from the Owner provided that all costs incurred by the Owner for any additional engineering shall be borne by the Contractor. The Owner shall deduct the cost of additional engineering from monies due the Contractor.

B. If it shall become imperative to perform work outside of the normal working hours the Owner and Engineer shall be informed a reasonable time in advance of the beginning of such work. Temporary lighting and all other necessary facilities for performing and inspecting the work shall be provided and maintained by the Contractor.

1.08 SURVEYS AND LAYOUT

A. All work under this Contract shall be constructed in accordance with the lines and grades shown on the Drawings or as directed by the Engineer. Elevations of existing ground and appurtenances are believed to be reasonably correct but are not guaranteed to be absolute and therefore are presented only as an approximation. Any error or apparent discrepancy in the data shown or omissions of data required for accurately accomplishing the stake out survey shall be referred immediately to the Engineer for interpretation or correction.

B. All survey work for construction control purposes shall be made by the Contractor at his expense. The Contractor shall provide a Licensed Surveyor as Chief of Party, competently qualified survey party, all necessary instruments, stakes, and other material to perform the work.

C. Contractor shall establish all baselines for the location of the principal component parts of the work together with a suitable number of benchmarks adjacent to the work. Based upon the information provided by the Contract Drawings, the Contractor shall develop and make all detail surveys necessary for construction, including stakes for all working points, lines and elevations.

D. Contractor shall have the responsibility to carefully preserve the bench marks, reference points and stakes, and in the case of destruction thereof by the Contractor or resulting from his negligence, the Contractor shall be charged with the expense and damage resulting therefrom and shall be responsible for any mistakes that may be caused by the unnecessary loss or disturbance of such bench marks, reference points and stakes.

E. Existing or new control points, property markers and monuments that will be or are destroyed during the normal causes of construction shall be reestablished by the Contractor and all reference ties recorded therefore shall be furnished to the Engineer. All computations necessary to establish the exact position of the work shall be made and preserved by the Contractor.

F. The Engineer may check all or any portion of the work and the Contractor shall afford all necessary assistance to the Engineer in carrying out such checks. Any necessary corrections to the work shall be immediately made by the Contractor. Such checking by the Engineer shall not relieve the Contractor of any responsibilities for the accuracy or completeness of his work.

G. At completion of the work, the Contractor shall furnish Record Drawings indicating the final layout of all constructed piping and manholes and finished grades constructed or changed as part of this work.

1.09 FIRE PROTECTION

A. Contractor shall take all necessary precautions to prevent fires at or adjacent to the work and shall provide adequate facilities for extinguishing fires which do occur. Burning shall not be permitted on site.

B. When fire or explosion hazards are created in the vicinity of the work as a result of the locations of fuel tanks or similar hazardous utilities or devices, the Contractor shall immediately alert the local Fire Marshal, the Engineer, and the Owner of such tank or device. The Contractor shall exercise all safety precautions and shall comply with all instructions issued by the Fire Marshal and shall cooperate with the Owner of the tank or device to prevent the occurrence of fire or explosion.

1.10 CHEMICALS

A. All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, or reactant of other classification, must show approval of either the EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with all applicable rules and regulations.

1.11 FIRST AID FACILITIES AND ACCIDENTS

A. First Aid Facilities

1. The Contractor shall provide at the site such equipment and facilities as are necessary to supply first aid to any of his personnel who may be injured in connection with the work.

B. Accidents

1. The Contractor shall promptly report, in writing, to the Engineer and Owner all accidents whatsoever out of, or in connection with, the performance of the work, whether on or adjacent to the site, which cause death, personal injury or property damage, giving full details and statements of witnesses.

2. If death, serious injuries, or serious damages are caused, the accident shall be reported immediately by telephone or messenger to both the Owner and the Engineer.

3. If any claim is made by anyone against the Contractor or a Subcontractor on account of any accidents, the Contractor shall promptly report the facts, in writing, to the Engineer and Owner, giving full details of the claim.

1.12 ULTIMATE DISPOSITION OF CLAIMS BY ONE CONTRACTOR ARISING FROM ALLEGED DAMAGE BY ANOTHER CONTRACTOR

A. During the progress of the Work, other Contractors may be engaged in performing other work or may be awarded other Contracts for additional work on this project. In that

event, the Contractor shall coordinate the work to be done hereunder with the work of such other Contractors and the Contractor shall fully cooperate with such other Contractors and carefully fit its own work to that provided under other Contracts as may be directed by the Engineer. The Contractor shall not commit or permit any act which will interfere with the performance of work by any other Contractor.

B. If the Engineer shall determine that the Contractor is failing to coordinate his work with the work of the other Contractors as the Engineer directed, then the Owner shall have the right to withhold any payments otherwise due hereunder until the Contractor completely complies with the Engineer's directions.

C. If the Contractor notifies the Engineer in writing that another Contractor is failing to coordinate his work with the work of this Contract as directed, the Engineer will promptly investigate the charge. If the Engineer finds it to be true, he will promptly issue such directions to the other Contractor with respect thereto as the situation may require. The Owner, the Engineer, nor any of their agents shall not, however, be liable for any damages suffered by the Contractor by reason of the other Contractor's failure to promptly comply with the directions so issued by the Engineer, or by reason of another Contractor's default in performance, it being understood that the Owner does not guarantee the responsibility or continued efficiency of any Contractor.

D. The Contractor shall indemnify and hold the Owner and the Engineer harmless from any and all claims of judgments for damages and from costs and expenses to which the Owner may be subjected or which it may suffer or incur by reason of the Contractor's failure to promptly comply with the Engineer's directions.

E. Should the Contractor sustain any damage through any act or omission of any other Contractor having a Contract with the Owner for the performance of work upon the site or of work which may be necessary to be performed for the proper execution of the work to be performed hereunder, or through any act or omission of a Subcontractor of such Contract, the Contractor shall have no claim against the Owner or the Engineer for such damage, but shall have a right to recover such damage from the other Contractor under the provision similar to the following provisions which have been or will be inserted in the Contracts with such other Contractors.

F. Should any other Contractor having or who shall hereafter have a Contract with the Owner for the performance of work upon the site sustain any damage through any act or omission of the Contractor hereunder or through any act or omission of any Subcontractor of the Contractor, the Contractor agrees to reimburse such other Contractor for all such damages and to defend at his own expense any suit based upon such claim and if any judgment or claims against the Owner shall be allowed, the Contractor shall pay or satisfy such judgment or claim and pay all costs and expenses in connection therewith and shall indemnify and hold the Owner harmless from all such claims.

G. The Owner's right to indemnification hereunder shall in no way be diminished, waived or discharged, by its recourse to assessment of liquidated damages as provided in the

Contract, or by the exercise of any other remedy provided for by Contract Documents or by law.

1.13 BLASTING AND EXPLOSIVES

A. No blasting allowed on the project.

1.14 LIMITS OF WORK AREA

A. The Contractor shall confine his construction operations within the Contract limits shown on the Drawings and/or property lines and/or fence lines of the pump station. Storage of equipment and materials, or erection and use of sheds outside of the Contract limits, if such areas are the property of the Owner, shall be used only with the Owner's approval. Such storage or temporary structures, even within the Contract's limits, shall not be placed on properties designated as easements or rights-of-way unless specifically permitted elsewhere in the Contract Documents.

B. The Contractor shall secure, insure, maintain, rent/lease, and restore staging area.

C. The Contractor shall provide Engineer and Owner copy of agreement with landowner of staging areas.

1.15 WEATHER CONDITIONS

A. The Contractor shall take necessary precautions (in the event of impending storms) to protect all work, materials, or equipment from damage or deterioration due to floods, driving rain, or wind, and snow storms. The Owner reserves the right, through the opinion of the Engineer, to order that additional protection measures over and beyond those proposed by the Contractor, be taken to safeguard all components of the Project. The Contractor shall not claim any compensation for such precautionary measures so ordered, nor claim any compensation from the Owner for damage to the work from weather elements.

1.16 PERIODIC CLEANUP: BASIC SITE RESTORATION

A. During construction, the Contractor shall regularly remove from the site of the work all accumulated debris and surplus materials of any kind which result from his operations. Unused equipment and tools shall be stored at the Contractor's staging area for the Project.

B. As the work involves installation of sewers, drains, manholes, underground structures, or other disturbance of existing features in or across streets, rights-of-way, easements, or private property, the Contractor shall (as the work progresses) promptly backfill, compact, grade, and otherwise restore the disturbed area to the basic condition which will permit resumption of pedestrian or vehicular traffic and any other critical activity or functions consistent with the original use of the land. The requirements for temporary paving of streets, walks, and driveways are specified elsewhere. Unsightly mounds of

earth, large stones, boulders, and debris shall be removed so that the site presents a neat appearance.

C. The Contractor shall perform the cleanup work on a regular basis and as frequently as ordered by the Engineer. Basic site restoration in a particular area shall be accomplished immediately following the installation or completion of the required facilities in that area. Furthermore, such work shall also be accomplished, when ordered by the Engineer, if partially completed facilities must remain incomplete for some time period due to unforeseen circumstances.

D. Upon failure of the Contractor to perform periodic cleanup and basic restoration of the site to the Engineer's satisfaction, the Owner may, upon five (5) days prior written notice to the Contractor, without prejudice to any other rights or remedies of the Owner, cause such work for which the Contractor is responsible to be accomplished to the extent deemed necessary by the Engineer, and all costs resulting therefrom shall be charged to the Contractor and deducted from the amounts of money that may be due him.

1.17 USE OF FACILITIES BEFORE COMPLETION

A. The Owner reserves the right to enter the site and use any portion of the constructed facilities before final completion of the whole work to be done under this Contract. However, only those portions of the facilities which have been completed to the Engineer's satisfaction, as evidenced by his issuing a Certificate of Substantial Completion covering that part of the work, shall be placed in service.

B. It shall be the Owner's responsibility to prevent premature connections to or use of any portion of the installed facilities by private or public parties, persons or groups of persons, before the Engineer issues his Certificate of Substantial Completion covering that portion of the work to be placed in service.

C. Consistent with the approved progress schedule, the Contractor shall cooperate with the Owner, his agents, and the Engineer to accelerate completion of those facilities, or portions thereof, which have been designated for early use by the Owner.

1.18 CONSTRUCTION VIDEO

A. The Contractor shall video and take site photos the entire project site, building, and interior of pump station prior to the start of construction and provide the video to the Owner and Engineer.

PART 2 – PART 2 – PRODUCT (NOT USED)

PART 3 – PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01025
MEASUREMENT AND PAYMENT

PART 1 – GENERAL

1.01 WORK INCLUDED

A. The Contractor shall furnish all necessary labor, machinery, tools, apparatus, equipment, materials, equipment, service, other necessary supplies and perform all work including all excavation and backfilling (without additional compensation, except where specifically set out in these specifications) at the contract unit prices bid for the work described in Part 2 of this Section.

1.02 PROGRESS AND PAYMENTS SCHEDULES

A. Within fifteen (15) days after the date of formal execution of the Agreement (Contract), the Contractor shall prepare and submit to the Engineer, for approval, a construction schedule of the Critical Path Method (CPM) type which depicts the Contractor's plan for completing the contract requirements and show work placement in dollars versus contract time. The Contractor's construction schedule must be approved by the Engineer before any payments shall be made on this contract.

B. Within fifteen (15) days after the date of formal execution of the Agreement (Contract), the Contractor shall prepare and submit to the Engineer, for approval, a periodic estimate which depicts the Contractor's cost for completing the contract requirements and show by major unit of the project work, the Contractor's dollar value for the material and the labor (two separate amounts) to be used as a basis for the periodic payments. The Contractor's periodic estimate must be approved by the Engineer before any payments shall be made on this contract.

C. The Engineer's decision as to sufficiency and completeness of the Contractor's construction schedule and periodic estimate shall be final.

D. The Contractor must make current, to the satisfaction of the Engineer, the construction schedule and periodic estimate each time the Contractor requests a payment on this contract.

E. The Contractor's construction schedule and periodic estimate must be maintained at the construction site available for inspection and shall be revised to incorporate approved change orders as they occur.

F. When the Contractor requests a payment on this contract, it must be on the approved periodic estimate and be current. Further, the current periodic estimate and construction schedule (both updated and revised) shall be submitted for review and approval by the Engineer before monthly payments shall be made by the Owner. The Contractor shall submit as stored materials for pay purposes provided proper documentation is provided.

1. Documentation for stored materials includes at a minimum, an approved Shop Drawing, materials to be on site, etc. See Specification Section 00800-14.02.A.5 for additional information.

G. Refer to Section 00800, Articles 14.02.A.6-8 for retainage requirements.

1.03 CLAIMS FOR EXTRA WORK

A. If the Contractor claims that any instructions by Drawings or otherwise involve extra cost, the Contractor shall give the Engineer written notice of said claim within seven (7) days after the receipt of such instructions, and in any event before proceeding to execute the work, stating clearly and in detail the basis of its claim or claims. No such claim shall be valid unless so made.

B. Claims for additional compensation for extra work, due to alleged errors in spot elevations, contour lines, or benchmarks, shall not be recognized unless accompanied by certified survey data, made prior to the time the original ground was disturbed, clearly showing that errors exist which resulted, or would result, in handling more material, or performing more work than would reasonably be estimated from the Drawings and topographical maps issued.

C. Any discrepancies which may be discovered between actual conditions and those represented by the topographical maps and Drawings shall at once be reported to the Engineer, and work shall not proceed, except at the Contractor's risk, until written instructions have been received by the Contractor from the Engineer.

D. If, on the basis of the available evidence, the Engineer determines that an adjustment of the Contract Price or time is justifiable, the procedure shall then be as provided herein for "Changes in the Work".

E. By execution of this Contract, the Contractor warrants that it has visited the site of the proposed work and fully acquainted himself with the conditions there existing relating to construction and labor, and that it fully understands the facilities, difficulties, and restrictions attending the execution of the work under this Contract. The Contractor further warrants that it has thoroughly examined and is familiar with the Drawings, Specifications and all other documents comprising the Contract. The Contractor further warrants that by execution of this Contract its failure when it was bidding on this Contract to receive or examine any form, instrument or document, or to visit the site and acquaint himself with conditions there existing, in no way relieves the Contractor from any obligation under the Contract, and the Contractor agrees that the Owner shall be justified in rejecting any claim based on facts regarding which it should have been on notice as a result thereof.

1.04 DETERMINATION OF THE VALUE OF EXTRA (ADDITIONAL) OR OMITTED WORK

A. The value of extra (additional) or omitted work shall be determined in one or more of the following ways:

1. On the basis of the actual cost of all the items of labor (including on-the-job supervision), materials, and use of equipment, plus a maximum 15 percent for added work or a minimum 15 percent for deleted work which shall cover the Contractor's general supervision, overhead and profit.

    a. Labor may include on-site supervision, on-site project management, in addition to field personal associated with the work.

    b. In case of subcontracts, the 15 percent (maximum for added work and minimum for deleted work) is interpreted to mean the subcontractor's supervision, overhead and profit, and an additional 5 percent (maximum for added work and minimum for deleted work) may then be added to such costs to cover the General Contractor's supervision, overhead and profit.

    c. The cost of labor shall include required insurance, taxes and fringe benefits.

    d. Equipment costs shall be based on current rental rates in Lexington, KY.

2. By estimate and acceptance in a lump sum.

3. By unit prices named in the Contract or subsequently agreed upon.

B. Provided, however, that the cost or estimated cost of all extra (additional) work shall be determined in advance of authorization by the Engineer and approved by the Owner.

C. All extra (additional) work shall be executed under the conditions of the original Contract. Any claim for extension of time shall be adjusted according to the proportionate increase or decrease in the final total cost of the work unless negotiated on another basis.

D. Except for over-runs in contract unit price items, no extra (additional) work shall be done except upon a written Change Order from the Engineer, and no claim on the part of the Contractor for pay for extra (additional) work shall be recognized unless so ordered in writing by the Engineer.

PART 2 – PRODUCTS

2.01 MOBILIZATION

A. Payment for the Contractor's mobilization shall be made at the Contract lump sum price and shall include all costs incurred for moving equipment onto the project area, staging, security fencing, and any pertinent costs related thereto, for the duration of the contract term. Mobilization unit price shall not exceed two percent (2%) of the total Bid Amount.

2.02 BONDS AND INSURANCE

A. Payment for bonds and insurance shall be made at the Contract lump sum price and shall include the costs of all bonds provided under the Contract, and the premiums for

insurance required under the Contract, for the duration of the contract term. Unit price shall be based on actual invoices and payment shall be made upon receipt of invoices attached to a monthly progress payment request.

2.03 GENERAL REQUIREMENTS

A. Payment for general requirements shall be made at the Contract lump sum price and shall include field supervision and support staff, office supervision and support staff, costs associated with maintaining the field operation, and other items required by the general requirements and conditions of the Contract. Payment for General Requirements shall be made on an equal distribution across the Contract term on a monthly basis.

2.04 DEMOBILIZATION

A. Payment for the Contractor's demobilization upon completion of the project shall be made at the Contract lump sum price and shall include all costs incurred for removing equipment and materials from the project area and any pertinent costs related thereto, for the duration of the Contract term. Demobilization unit price shall not exceed one percent (1%) of the total Bid Amount.

2.05 EROSION AND SEDIMENT CONTROL AND CONFORMANCE WITH SWPPP

A. Payment is for furnishing, installing, maintaining and removing erosion and sediment control devices. This is to be paid at the contract lump sum price, complete in place, which shall include compensation for materials, placing, cleaning, and maintaining the sediment and erosion control devices throughout the construction period and removal of the of the sediment and erosion control devices once vegetation is established. Payment shall be distributed as follows: 25% when all ESC measures are in place and operating correctly; 50% equally distributed across the Contract term; and 25% for the removal of the ESC measures and final stabilization/restoration.

2.06 EAST HICKMAN PUMP STATION PHASE 2 MODIFICATIONS

A. Payment for furnishing, modifying, and installing the East Hickman Pump Station (EHPS) will be made at the contract lump sum price to the contractor for demolition of the existing four (4) dry weather pumps, bases, rails, cables, etc., demolition of the two mechanical bar screens, mounts, rails, cables, electrical conduit as needed, grating, and gates as shown on the Contract Drawings, removal of all associated electrical equipment required for the pump, screen, and grinder replacement as shown on the Drawings and demolition of all required items within the dumpster room as noted for a proper installation, including the iron plates on the floor, common wall for proposed work, installation of four new submersible pump packages, bases, piping, fittings, paint, grout, rails, isolation of the wet wells, pumping down and cleaning as needed for a property installation. This lump sum item also includes the installation of two new grinders, grinder hoist system, beam construction, excavation, shaft coring, installation, structural fill, rebar, structural plates, anchors, headers/lintels, concrete, new grating, testing, painting, wall modifications, and electrical. All electrical conduit, wiring, floats/level indicators, brackets, pressure gauges,

operations and controls associated with revised pumping operations, flushing operations, SCADA screen modification, and all other work described in the Contract Drawings. All electrical and instrumentation modifications to the existing flow meter. The excavation including shoring plans of the site and installation of the 30-inch wet well connector pipe, wall coring, wall pipes, plates, anchors, epoxy grout, fittings, valve(s) and cleanout, piping, box and cap, backfill, compaction and asphalt are included in this pay item. Other site improvements, including paved and non-paved site restoration, startup, training, etc. for complete operation and startup of the EHPS as shown on the Contract Drawings and in the Specifications.

PART 3 – EXECUTION

3.01 PAY ITEMS

A. The pay items listed hereinbefore refer to the items listed in the Bid Schedule and are the only pay items for this contract.

B. Any and all other items of work listed in the specifications or shown on the Contract Drawings for this contract shall be considered incidental to and included in the associated pay items.

END OF SECTION

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SECTION 01040
COORDINATION

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall allow the Owner or his agents, and other project Contractors or their agents, to enter upon the work for the purpose of constructing, operating, maintaining, removing, repairing, altering, or replacing such pipes, sewers, conduits, manholes, wires, poles, or other structures and appliances which may be required to be installed at or in the work. The Contractor shall cooperate with all aforesaid parties and shall allow reasonable provisions for the prosecution of any other work by the Owner, or others, to be done in connection with his work, or in connection with normal use of the facilities.

B. Each Contractor shall cooperate fully with the Owner, the Engineer, and all other Contractors employed on the Work, to effect proper coordination and progress to complete the project on schedule and in proper sequence. Insofar as possible, decisions of all kinds required from the Engineer shall be anticipated by the Contractor to provide ample time for inspection, or the preparation of instructions.

C. Each Contractor shall assume full responsibility for the correlation of all parts of his work with that of other Contractors. Each Contractor's superintendent shall correlate all work with other Contractors in the laying out of work. Each Contractor shall lay out his own work in accordance with the Drawings, Specifications, and instructions of latest issue and with due regard to the work of other Contractors.

D. Monthly general progress coordination meetings will be held at regularly scheduled times convenient for all parties involved. These meetings are in addition to specific meetings held for other purposes, such as special pre-installation meetings. Representation at each meeting by every part currently involved in coordination or planning for the work of the entire project is requested. Meetings shall be conducted in a manner that will resolve coordination problems. Results of the meetings shall be recorded and copies distributed to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.02 COORDINATION OF CRAFTS, TRADES, AND SUBCONTRACTORS

A. The Contractor shall coordinate the work of all crafts, trades and subcontractors engaged on the Work, and he shall have final responsibility as regards the schedule, workmanship and completeness of each and all parts of the work.

B. Each Subcontractor is expected to be familiar with the General requirements and all sections of the detailed Specifications for all other trades and to study all Drawings

applicable to his work to the end that complete coordination between trades will be affected. Consult the Engineer if conflicts exist on the Drawings.

C. Contractor's Superintendent, or his designee who is employed by Contractor, must be on site at all times when work is being performed, except for periods which will not exceed 1 hour.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01170
SPECIAL CONDITIONS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall review the Special Conditions listed herein associated with the project.

1.02 PROJECT FUNDING

A. This project is funded in part by a Kentucky Cleaner Water Program (CWP) grant fund in the amount of $2,780,000.

B. Please be aware that these CWP Grant Projects are provided through the American Rescue Plan Act of 2021, Coronavirus State Fiscal Recovery Fund and must be obligated by December 31, 2024 and fully expended by December 31, 2026. Any funds not obligated by December 31, 2024 or expended by December 31, 2026 will be forfeited and will not be available for this project.

C. For funds to be obligated by December 31, 2026 the final Application for Payment on the project must be fully executed and submitted to KIA-SRF no later than December 4, 2026.

1.03 MECHANICAL SCREENS AND OPEN CHANNEL GRINDERS

A. Each existing channel within the EHPS is designed for full flow to the pump station wet well. There are two channels in the pump station and grinder designed to be installed in each channel for 100% redundancy. The Owner may choose to operate the channel grinders in an A – B fashion by isolating a channel with the existing gates located on either side of each channel.

B. A hoist system is included in the Phase 2 project which allows the Owner to remove and replace either grinder as needed for inspection and or maintenance.

C. The Contractor shall always maintain the operation of either one existing mechanical bar screen or one proposed channel grinder throughout construction until both proposed grinders are in operation.

D. The operation of a grinder pump is continuous no matter the flow conditions.

PART 2 – PART 2 – PRODUCTS (NOT USED)

PART 3 – PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01200
PROJECT MEETINGS

PART 1 – GENERAL

1.01 PRECONSTRUCTION MEETING

A. A preconstruction meeting will be held after Award of Contract, but prior to starting work at the site. Contractor's Project Manager and Site Superintendent are required to attend, as are representatives of all major subcontractors. Progress schedule update shall be submitted in advance of each meeting.

1.02 PROGRESS MEETINGS

A. Progress meetings will be held monthly at the Division of Water Quality offices during the performance of the Work. Additional progress meetings may be called as progress of work dictates. Prior to each progress meeting, Contractor shall submit a progress report summarizing the work completed over the past month and providing a look ahead at the work to be done over the next month.

B. Minimum Agenda for meeting shall include:

1. Review and approve minutes of previous meetings.
2. Review progress of Work since last meeting.
3. Review proposed 30 day construction schedule.
4. Note and identify problems which impede planned progress.
5. Develop corrective measures and procedures to regain planned schedule.
6. Revise construction schedule as indicated and plan progress during next work period.
7. Maintaining of quality and work standards.
8. Complete other current business.
9. Schedule next progress meeting.

1.03 SPECIAL MEETINGS

A. Owner or Engineer may schedule special meetings at the site or at Division of Water Quality offices to resolve construction issues. Contractor and when appropriate, subcontractors, shall attend upon request. No additional compensation shall be paid for meeting attendance.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01300
SUBMITTALS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Progress Schedule

1. Within thirty (30) days after execution of the Agreement, but at least 20 days prior to submitting the first application for a progress payment, the Contractor shall prepare and submit three (3) copies of his proposed progress schedule to the Engineer for review and approval.

2. If so required, the schedule shall be revised until it is approved by the Engineer.

3. The schedule shall be updated monthly, depicting progress to the last day of the month and three (3) copies submitted to the Engineer not later than the fifth day of the month with the application for progress payment.

4. The schedule shall be prepared in the form of a horizontal bar chart showing in detail the proposed sequence of the work and identifying construction activities for each structure and for each portion of work.

5. The schedule shall be time scaled, identifying the first day of each week. The Schedule shall be provided with estimated dates for Early Start, Early Finish, Late Start and Late Finish as applicable. The work shall be scheduled to complete the Project within the Contract time. The Late Finish date shall equal the Contract Completion Date.

6. The schedule shall show duration (number of days) and float for each activity. Float shall be defined as the measure of leeway in starting or completing a scheduled activity without adversely affecting the project completion date established by the Contract Documents.

7. The updated schedule shall show all changes since the previous submittal.

8. All revisions to the schedule must have the prior approval of the Engineer.

B. Equipment and Material Orders Schedule

1. Contractor shall prepare and submit three (3) copies of his schedule of principal items of equipment and materials to be purchased to the Engineer for review and approval.

2. If so required, the schedule shall be revised until it is approved by the Engineer.

3. The schedule shall be updated monthly and three (3) copies submitted to the Engineer not later than the fifth day of every month with the application for progress payment.

4. The updated schedule shall be based on the Progress Schedule developed under the requirements of Paragraph 1.01(A) of this Section.

5. The schedule shall be in tabular form with appropriate spaces to insert the following information for principal items of equipment and materials:

    a. Dates on which Shop Drawings are requested and received from the manufacturer.

    b. Dates on which certification is received from the manufacturer and transmitted to the Engineer.

    c. Dates on which Shop Drawings are submitted to the Engineer and returned by the Engineer for revision.

    d. Dates on which Shop Drawings are revised by manufacturer and resubmitted to the Engineer.

    e. Date on which Shop Drawings are returned by Engineer annotated either "Furnish as Submitted" or "Furnish as Corrected".

    f. Date on which accepted Shop Drawings are transmitted to manufacturer.

    g. Date of manufacturer's scheduled delivery.

    h. Date on which delivery is actually made.

C. Working Drawings

1. Within thirty (30) days after the Notice to Proceed, each prime Contractor shall prepare and submit three (3) copies of his preliminary schedule of Working Drawing submittals to the Engineer for review and approval. If so required, the schedule shall be revised until it is approved by the Engineer.

2. Working Drawings include, but are not limited to, Shop Drawings, layout drawings in plan and elevation, installation drawings, etc. Contractor shall be responsible for securing all of the information, details, dimensions, Drawings, etc., necessary to prepare the Working Drawings required and necessary under this Contract and to fulfill all other requirements of his Contract. Contractor shall secure such information, details, Drawings, etc., from all possible sources including the Drawings, Working Drawings prepared by subcontractors, Engineers, suppliers, etc.

3. In the event that the Engineer is required to provide additional engineering services as a result of a substitution of materials or equipment by the Contractor, the additional services will be provided in accordance with Section 01010 - Summary of Work, and will be covered in supplementary or revised Drawings which will be issued to the Contractor. All changes indicated that are necessary to accommodate the equipment and appurtenances shall be incorporated into the Working Drawings submitted to the Engineer.

4. Shop Drawings

   a. Contractor shall submit for review by the Engineer Shop Drawings for all fabricated work and for all manufactured items required to be furnished by the Contract Documents. This project will utilize the Procore electronic method of submittals and examples of the format and procedures are included in the specifications.

   b. Structural and all other layout Drawings prepared specifically for the Project shall have a plan scale of not less than 1/4-inch = 1 foot.

   c. The submitted documents shall provide information indicating that the materials are in conformance with the Technical Specifications and Contract Documents.

   d. Where manufacturer's publications in the form of catalogs, brochures, illustrations or other data sheets are submitted in lieu of prepared Shop Drawings, such submittals shall specifically indicate the item for which approval is requested. Identification of items shall be made in ink, and submittals showing only general information are not acceptable.

5. Contractor Responsibilities

   a. All submittals from subcontractors, manufacturers or suppliers shall be sent directly to the Contractor for checking. Contractor shall thoroughly check all Drawings for accuracy and conformance to the intent of the Contract Documents. Drawings found to be inaccurate or otherwise in error shall be returned to the subcontractors, manufacturers, or suppliers by the Contractor for correction before submitting them to the Engineer.

   b. All submittals shall be bound, dated, properly labeled and consecutively numbered. Information on the label shall indicate Specification Section, Drawing number, subcontractors', manufacturer's or supplier's name and the name or type of item the submittal covers. Each part of a submittal shall be marked and tabulated.

   c. Working Drawings shall be submitted as a single complete package including all associated drawings relating to a complete assembly of the various parts necessary for a complete unit or system.

d. Shop Drawings shall be submitted as a single complete package for any operating system and shall include all items of equipment and any mechanical units involved or necessary for the functioning of such system.

e. ALL SUBMITTALS SHALL BE THOROUGHLY CHECKED BY THE CONTRACTOR FOR ACCURACY AND CONFORMANCE TO THE INTENT OF THE CONTRACT DOCUMENTS BEFORE BEING SUBMITTED TO THE ENGINEER AND SHALL BEAR THE CONTRACTOR'S STAMP OF APPROVAL CERTIFYING THAT THEY HAVE BEEN SO CHECKED. SUBMITTALS WITHOUT THE CONTRACTOR'S STAMP OF APPROVAL WILL NOT BE REVIEWED BY THE ENGINEER AND WILL BE RETURNED TO THE CONTRACTOR. Any comments added to the drawings by the Contractor shall be done in green ink so as to denote any Contractor notes.

f. If the submittals contain any departures from the Contract Documents, specific mention thereof shall be made in the Contractor's letter of transmittal. Otherwise, the review of such submittals shall not constitute approval of the departure.

g. No materials shall be ordered, fabricated or shipped or any work performed until the Engineer returns to the Contractor the submittals, herein required, annotated either "Furnish as Submitted" or "Furnish as Corrected".

h. Where errors, deviations, and/or omissions are discovered at a later date in any of the submittals, the Engineer's prior review of the submittals does not relieve the Contractor of the responsibility for correcting all errors, deviations, and/or omissions.

6. Procedure for Review

a. Submittals shall be transmitted in sufficient time to allow the Engineer at least thirty (30) working days for review and processing.

b. Electronic Submittals

1) If the electronic method of submittals is agreed to by Contractor, Engineer, and Owner, the format and procedures will be determined and implemented prior to any submittal.

2) Submittals will be processed through “Procore” software. Each item of the submittal documents shall be in .pdf format and shall be oriented so they are read from upper left corner to lower right corner, with no rotation of said document being required after receiving it. The .pdf file shall be named so that it describes the item being submitted.

3) All other requirements herein are part of the electronic submittal process with the exception of the duplicate copies. Contractor stamp

indicating review and any comments or notes must be on the .pdf submittal.

c. Submittal shall be accompanied by a letter of transmittal, in duplicate, containing date, project title, Contractor's name, number and titles of submittals, notification of departures and any other pertinent data to facilitate review.

d. Submittals will be annotated by the Engineer in one of the following ways:
"Furnish as Submitted" - no exceptions are taken.

"Furnish as Corrected" - minor corrections are noted and shall be made.

"Furnish as Corrected - Confirm" - minor corrections are noted and shall be made and a resubmittal is required for a specific item noted in the submittal.

"Revise and Resubmit" - major corrections are noted and a resubmittal is required.

"Rejected" - Based on the information submitted, the submission is not in conformance with the Contract Documents. The deviations from the Contract Documents are too numerous to list and a completely revised submission of the proposed equipment or a submission of other equipment is required.

e. If a submittal is satisfactory to the Engineer, the Engineer will annotate the submittal "Furnish as Submitted" or "Furnish as Corrected", retain four (4) copies and return remaining copies to the Contractor.

f. If a resubmittal is required, the Engineer will annotate the submittal "Revise and Resubmit" and transmit five (5) copies to the Contractor for appropriate action.

g. Contractor shall revise and resubmit submittals as required by the Engineer until submittals are acceptable to the Engineer. It is understood by the Contractor that Owner may charge the Contractor the Engineer's charges for review in the event a submittal is not approved (either "Furnish as Submitted" or "Furnish as Corrected") by the third submittal for a system or piece of equipment. These charges shall be for all costs associated with engineering review, meetings with the Contractor or manufacturer, etc., commencing with the fourth submittal of a system or type of equipment submitted for a particular Specification Section.

h. Acceptance of a Working Drawing by the Engineer will constitute acceptance of the subject matter for which the Drawing was submitted and not for any other structure, material, equipment or appurtenances indicated or shown.

7. Engineer's Review

a. Engineer's review of the Contractor's submittals shall in no way relieve the Contractor of any of his responsibilities under the Contract. An acceptance of a submittal shall be interpreted to mean that the Engineer has no specific objections to the submitted material, subject to conformance with the Contract Drawings and Specifications. The Engineer will denote any notes in red ink so as to record his comments.

b. Engineer's review will be confined to general arrangement and compliance with the Contract Drawings and Specifications only, and will not be for the purpose of checking dimensions, weights, clearances, fittings, tolerances, interferences, coordination of trades, etc.

8. Record Working Drawings

a. Prior to final payment, the Contractor shall furnish the Engineer one complete set of all accepted Working Drawings, including Shop Drawings, for equipment, piping, electrical work, heating system, ventilating system, air conditioning system, instrumentation system, plumbing system, structural, interconnection wiring diagrams, etc.

b. Manufacturer's publications, submitted in lieu of prepared Shop Drawings, will not be required in reproducible form. However, three (3) sets of such material shall be furnished by the Contractor to the Engineer.

c. Working Drawings furnished shall be corrected to include any departures from previously accepted Drawings.

D. Construction Photographs

1. The General Contractor shall take photographs at the locations and at such stages of the construction as directed by the Engineer. Digital format shall be used. Provide all pictures for a given period on a CD or DVD.

2. Provide the equivalent of 36 different exposures per month for the duration of the Contract time. When directed by the Engineer, frequency of photographs may be increased to weekly sessions provided that the equivalent number of exposures is not exceeded. Engineer may waive requirements for photographs during inactive construction periods in favor of increased photographs during active construction sequences.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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Hazen Hazen and Sawyer

Hazen's Procore Guidelines for Contractors

July, 2017

1. Invitation To Project From Hazen:

1.1. After the pre-construction meeting has been held, Hazen will invite the contractor's project team to Procore. Please provide contact information using the table below for 1) your company and 2) users you wish to add from your company.

Company Information	
Company Name:	
Address:	
City:	
State:	
Zip:	
Business Phone:	
Fax:	

User Information							
First Name	Last Name	Email Address	Address (If different from Company Address)	Business Phone	Cell Phone	Job Title	Folder Tracking For Submittals? (See 2.6)

1.2. Once Hazen has received a Contractor's company and user information, an invitation will be sent to each user. Procore will send two emails: One email invites the user to join Procore, provides a link to set-up an account password, and offers links to download Procore's mobile apps. The second email informs the user that they have been added to a project and provides a link to access the project page in Procore.

1.2.1. Procore invitation email:

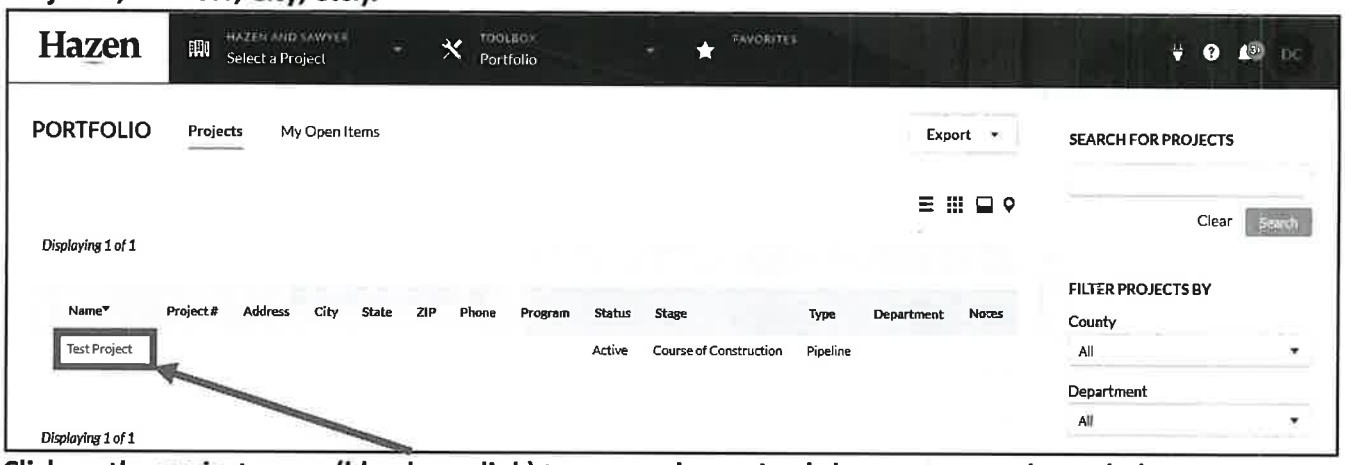


1.2.2. Added to Project email:

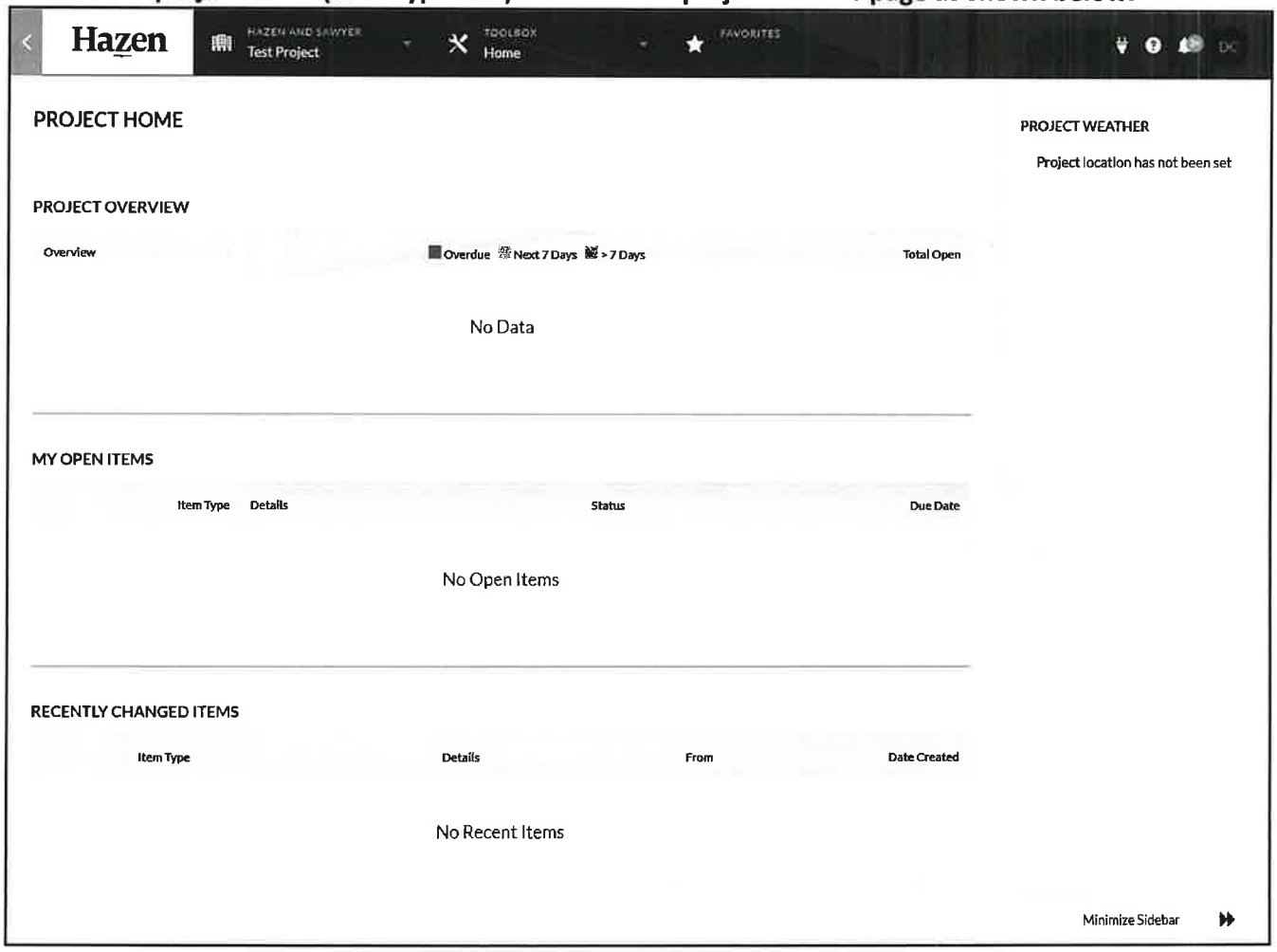


2. Submittal Upload/Response

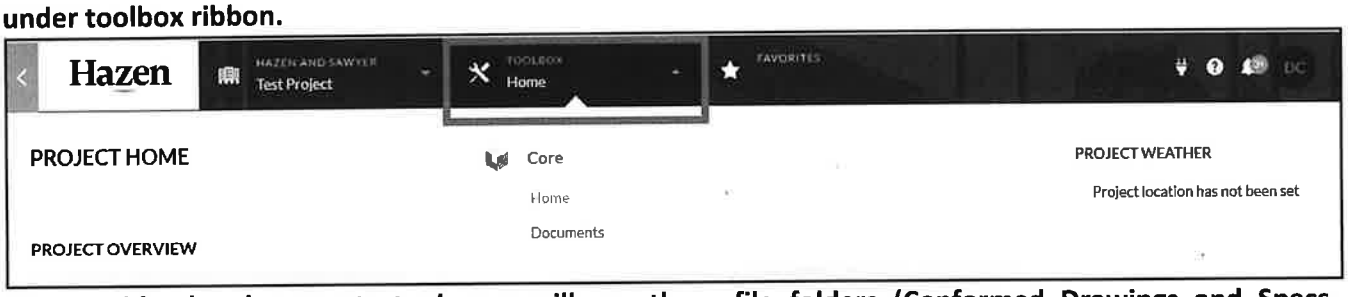
2.1. After you have setup your account/password. Go to procore.com. Your login will be the email you provided Hazen. Enter your password created in step 1.2.1. Once logged in, you will be directed to the main "Portfolio" screen as shown below. In this view you will see the main project information (Hazen Project #, Address, City, etc.).



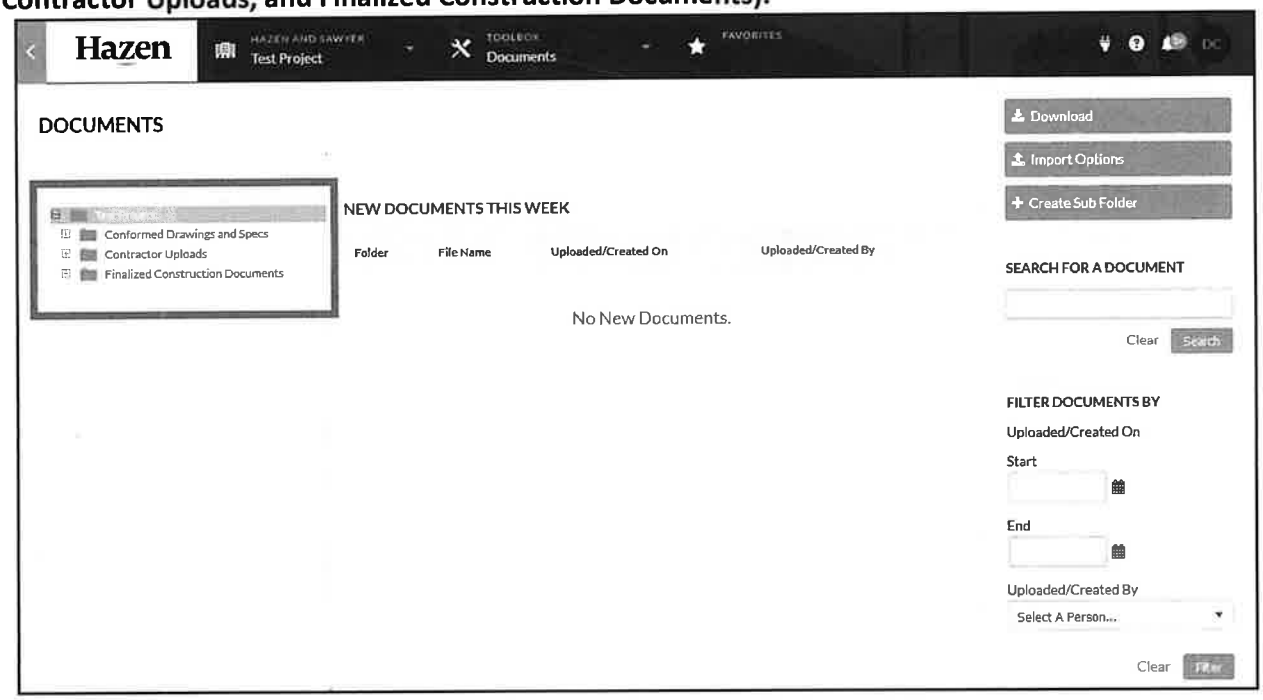
2.2. Click on the project name (blue hyperlink) to access the project's home page as shown below.



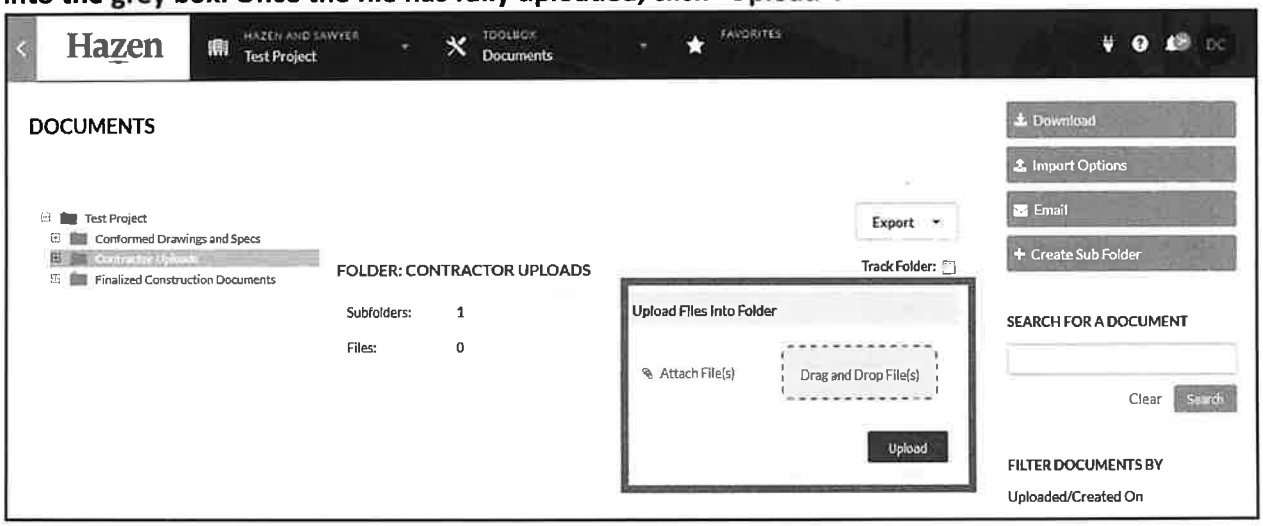
2.3. To upload a submittal for Hazen's review, go to the "Documents" tool by clicking the dropdown arrow under toolbox ribbon.



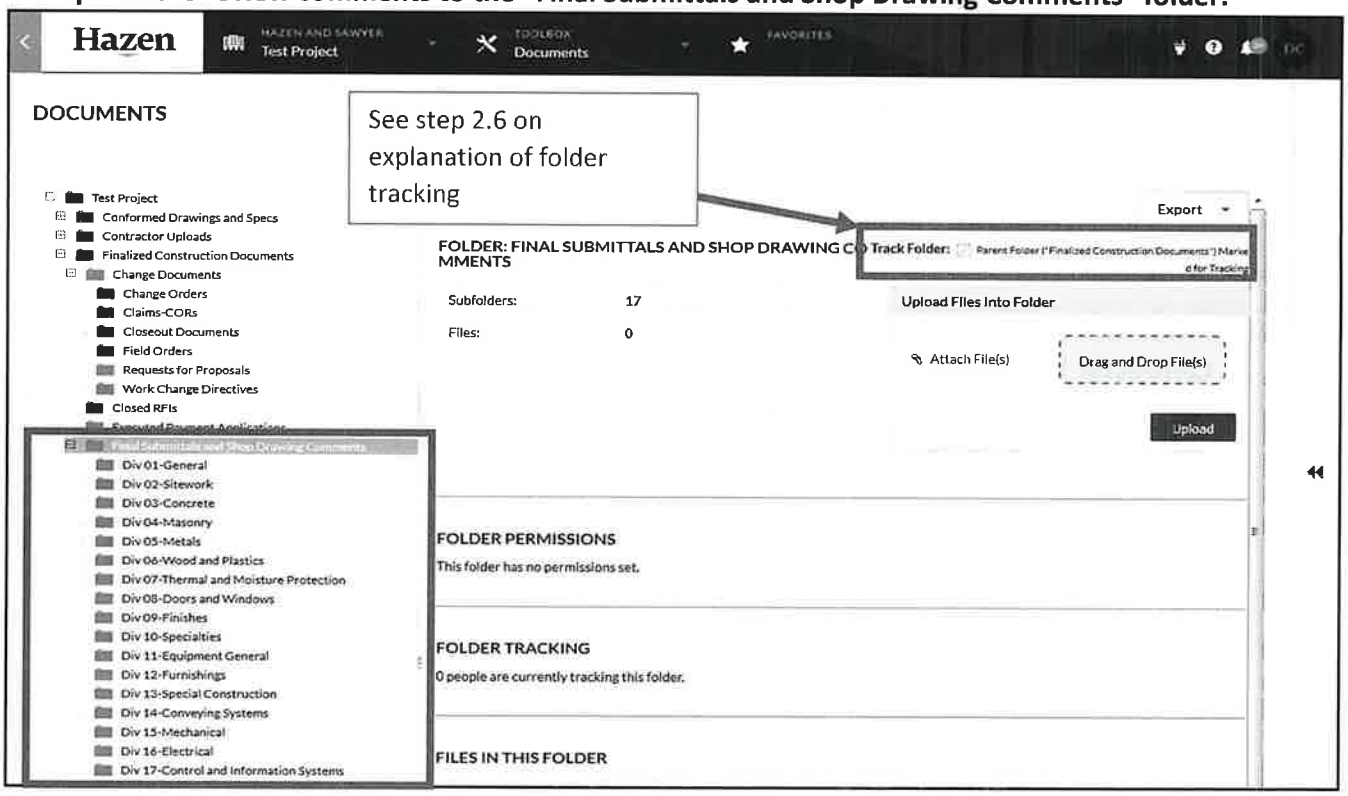
2.3.1. Inside the documents tool, you will see three file folders (Conformed Drawings and Specs, Contractor Uploads, and Finalized Construction Documents).



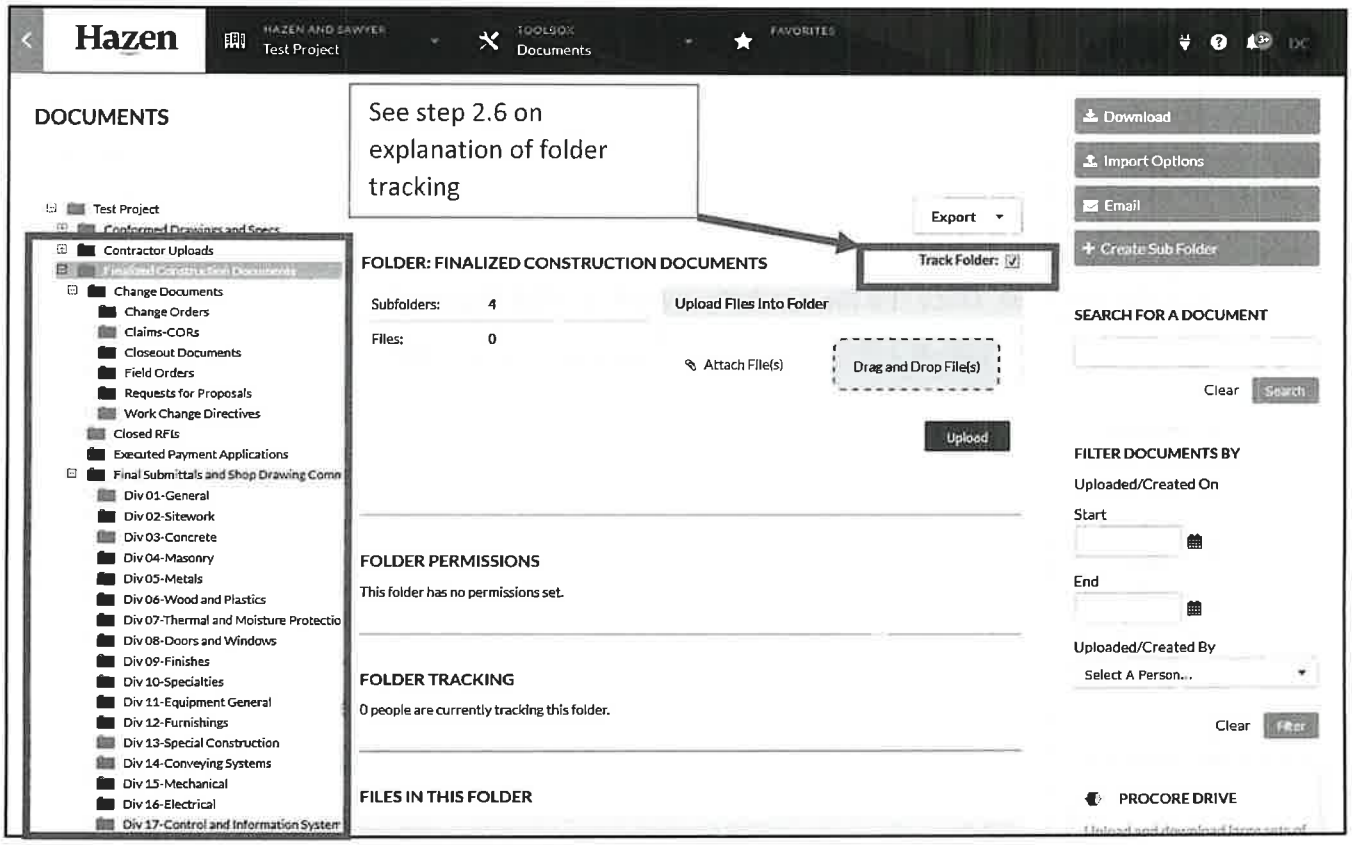
2.3.2. To upload a submittal for review, highlight the Contractor Uploads folder. The middle portion of your screen will update and you will see a box labeled "Upload Files Into Folder". Simply drag and drop a PDF file of the submittal (properly named, spec section-submittal number-revision number) into the grey box. Once the file has fully uploaded, click "Upload".



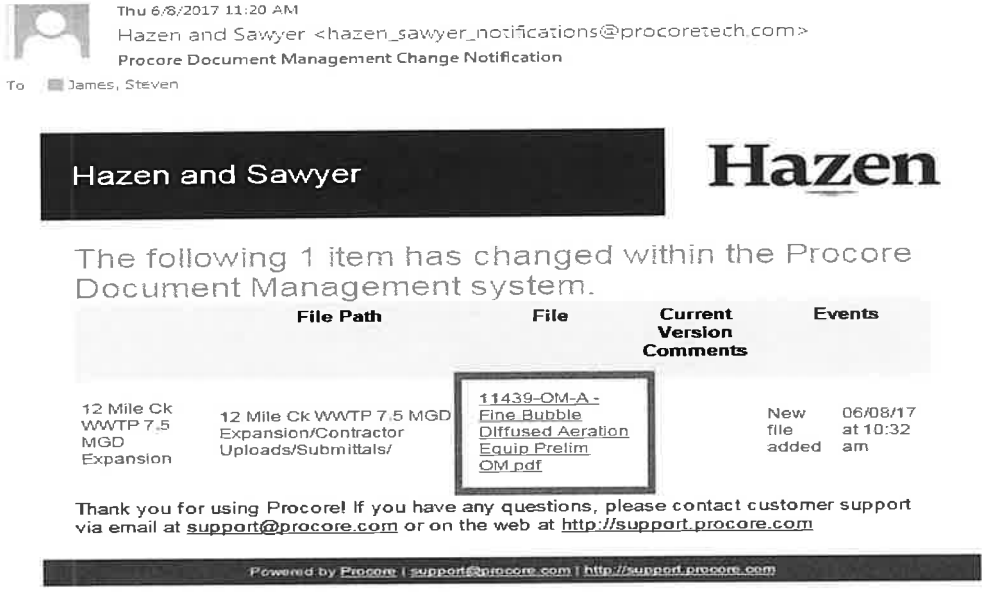
2.4. Once a submittal has been reviewed by Hazen, the Project Manager (PM) or Submittal Coordinator (SC) will upload the review comments to the "Final Submittals and Shop Drawing Comments" folder.



2.5. This process is similar for other documents (Change Documents, RFIs, etc.). Contractor shall upload all documents to the "Contractor Uploads" folder. Once reviewed, Hazen will upload responses to the "Finalized Construction Documents".



2.6. Hazen's PM/SC will adjust Procore settings so that the Contractor is automatically tracking the "Finalized Construction Documents" folder. This allows Procore to automatically send the Contractor an email when Hazen has uploaded final construction documents (closed RFIs, submittal comments, etc.). As shown below, Procore will send an email stating that "The following item(s) has changed within the Procore Document Management system". You may click on the blue link directly to view the document or you may log into Procore and access the documents tool.



Thu 6/8/2017 11:20 AM
Hazen and Sawyer <hazen_sawyer_notifications@procoretech.com>
Procore Document Management Change Notification
To James, Steven

Hazen and Sawyer

Hazen

The following 1 item has changed within the Procore Document Management system.

File Path	File	Current Version Comments	Events	
12 Mile Ck WWTP 7.5 MGD Expansion	12 Mile Ck WWTP 7.5 MGD Expansion/Contractor Uploads/Submittals/	11439-OM-A - Fine Bubble Diffused Aeration Equip Prelim OM.pdf	New file added	06/08/17 at 10:32 am

Thank you for using Procore! If you have any questions, please contact customer support via email at support@procore.com or on the web at http://support.procore.com

Powered by Procore | support@procore.com | http://support.procore.com

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SECTION 01320
PROGRESS SCHEDULES

PART 1 – GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. Scheduling Responsibilities:

1. In order to provide a definitive basis for determining job progress, a construction schedule of a type approved by the Owner will be used to monitor the project.

2. Each week the Contractor shall be responsible for preparing the schedule and updating it based on a tentative two week basis. It shall at all times remain the Contractor's responsibility to schedule and direct his forces in a manner that will allow for the completion of the work within the contractual period.

B. Construction Hours: see Section 01010 – Summary of Work – for construction working hours requirements.

C. Progress of the Work:

1. The work shall be started within ten (10) days following the Notice to Proceed and shall be executed with such progress as may be required to prevent delay to other Contractors or to the general completion of the project. The work shall be executed at such times and in or on such parts of the project, and with such forces, material and equipment, to assure completion of the work in the time established by the Contract.

2. The Contractor agrees that whenever it becomes apparent from the current monthly schedule update that delays have resulted and, hence, that the Contract completion date will not be met or when so directed by the Owner, he will take some or all of the following actions at no additional cost to the Owner:

a. Increase construction manpower in such quantities and crafts as will substantially eliminate the backlog of work.

b. Increase the number of working hours per shift, shifts per working day or days per week, the amount of construction equipment, or any combination of the foregoing to substantially eliminate the backlog of work.

c. Reschedule activities to achieve maximum practical concurrency of accomplishment of activities, and comply with the revised schedule.

d. The Contractor shall submit to the Owner or the Owner's representative for review a written statement of the steps he intends to take to remove or arrest the delay to the critical path in the accepted schedule.

1.02 CONSTRUCTION SCHEDULE

A. Within ten (10) calendar days of the Notice to Proceed, the Contractor shall submit to the Engineer five (5) copies of his proposed schedule: The schedule will be the subject of a schedule review meeting with the Contractor, the Engineer and the Owner or the Owner's representative within one (1) week of its submission. The Contractor will revise and resubmit the schedule until it is acceptable and accepted by the Owner or the Owner's representative.

1.03 CONTRACT COMPLETION TIME

A. Causes for Extensions:

1. The Contract completion time will be adjusted only for causes specified in this Contract. In the event the Contractor requests an extension of any Contract completion date, he shall furnish such justification and supporting evidence as the Owner or the Owner's representative may deem necessary for a determination as to whether the Contractor is entitled to an extension of time under the provisions of this Contract. The Owner, with the assistance of the Engineer, will, after receipt of such justification and supporting evidence, make findings of fact and will advise the Contractor in writing thereof.

B. Requests for Time Extension:

1. Each request for change in any Contract completion date shall be initially submitted to the Owner within the time frame stated in the General Conditions. All information known to the Contractor at that time concerning the nature and extent of the delay shall be transmitted to the Owner at that time. Within the time frame stated in the General Conditions but before the date of final payment under this Contract, all information as required above concerning the delay must be submitted to the Owner. No time extension will be granted for requests which are not submitted within the foregoing time limits.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01400
QUALITY CONTROL

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Testing Laboratory Services

1. Laboratory testing and checking required by the Specifications, including the cost of transporting all samples and test specimens, shall be provided and paid for by the Owner unless otherwise indicated in the Specifications.

2. Materials to be tested include, but are not necessarily limited to the following: cement, concrete aggregate, concrete, and reinforcing steel.

3. Tests required by the Owner shall not relieve the Contractor from the responsibility of supplying test results and certificates from manufacturers or suppliers to demonstrate conformance with the Specifications.

4. In place testing of compacted materials will be conducted as specified or recommended by Engineer.

5. Procedure

   a. The Contractor shall plan and conduct his operations to permit taking of field samples and test specimens, as required, and to allow adequate time for laboratory tests.

   b. The collection, field preparation and storage of field samples and test specimens shall be as directed by the Engineer with the cooperation of the Contractor.

6. Significance of Tests

   a. Test results shall be binding on both the Contractor and the Owner, and shall be considered irrefutable evidence of compliance or noncompliance with the Specification requirements, unless supplementary testing shall prove, to the satisfaction of the Owner, that the initial samples were not representative of actual conditions.

7. Supplementary and Other Testing

   a. Nothing shall restrict the Contractor from conducting tests he may require. Should the Contractor at any time request the Owner to consider such test results, the test reports shall be certified by an independent testing

laboratory acceptable to the Owner. Testing of this nature shall be conducted at the Contractor's expense.

1.02 IMPERFECT WORK OR MATERIALS

A. Any defective or imperfect work or materials furnished by the Contractor which is discovered before the final acceptance of the work, as established by the Certificate of Substantial Completion, or during the subsequent guarantee period, shall be removed immediately even though it may have been overlooked by the Engineer and estimated for payment. Any materials condemned or rejected by the Engineer shall be tagged as such and shall be immediately removed from the site. Satisfactory work or materials shall be substituted for that rejected.

B. The Engineer may order tests of imperfect or damaged work or materials to determine the required functional capability for possible acceptance, if there is no other reason for rejection. The cost of such tests shall be borne by the Contractor; and the nature, tester, extent and supervision of the tests will be as determined by the Engineer. If the results of the tests indicate that the required functional capability of the work or material was not impaired, consistent with the final general appearance of same, the work or materials may be deemed acceptable. If the results of such tests reveal that the required functional capability of the questionable work or materials has been impaired, then such work or materials shall be deemed imperfect and shall be replaced. The Contractor may elect to replace the imperfect work or material in lieu of performing the tests.

1.03 INSPECTION AND TESTS

A. The Contractor shall allow the Engineer ample time and opportunity for testing materials to be used in the work. He shall advise the Engineer promptly upon placing orders for material so that arrangements may be made, if desired, for inspection before shipment from the place of manufacture. The Contractor shall at all times furnish the Engineer and his representatives, facilities including labor, and allow proper time for inspecting and testing materials and workmanship. The Contractor must anticipate possible delays that may be caused in the execution of his work due to the necessity of materials being inspected and accepted for use. The Contractor shall furnish, at his own expense, all samples of materials required by the Engineer for testing, and shall make his own arrangements for providing water, electric power, or fuel for the various inspections and tests of structures and material.

B. Where other tests or analyses are specifically required in other Sections of these Specifications, the cost thereof shall be borne by the party (Owner or Contractor) so designated in such Sections. The Owner will bear the cost of all tests, inspections, or investigations undertaken by the order of the Engineer for the purpose of determining conformance with the Contract Documents if such tests, inspection, or investigations are not specifically required by the Contract Documents, and if conformance is ascertained thereby. Whenever nonconformance is determined by the Engineer as a result of such tests, inspections, or investigations, the Contractor shall bear the full cost thereof or shall reimburse the Owner for said cost. In this connection, the cost of any additional tests

and investigations, which are ordered by the Engineer to ascertain subsequent conformance with the Contract Documents, shall be borne by the Contractor.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

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SECTION 01510
TEMPORARY UTILITIES

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The General Contractor shall provide temporary sanitary facilities for the construction operations of this Contract. The temporary services shall be provided for use throughout the construction period.

B. Temporary Sanitary Service

1. Sanitary conveniences, in sufficient numbers, for the use of all persons employed on the work and properly screened from public observation, shall be provided and maintained at suitable locations by the General Contractor, all as prescribed by State Labor Regulations and local ordinances. The contents of same shall be removed and disposed of in a manner consistent with local and state regulations, as the occasion requires. Sanitary facilities shall be removed from the site when no longer required.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01520

MAINTENANCE OF UTILITY OPERATIONS DURING CONSTRUCTION

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The sanitary sewer system shall be maintained in continuous operation during the entire construction period of all Contracts as hereinafter specified. The intent of this section is to outline the minimum requirements necessary to provide continuous transference of wastewater throughout the construction period.

B. Work under each Contract shall be scheduled and conducted by each Contractor so as to not reduce the quality of near-by water streams or cause odor or other nuisance except as explicitly permitted hereinafter. In performing the work shown and specified, the Contractor shall plan and schedule his work to meet the plant and collection system operating requirements, and the constraints and construction requirements as outlined in this Section. No discharge of raw or inadequately treated wastewater shall be allowed. The Contractor shall pay all civil penalties, costs, and assessments associated with any discharge of raw or inadequately treated wastewater associated with the Contractor's work.

C. The General Contractor shall be responsible for coordinating the general construction and for ensuring that permanent or temporary power is available for all existing, proposed, and temporary facilities that are required to be on line at any given time.

D. The Contractor has the option of providing additional temporary facilities that can eliminate a constraint, provided it is done without cost to the Owner and provided that all requirements of these Specifications are fulfilled and approved by the Engineer.

1.02 TEMPORARY BYPASS PUMPING

A. Requirements for this section shall apply to all pumping required for Contractor to perform tie-ins, shutdowns, etc. for construction of the work. Temporary bypass pumping shall be performed in accordance with this section unless noted otherwise herein. Temporary pumping system design calculations and equipment information shall be submitted for review by Engineer per Section 01300. Calculations shall be stamped by a professional engineer (PE).

B. Contractor shall furnish, install, maintain, and operate temporary bypass pumping facilities as required to complete the Work. Contractor shall be responsible for all construction necessary to accommodate pumps and piping including but not limited to structure modifications, pump base construction, pipe supports, etc.

C. The Contractor shall perform a test run of the bypass pumping set-up before being allowed to continue with the full scale bypass pumping.

D. Contractor shall design the temporary bypass pumping facilities to convey flows from the upstream manholes where existing manhole or sewer tie-ins, replacement, or modifications will be conducted in a manner that will prevent backup of the existing system.

E. All tie-ins, replacement, or modifications shall be performed during low flow conditions.

F. All tie-ins, replacement, or modifications Work shall be accomplished as quickly as possible. If Work required extends beyond 8-hours or weather causes higher flows in the existing system during the Work, the new Work shall be stopped and the existing system shall be placed back into service. The new Work shall be properly protected from damage. Any damage to the new Work or damage to surrounding areas caused by the new Work shall be repaired or replaced at the Owner's decision by the Contractor at the Contractor's sole expense.

G. Contractor shall provide all power, fuel, maintenance materials, parts, and other expendables in order to maintain temporary pumping through the duration of the Work.

H. Contractor shall provide one standby pump equal in capacity to the largest pump installed. If temporary pumping requires non-identical pumps in series, a standby pump of each type shall be provided. Temporary control system shall start standby pump on high level and dial-out to local contact who will respond and be on-site within an hour to check and address problem. High-high level shall also alarm and dial-out indicating that standby pump is not maintaining level. Temporary pumping system shall be provided by company that has spare pumps ready to be delivered and installed locally if problems occur.

I. Contractor shall provide standby power or 48-hour on-site fuel storage capacity for diesel engine type pumps to ensure continuous operation at all times.

J. Contractor shall provide sound attenuation for temporary pumping facilities to limit noise levels to no more than 85 dBA at a distance of 21 feet from the noise source.

K. Temporary pumping system shall remain fully operational until all modifications are complete and approved by Owner or Engineer.

L. Following successful completion of the new Work, Contractor shall remove all temporary pumps, piping and appurtenances and restore area and/or structures to original condition prior to start of work.

M. Contractor shall prepare Temporary Bypass Plan and submit to Owner and Engineer at pre-construction conference for review and approval.

N. Contractor shall reconnect to existing gravity sewer or put the pump station back into operation at the end of each day, weather delay, or completion of Work so that bypass pumping does <u>not</u> occur when not on jobsite. Overnight bypass pumping will only be allowed when directed by Engineer and Owner.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01530
PROTECTION OF EXISTING FACILITIES

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Contractor shall be responsible for the preservation and protection of property adjacent to the work site against damage or injury as a result of his operations under this Contract. Any damage or injury occurring on account of any act, omission or neglect on the part of the Contractor shall be restored in a proper and satisfactory manner or replaced by and at the expense of the Contractor to an equal or superior condition than previously existed.

B. Contractor shall comply promptly with such safety regulations as may be prescribed by the Owner or the local authorities having jurisdiction and shall, when so directed, properly correct any unsafe conditions created by, or unsafe practices on the part of, his employees. In the event of the Contractor's failure to comply, the Owner may take the necessary measures to correct the conditions or practices complained of, and all costs thereof will be deducted from any monies due the Contractor. Failure of the Engineer to direct the correction of unsafe conditions or practices shall not relieve the Contractor of his responsibility hereunder.

C. In the event of any claims for damage or alleged damage to property as a result of work under this Contract, the Contractor shall be responsible for all costs in connection with the settlement of or defense against such claims. Prior to commencement of work in the vicinity of property adjacent to the work site, the Contractor, at his own expense, shall take such surveys as may be necessary to establish the existing condition of the property. Before final payment can be made, the Contractor shall furnish satisfactory evidence that all claims for damage have been legally settled or sufficient funds to cover such claims have been placed in escrow, or that an adequate bond to cover such claims has been obtained.

1.02 PROTECTION OF WORK AND MATERIAL

A. During the progress of the work and up to the date of final payment, the Contractor shall be solely responsible for the care and protection of all work and materials covered by the Contract.

B. All work and materials shall be protected against damage, injury or loss from any cause whatsoever, and the Contractor shall make good any such damage or loss at his own expense. Protection measures shall be subject to the approval of the Engineer.

1.03 EXISTING UTILITIES AND APPURTENANT STRUCTURES

A. The term existing utilities shall be deemed to refer to both publicly-owned and privately-owned utilities such as electric power and lighting, telephone, water, gas, storm drains, sanitary sewers and all appurtenant structures.

B. Where existing utilities and structures are indicated on the Drawings, it shall be understood that all of the existing utilities and structures affecting the work may not be shown and that the locations of those shown are approximate only. It shall be the responsibility of the Contractor to ascertain the actual extent and exact location of existing utilities and structures. In every instance, the Contractor shall notify the proper authority having jurisdiction and obtain all necessary directions and approvals before performing any work in the vicinity of existing utilities.

C. Prior to beginning any excavation work, the Contractor shall, through field investigations, determine any conflicts or interferences between existing utilities and new utilities to be constructed under this project. This determination shall be based on the actual locations, elevations, slopes, etc., of existing utilities as determined in the field investigations, and locations, elevation, slope, or other information of new utilities as shown on the Drawings. If an interference exists, the Contractor shall bring it to the attention of the Engineer as soon as possible. If the Engineer agrees that an interference exists, he shall develop a plan to address the interference as required, and obtain the Owner's approval. Additional costs to the Contractor for this change shall be processed through a Change Order as detailed elsewhere in these Contract Documents. In the event the Contractor fails to bring a potential conflict or interference to the attention of the Engineer prior to beginning excavation work, any actual conflict or interference which does arise during the Project shall be corrected by the Contractor, as directed by the Engineer, at no additional expense to the Owner.

D. The work shall be carried out in a manner to prevent disruption of existing services and to avoid damage to the existing utilities. Temporary connections shall be provided, as required, to insure uninterruption of existing services. Any damage resulting from the work of this Contract shall be promptly repaired by the Contractor at his own expense in a manner approved by the Engineer and further subject to the requirements of any authority having jurisdiction. Where it is required by the authority having jurisdiction that they perform their own repairs or have them done by others, the Contractor shall be responsible for all costs thereof.

E. Where excavations by the Contractor require any utility lines or appurtenant structures to be temporarily supported and otherwise protected during the construction work, such support and protection shall be provided by the Contractor. All such work shall be performed in a manner satisfactory to the Engineer and the respective authority having jurisdiction over such work. In the event the Contractor fails to provide proper support or protection to any existing utility, the Engineer may, at his discretion, have the respective authority to provide such support or protection as may be necessary to insure the safety of such utility, and the costs of such measures shall be paid by the Contractor. This is not a pay item.

1.04 DOCUMENTATION OF EXISTING STRUCTURES

A. The term existing structures shall be deemed to refer to both publicly-owned and privately-owned buildings, structures, and other facilities on the ground surface and any foundations or extensions below the ground surface.

B. Prior to beginning any excavation work in close proximity to existing structures, the Contractor shall complete a Pre-Construction Survey to assess the condition of existing structures surrounding the work site. The survey must be performed a maximum of 7 days prior to excavation and submitted to the Engineer and Owner.

C. Documentation for the Pre-Construction Survey shall be provided as photographs, videos, and report forms to document each structure. Prior to the Pre-Construction Survey, the construction limits must be flagged. Take photographs and video to show existing conditions adjacent to property and to show existing buildings either on or adjoining property to accurately record physical conditions. Include video and photographs of the visible foundation and wall of the buildings, both inside and outside of each structure. Any existing deformities or cracks must be clearly documented in the video and photographs, and shall be documented from different vantage points.

D. All photographs and videos shall be digital and provided on compact disc (CD), digital video disc (DVD), or flash drive. Digital photographs and videos shall be time and date stamped. See Section 01010 for additional video requirements.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01540

DEMOLITION AND REMOVAL OF EXISTING STRUCTURES AND EQUIPMENT

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. This Section covers the demolition, removal, and disposal of structures, pavement, curbs, sidewalk, and any existing equipment. The Contractor shall furnish all labor, materials and equipment to demolish and remove structures and equipment designated to be removed on Drawings.

1.02 TITLE TO EQUIPMENT AND MATERIALS

A. Contractor shall have no right or title to any of the equipment, materials or other items to be removed from the existing structures unless authorized by Owner.

1.03 CONDITION OF STRUCTURES AND EQUIPMENT

A. The Owner does not assume responsibility for the actual condition of structures and equipment to be demolished and removed.

PART 2 – PRODUCTS (NOT USED)

PART 3 – PART 3 - EXECUTION

3.01 DEMOLITION AND REMOVALS

A. The removal of all equipment, piping, and all materials from the demolition of structures shall, when released by the Owner and Engineer, be done by the Contractor and become the Contractor's property, unless otherwise noted, for disposition in any manner not contrary to the Contract requirements and shall be removed from the site to the Contractor's own place of disposal.

B. Any equipment piping and appurtenances removed without proper authorization, which are necessary for the operation of the existing facilities shall be replaced to the satisfaction of the Engineer at no cost to the Owner.

C. Excavation caused by demolitions shall be backfilled with fill free from rubbish and debris.

D. All materials removed by demolition or excavation shall be lawfully and properly handled and disposed according to applicable local, state, and federal laws. Where materials shall be disposed at landfill, manifests and documentation shall be provided to Owner showing / documenting that materials have been properly handled and disposed.

E. Manhole frames and covers that have been removed shall become the property of the Contractor and shall be disposed on in a legal manner.

END OF SECTION

SECTION 01550
SITE ACCESS AND STORAGE

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Access Roads

1. The General Contractor shall construct and maintain such temporary access roads as required to perform the work of this Contract.

2. Access roads shall be located within the property lines of the Owner unless the Contractor independently secures easements for his use and convenience. Contractor shall submit written documentation to the Engineer for any Contractor secured easements across privately held property. Easement agreement shall specify terms and conditions of use and provisions for site restoration. A written release from the property owner certifying that all terms of the easement agreement have been complied by the Contractor shall be furnished to the Engineer prior to final payment.

3. Existing access roads used by the Contractor shall be suitably maintained by the Contractor at his expense during construction. Contractor shall not be permitted to restrict Owner access to existing facilities. Engineer may direct Contractor to perform maintenance of existing access roads when Engineer determines that such work is required to insure all weather access by the Owner.

4. The Contractor will maintain the primary roads to be free of mud and dirt. All mud and dirt carried from the access roads to the primary roads shall be washed and cleaned.

5. The Contractor shall obtain and pay all cost associated with any bonds required by the Kentucky Department of Transportation for the use of State maintained roads.

B. Parking Areas

1. Each Contractor shall construct and maintain suitable parking areas for his construction personnel on the project site where approved by the Engineer and the Owner.

C. Restoration

1. At the completion of the Work, the surfaces of land used for access roads and parking areas shall be restored by the Contractor to its original condition and to the satisfaction of the Engineer.

D. Traffic Regulations

1. Contractor shall obey all traffic laws and comply with all the requirements, rules and regulations of the Kentucky Transportation Cabinet, LFUCG, and other local authorities having jurisdiction to maintain adequate warning signs, lights, barriers, etc., for the protection of traffic on public roadways.

E. Storage of Equipment and Materials

1. Contractor shall store his equipment and materials at the job site in accordance with the requirements of the Contract Documents, and as hereinafter specified. All equipment and materials shall be stored in accordance with manufacturer's recommendations and as directed by the Owner or Engineer, and in conformity to applicable statutes, ordinances, regulations and rulings of the public authority having jurisdiction.

2. Contractor shall secure a site for staging area and material storage, including portable restroom facilities. Contractor shall not store materials or encroach upon private property without the written consent of the owners of such private property. Use of public lands must be with the written approval of the Owner.

3. Contractor shall not store unnecessary materials or equipment on the job site, and shall take care to prevent any structure from being loaded with a weight which will endanger its security or the safety of persons.

4. Materials shall not be placed within ten (10) feet of fire hydrants. Gutters, drainage channels and inlets shall be kept unobstructed at all times.

5. Contractor shall provide adequate temporary storage buildings/facilities, if required, to protect materials or equipment on the job site. If there is space within the existing structure for storage the Contractor may use this space upon agreement with the Owner.

6. Contractor shall provide Engineer with copy of agreement with property owner of staging area. Contractor will be responsible for all restoration. Agreement between Contractor and property owner shall include language holding the Owner harmless from responsibility and liability.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01560
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 – GENERAL

1.01 GENERAL

A. Provide and maintain equipment and temporary construction, as necessary to provide controls over environmental and safety conditions at the construction site and adjacent areas. Remove physical evidence of temporary facilities at completion of Work.

B. Prohibited Construction Activities:

1. Dumping/disposing of excess or unsuitable excavated material in wetlands or floodplains, even with the permission of the property owner.

2. Locating stockpile storage areas in environmentally sensitive areas.

3. Indiscriminate, arbitrary, or capricious operation of equipment in any stream corridors, any wetlands, any surface waters, or outside the construction limits.

4. Pumping of sediment-laden water from trenches or other excavations directly into any surface waters, any stream corridors, any wetlands, or storm sewers; all such water will be properly filtered or settled to remove silt prior to release.

5. Discharging pollutants such as chemicals, fuels, lubricants, bituminous materials, raw sewage and other harmful waste into or alongside of rivers, streams, impoundments, or into natural or manmade channels leading thereto.

6. Permanent or unspecified alteration of the flow line of any stream.

7. Damaging vegetation outside of the construction area.

8. Disposal of trees, brush, and other debris in any stream corridors, any wetlands, any surface waters, or at unspecified locations.

9. Open burning of project debris without a permit.

10. Discharging injurious silica dust concentrations into the atmosphere resulting from breaking, cutting, chipping, drilling, buffing, grinding, polishing, shaping or surfacing closer than 200 feet to places of residences or commercial, professional, quasi-public or public places of human occupation.

11. Storing construction equipment and vehicles and/or stockpiling construction materials on property, public or private, not previously authorized for such purposes as noted in Section 01550.

12. Running well point or pump discharge lines through private property or public property and rights-of-way without an easement or the written permission of the property owner and the consent of the ENGINEER.

13. Non-compliance with the Contractor's, OSHA's, or the Owner's safety requirements.

14. Operations entailing the use of vibratory hammers or compactors outside the hours listed in Section 01010 - Summary of Work, or outside the hours allowed for construction by local ordinances or regulations.

1.02 SAFETY ADVISORY

A. Scope: Sewer Installation

1. Maintaining jobsite safety

2. Maintaining traffic safety

B. LFUCG-funded projects have a contractual and legal obligation for performance and breech of contract in regard to the safety of all exposed personnel. Reference the Occupational Safety Health Administration (OSHA) Multi Employer Citation Policy: Multi-employer Worksites, The Creating Employer, The Exposing Employer, The Correcting Employer, The Controlling Employer, Multiple Roles.

C. The Contractor shall at all times conduct the work safely in order to assure a safe work site. The Contractor shall be responsible for the safety of the Contractor's employees, agents and subcontractors, Owner's personnel and all other personnel or persons at the work site. The Contractor shall be responsible for the adequacy and safety of all construction methods or procedures and the safe prosecution of the work.

D. The Contractor shall be responsible at all times to conduct the work and keep the work site in compliance with federal, state, and local safety Laws and Regulations, including but not limited to Occupational Safety and Health (OSHA) requirements. This includes shaft drilling operations, concrete moving and placement, confined space entry requirements for trench construction, including use of a trench box or other shoring to support trench walls and proper means of exit from an excavation.

E. The Contractor shall have an authorized and competent safety representative as defined above on the work site at frequent and regular intervals, or more often, as conditions require. Failure to have such a person at the site as specified herein constitutes an unsafe practice.

F. The Contractor shall be responsible to suspend Work whenever a Work method or procedure or condition at work site is unsafe.

G. The Contractor shall submit a written notification to the Owner of any accident or injury. Such notification shall include the Contractor's investigation and what measures are

appropriate to avoid such accidents. Payment applications will not be authorized until such notice is provided.

H. Failure of the Contractor to comply with any provision of this Specification section or the Owner's safety requirements or any federal, state or local safety Laws and Regulations constitute just cause for the Owner to order suspension of Work.

I. None of the provisions of the section are intended to, nor shall be construed to, create any duty or responsibility on the Owner or Engineer to provide or enforce safety requirements of the Contractor. The duty, responsibility, and liability for safety shall remain with the Contractor.

1.03 AIR POLLUTION AND NOISE CONTROL

A. Contractor's vehicles and equipment shall be such as to minimize noise to the greatest degree practicable. Noise levels shall conform to the latest OSHA standards and in no case will noise levels be permitted which interfere with the work of the Owner or others.

1. Construction activities will be limited to hours specified in Section 01010 – Summary of Work.

2. Construction equipment will be provided with intake silencers and mufflers, as required by safety standards.

3. All construction vehicles should be equipped with proper emissions control equipment.

4. Periodically check equipment and machinery for proper tuning to minimize exhaust emissions and noise.

1.04 DUST CONTROL

A. Contractor shall be responsible for controlling objectionable dust caused by his operation of vehicles and equipment, clearing or for any reason whatever. Contractor shall apply water or use other methods subject to the Engineer's approval which will keep dust in the air to a minimum. Dust control measures shall be implemented multiple times throughout each working day if necessary.

1.05 PEST AND RODENT CONTROL

A. Provide rodent and pest control as necessary to prevent infestation of construction or storage area.

1. Employ methods and use materials which will not adversely affect conditions at the site or on adjoining properties.

1.06 WATER CONTROL

A. Contractor shall comply with the Storm Water Pollution Prevention Plan (SWPPP) approved by LFUCG.

B. Provide methods to control surface water and water from excavations and structures to prevent damage to the Work, the site, or adjoining properties.

C. Provide, operate and maintain equipment and facilities of adequate size to control surface water.

D. Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to any portion of the site or to adjoining areas and in conformance with all environmental requirements.

1.07 POLLUTION CONTROL

A. Provide methods, means and facilities required to prevent contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations.

B. Provide equipment and personnel, perform emergency measures required to contain any spillages, and to remove contaminated soils or liquids.

1. Excavate and dispose of any contaminated earth offsite, and replace with suitable compacted fill and topsoil.

C. Take special measures to prevent harmful substances from entering public waters.

1. Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to streams, or in sanitary or storm sewers.

D. Provide systems for control of atmospheric pollutants.

1. Prevent toxic concentrations of chemicals.

2. Prevent harmful dispersal of pollutants into the atmosphere.

E. All Contractor's equipment used during construction shall conform to all current federal, state and local laws and regulations.

1.08 EROSION AND SEDIMENT CONTROL

A. See Section 02370 for erosion and sediment control requirements.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01631
PRODUCTS AND SUBSTITUTIONS

PART 1 – GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. General: Substitution of materials and/or equipment is defined in the General Conditions and more fully hereinafter.

B. Substitutions: The Contractor's requests for changes in the products, materials, equipment and methods of construction required by the Contract Documents are considered requests for "substitutions", and are subject to the requirements specified herein. The following are not considered as substitutions:

1. Revisions to the Contract Documents, where requested by the Owner and Engineer are considered as "changes" not substitutions.

2. Substitutions requested during the bidding period, which have been accepted prior to the Contract Date, are included in the Contract Documents and are not subject to the requirements for substitutions as herein specified.

3. Specified Contractor options on products and construction methods included in the Contract Documents are choices available to the Contractor and are not subject to the requirements for substitutions as herein specified.

4. Except as otherwise provided in the Contract Documents, the Contractor's determination of and compliance with governing regulations and orders as issued by governing authorities do not constitute "substitutions" and do not constitute a basis for change orders.

1.02 SUBMITTALS

A. The information required to be furnished for evaluation of product substitution will be as follows:

1. Performance capabilities, and materials and construction details will be evaluated based upon conformance with the Specifications. Products that do not conform with the Specification shall not be accepted.

2. Manufacturer's production and service capabilities, and evidence of proven reliability will be acceptable if the following is furnished.

a. Written evidence that the manufacturer has not less than (3) years' experience in the design and manufacture of the substitute product.

b. Written evidence of at least one application, of a type and size similar to the proposed substitute product, in successful operation in a wastewater treatment plant or collection system for a period of at least one year.

c. In lieu of furnishing evidence of a manufacturer's Experience and successful operation of an application of the product to be substituted, the Contractor has the option of furnishing a cash deposit or bond which will guarantee replacement if the product the furnished does not satisfy the other requirements specified in this section. The amount of each deposit or bond will be subject to the approval.

3. Specific reference to characteristics either superior or inferior to specified requirements will be evaluated based on their net effect on the project. Products with any characteristics inferior to those specified will not be acceptable unless offset by characteristics that, in the opinion of the Engineer, will cause the overall effect of the product on the project to be at least equal to that of those specified.

1.03 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same generic kind, from a single source, for each unit of work.

B. Compatibility of Options: Compatibility of products is a basic requirement of product selection. When the Contractor is given the option of selecting between two or more products for use on the project, the product selected must be compatible with other products previously selected, even if the products previously selected were also Contractor options. The complete compatibility between the various choices available to the Contractor is not assured by the various requirements of the Contract Documents, but must be provided by the Contractor.

C. The detailed estimate of operating and maintenance costs will be evaluated based on comparison with similar data on the specified products. Proposed substitute products which have an operating and maintenance cost that, in the opinion of the Engineer, exceeds that of the specified products will not be considered equal and will not be acceptable.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Deliver, store, and handle products in accordance with manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft. Control delivery schedules to minimize long-term storage at the site and to prevent overcrowding of construction spaces. In particular coordinate delivery and installation to ensure minimum holding or storage times for items known or recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other sources of loss.

1. Deliver products to the site in the manufacturer's sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.

2. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.

3. Store heavy materials away from the project construction in a manner that will not endanger the supporting construction.

PART 2 – PRODUCTS

2.01 GENERAL PRODUCT COMPLIANCE

A. General: Requirements for individual products are indicated in the Contract Documents; compliance with these requirements is in itself a Contract Requirement. These requirements may be specified in any one of several different specifying methods, or in any combination of these methods. These methods include the following:

1. Proprietary

2. Descriptive

3. Performance

4. Compliance with Reference Standards

a. Compliance with codes, compliance with graphic details and similar provisions of the Contract Documents also have a bearing on the review and approval outcome.

B. Procedures for Selecting Products: Contractor's options in selecting products are limited by requirements of the Contract Documents and governing regulations. They are not controlled by industry traditions or procedures experienced by the Contractor on previous construction projects.

2.02 SUBSTITUTIONS

A. Conditions: Contractor's request for substitution will be received and considered when extensive revisions to the Contract Documents are not required, when the proposed changes are in keeping with the general intent of the Contract Documents, when the request is timely, fully documented and properly submitted, and when one or more of the following conditions is satisfied, all as judged by the Engineer; otherwise the requests will be returned without action except to record non-compliance with these requirements.

1. The Engineer will consider a request for substitution where the request is directly related to an "or equal" clause or similar language in the Contract Documents.

2. The Engineer will consider a request for substitution where the specified product or method cannot be provided within the Contract Time. However, the request will not be considered if the product or method cannot be provided as a result of the Contractor's failure to pursue the work promptly or to coordinate the various activities properly.

3. The Engineer will consider a request for substitution where the specified product or method cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

4. The Engineer will consider a request for a substitution where a substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. These additional responsibilities may include such considerations as additional compensation to the Engineer for redesign and evaluation services, the increased cost of other work by the Owner or separate contractors, and similar considerations.

5. The Engineer will consider a request for substitution when the specified product or method cannot be provided in a manner which is compatible with other materials of the work, and where the Contractor certifies that the substitution will overcome the incompatibility.

6. The Engineer will consider a request for substitution when the specified product or method cannot be properly coordinated with other materials in the work, and where the Contractor certifies that the proposed substitution can be properly coordinated.

7. The Engineer will consider a request for substitution when the specified product or method cannot receive a warranty as required by the Contract Documents and where the Contractor certifies that the proposed substitution receive the required warranty.

8. The Contractor shall reimburse the Owner any costs for review by the Engineer of proposed product substitutions which require major design changes, as determined by the Owner, to related or adjacent work made necessary by the proposed substitutions.

B. Work-Related Submittals: Contractor's submittal of and the Engineer's acceptance of shop drawings, product data or samples which relate to work not complying with requirements of the Contract Documents, does not constitute an acceptable or valid request for a substitution, nor approval thereof.

2.03 GENERAL PRODUCT REQUIREMENTS

A. General: Provide products that comply with the requirements of the Contract Documents and that are undamaged and, unless otherwise indicated, unused at the time of

installation. Provide products that are complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

1. Standard Products: Where they are available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

2. Continued Availability: Where, because of the nature of its application, the Owner is likely to need replacement parts or additional amounts of a product at a later date, either for maintenance and repair or replacement, provide standard, foreign or domestically produced products for which the manufacturer has published assurances that the products and its parts are likely to be available to the Owner at a later date. Domestically produced products are preferred, but not required.

B. The Owner will not accept any 'New old stock' as any equipment on the project.

PART 3 – EXECUTION

3.01 INSTALLATION OF PRODUCTS

A. General: Except as otherwise indicated in individual sections of these Specifications, comply with the manufacturer's instructions and recommendations for installation of the products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other work. Clean exposed surfaces and protect surfaces as necessary to ensure freedom from damage and deterioration at Time of Acceptance.

END OF SECTION

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SECTION 01731
CUTTING AND PATCHING

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. The Contractor shall be responsible for all cutting, fitting or patching that may be required to complete the work or to make its parts fit together properly.

C. The Contractor shall not damage or endanger any portion of the Work or the Work of the Owner or any separate contractors by cutting, patching or otherwise altering any work, or by excavation.

D. Any cutting of existing structures or facilities shall be approved in advance by Owner or Engineer. Approval shall not impact Contractor's full liability for any damage caused.

1.02 QUALITY ASSURANCE

A. Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that result in increased maintenance or decreased operational life or safety.

1.03 WARRANTY

A. Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 – PRODUCTS

2.01 MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications.

B. Existing Materials: Use materials identical to existing materials, to the extent practicable.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the functional performance of existing materials.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

3.02 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

3.03 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.

5. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

END OF SECTION

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SECTION 01740
CLEANING

PART 1 – GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. Maintain premises free from accumulations of waste, debris, and rubbish.

B. At completion of work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all exposed surfaces. Leave project clean and ready for occupancy.

1.02 RELATED DOCUMENTS

A. Cutting and Patching: Section 01731.

B. Project Closeout: Section 01770.

C. Cleaning for Specific Products of Work: Specification Section for that work.

1.03 SAFETY REQUIREMENTS

A. Hazards Control:

1. Store volatile wastes in covered metal containers, and remove from premises daily.

2. Prevent accumulation of wastes which create hazardous conditions.

3. Provide adequate ventilation during use of volatile noxious substances.

B. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

1. Do not burn or bury rubbish and waste materials on project site.

2. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.

3. Do not dispose of wastes into streams or waterways.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 – EXECUTION

3.01 DURING CONSTRUCTION

A. Execute cleaning to ensure that building, grounds, and public properties are maintained free from accumulations of waste materials and rubbish.

B. Wet down dry materials and rubbish to lay dust and prevent blowing dust.

C. At reasonable intervals during progress of work, clean site and public properties, and dispose of waste materials, debris and rubbish.

D. Provide on-site containers for collection of waste materials, debris and rubbish.

E. Remove waste materials, debris and rubbish from site and legally dispose of at public or private dumping areas off Owner's property.

F. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.

G. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

3.02 FINAL CLEANING

A. Employ experienced workmen, or professional cleaners, for final cleaning.

B. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces.

C. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials, from sight-exposed interior or exterior finished surfaces; polish surfaces so designated to shine finish.

D. Repair, patch and touch up marred surfaces to specified finish, to match adjacent surfaces.

E. Broom clean paved surfaces; rake clean other surfaces of grounds.

F. Maintain cleaning until project, or portion thereof, is occupied by Owner.

END OF SECTION

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SECTION 01770
PROJECT CLOSEOUT

PART 1 – GENERAL

1.01 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Liquidated Damages: Supplemental General Conditions

B. Cleaning: Section 01740.

C. Project Record Documents: Section 01785.

1.02 SUBSTANTIAL COMPLETION

A. In order to initiate project closeout procedures, the Contractor shall submit the following:

1. Written certification to Engineer that project is Substantially Complete.

2. List of major items to be completed or corrected.

B. Engineer will make an inspection within seven (7) days after receipt of certification, together with Owner's Representative.

C. Should Engineer consider that work is Substantially Complete:

1. Contractor shall prepare, and submit to Engineer, a list of items to be completed or corrected, as determined by the inspection.

2. Engineer will prepare and issue a Certificate of Substantial Completion, containing:

a. Date of Substantial Completion.

b. Contractor's list of items to be completed or corrected, verified and amended by Engineer.

c. The time within which Contractor shall complete or correct work of listed items.

d. Time and date Owner will assume possession of work or designated portion thereof.

e. Responsibilities of Owner and Contractor for:

1) Insurance

2) Utilities

3) Operation of Mechanical, Electrical, and Other Systems.

4) Maintenance and Cleaning.

5) Security.

f. Signatures of:

1) Engineer

2) Contractor

3) Owner

3. Owner occupancy of Project or Designated Portion of Project:

a. Contractor shall:

1) Obtain certificate of occupancy.

2) Perform final cleaning in accordance with Section 01740.

b. Owner will occupy Project, under provisions stated in Certificates of Substantial Completion.

4. Contractor: Complete work listed for completion or correction, within designated time.

D. Should Engineer consider that work is not Substantially Complete:

1. Engineer shall immediately notify Contractor, in writing, stating reasons.

2. Contractor: Complete work, and send second written certification to Engineer, certifying that Project or designated portion of Project is substantially complete.

3. Engineer will reinspect work.

E. Should Engineer consider that work is still not finally complete:

1. Engineer shall notify Contractor, in writing, stating reasons.

2. Contractor shall take immediate steps to remedy the stated deficiencies, and send third written notice to the Engineer certifying that the work is complete.

3. Engineer and Owner will reinspect work at Contractor's expense.

1.03 FINAL INSPECTION

A. Contractor shall submit written certification that:

1. Contract Documents have been reviewed.

2. Project has been inspected for compliance with Contract Documents.

3. Work has been completed in accordance with Contract Documents.

4. Equipment and systems have been tested in presence of Owner's Representative and are operational.

5. Project is completed, and ready for final inspection.

B. Engineer will make final inspection within seven (7) days after receipt of certification.

C. Should Engineer consider that work is finally complete in accordance with requirements of Contract Documents, he shall request Contractor to make Project Closeout submittals.

D. Should Engineer consider that work is not finally complete:

1. Engineer shall notify Contractor in writing, stating reasons.

2. Contractor shall take immediate steps to remedy the stated deficiencies and send second written notice to Engineer certifying that work is complete.

3. Engineer will reinspect work.

1.04 CLOSEOUT SUBMITTALS

A. Project Record Documents: To requirements of Section 01785.

B. Guarantees, Warranties and Bonds: To requirements of particular technical Specifications and Section 01782.

C. Project Closeout Checklist: Contractor shall submit all required items to the Engineer and/or Owner with their responsibility identified. See Project Closeout Checklist included in this section.

1.05 INSTRUCTION

A. Instruct Owner's personnel in operation of all systems, mechanical, electrical, and other equipment.

1.06 FINAL APPLICATION FOR PAYMENT

A. Contractor shall submit final applications in accordance with requirements of General Conditions.

1.07 FINAL CERTIFICATE FOR PAYMENT

A. Engineer will issue final certificate in accordance with provisions of general conditions.

B. Should final completion be materially delayed through no fault of Contractor, Engineer may issue a Semi-Final Certificate for Payment.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PROJECT CLOSEOUT CHECKLIST

A. See attached Project Closeout Checklist.

RMP Project Closeout Checklist

DWQ Project Manager (DWQ PM): Bob Peterson PE

RMP Project Manager (RMP PM):

Engineer of Record (EOR):

Contractor:

File Manager: Diann Williams

Project Name:

EOR
Contractor
DWQ PM
RMP PM

	Task	From	To	cc	Completed Submitted	Approved	Closeout Requirement:	Notes
	General Administration Closeout Checklist							
1	Plan o' Operation (Pump Station and Wet Weather Storage Projects Only)	EOR	DWQ PM				Copy of plan to file (plan will include description of facility, how it was design to work, etc) DWQ PM will provide copy to Pump Station Maintenance or Plant Staff	
2	Manufacturer's Statics (Pump Station and Wet Weather Storage Projects Only)	EOR	DWQ PM				Report from LCH Main Electric with date of startup	
3	Training (Lyme Station and Wet Weather Storage Projects Only)	Contractor	LFUCD Staff				Letter or email from EOR with attendees to file	
4	Startup with LFUCD (Pump Station and Wet Weather Storage Projects Only)	Contractor	EOR / LFUCD Staff				Letter or email from EOR with date of startup and attendees to file	
5	Deliver copies of CCTV Logs	Contractor	EOR/DWQ PM				Hard Copies in File	
6	Declaration of Beneficial Occupancy (Consent Decree Certification)	EOR	DWQ PM	File Manager			Memo from EOR to file	
7	Receive Ltr Substantial Completion and Punchlist	Contractor	EOR	File Manager			Memo from Contractor to file	
8	Verify all easements requirements (as listed in the NOI) have been satisfied	EOR	DWQ PM	Contractor			EOR Memo to File	
9	~~Status Report: Owner signature, easements (any unusual requirements have been satisfied~~	~~EOR~~	~~DWQ PM~~		n/a		~~Copies of all relevant to file~~	
10	EOR coordinates final inspection and prepares Punchlist	EOR	Contractor	DWQ PM			Punchlist to file	
11	Recommendation of release of retainage less 200% of remaining work estimate)	EOR	DWQ PM	File Manager			Memo from EOR to file	
12	Release of retainage less 200% of remaining work estimate	DWQ PM	Contractor	EOR			Pay app to file	
13	Process Final Additive Change Order	EOR	DWQ PM	RMP PM			EOR Memo to File	
14	Distribution of final adjusting Change Order for signature	EOR	Contractor RMP PM				Copy of executed final change order	
15	Upon completion of punchlist Letter requesting final pay and release of all retainage. Must include:	Contractor	EOR	DWQ PM			Letter to file	
16	~~O&E Operation Record~~	Contractor	EOR	DWQ PM			EOR Document to File	
17	~~Waiver of Release Claims and Liens~~	Contractor	EOR	DWQ PM			EOR Document to File	
18	~~Warranty Bond~~	Contractor	EOR	DWQ PM			EOR Document to File	
19	Recommendation for final pay and release of all retainage	EOR	DWQ PM	Contractor			EOR Memo to file	
20	Final Pay Application	Contractor	EOR	DWQ PM			Final Pay App to file	
21	Recommendation for project acceptance and initiation of warranty period	EOR	DWQ PM	RMP PM			EOR Memo to file	
22	Release of B&C Bonds	DWQ PM	Contractor	EOR			Copy to file	
23	Release of Performance Bond	DWQ PM	Contractor	EOR			Copy to file	
24	Release of Payment Bond	DWQ PM	Contractor	EOR			Copy to file	

END OF SECTION

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SECTION 01780
OPERATIONS AND MAINTENANCE MANUALS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Compile product data and related information appropriate for Owner's maintenance and operation of equipment furnished under the Contract. Prepare operating and maintenance data as specified.

B. In addition to maintenance and operations data, the manufacturer's printed recommended installation practice shall also be included. If not part of the operations and maintenance manual, separate written installation instructions shall be provided, serving to assist the Contractor in equipment installation.

C. Related requirements specified elsewhere:

1. Submittals: Section 01300.
2. Project Closeout: Section 01770.
3. Project Record Documents: Section 01785.
4. Warranties and Bonds: Section 01782.

1.02 FORM OF SUBMITTALS

A. Prepare data in the form of an instructional manual for use by Owner's personnel.

B. Format:

1. Size: 8-1/2 in. x 11 in.
2. Paper: 20 pound minimum, white.
3. Text: Manufacturer's printed data.
4. Photocopies must be clear and legible.
5. Drawings:
    a. Provide reinforced punched binder tab, bind in with text.
    b. Fold large drawings to the size of the text pages where feasible.

c. For flow or piping diagrams that cannot be detailed on the standard size drawings, a larger, appropriate size drawing may be submitted and supplied in a properly marked map packet.

6. Provide fly-leaf for each separate product, or each piece of operating equipment.

   a. Provide typed description of product, and major component parts of equipment.

   b. Provide indexed tabs.

7. Cover: Identify each volume with types or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:

   a. Title of Project.

   b. Identity of separate structure as applicable.

   c. Identity of general subject matter covered in the manual.

C. Binders:

1. Commercial quality, durable and cleanable, 3-hole, 3" or 4" D-ring binders, with oil and moisture resistant hard covers.

2. When multiple binders are used, correlate the data into related consistent grouping.

3. Imprinted on the front cover and side of each binder shall be the name of the Plant, the Contract Number and Volume Number.

4. Binders shall be new and not recycled form a prior data manual.

1.03 SUBMITTAL SCHEDULE

A. Submit one (1) copy of preliminary draft of proposed formats and outlines of contents prior to operation of equipment. Engineer will review draft and return with comments.

B. Submit one (1) copy of completed data for final review prior to the completion of the Contract and before payment in excess of 90% of the total Contract amount is authorized.

C. Provide two (2) copies plus pdf on CD of approved completed O & M Manual in final form ten (10) days prior to final inspection or acceptance to the Owner. Final version of each manual shall reflect any changes made during testing and start-up of equipment.

1.04 QUALITY ASSURANCE

A. Preparation of data shall be done by personnel:

1. Trained and experienced in maintenance and operation of the described products.

2. Completely familiar with requirements of this Section.

3. Skilled as a technical writer to the extent required to communicate essential data.

4. Skilled as a draftsman competent to prepare required drawings.

1.05 CONTENTS OF MANUAL

A. Each item of equipment shall be placed in a logical sequential order, as listed or ordered in the Contract Documents.

B. Content, for each unit of equipment and system, as appropriate:

1. Detailed description of the process and operation procedures as applicable.

2. Instructions for all components of the equipment whether manufactured by the supplier or not, including valves, controllers and other miscellaneous components.

3. Description of unit and component parts.

   a. Function, normal operating characteristics, and limiting conditions.

   b. Performance curves, engineering data and tests.

   c. Complete nomenclature and commercial number of all replaceable parts.

   d. Exploded and/or sectional drawing views.

   e. Equipment model number.

4. Operating procedures:

   a. Start-up, break-in, routine and normal operating instructions.

   b. Regulation, control, stopping, shutdown and emergency instructions.

   c. Summer and winter operating instructions.

   d. Special operating instructions.

5. Maintenance Procedures:

   a. Routine operations.

b. Guide to "trouble-shooting".

c. Disassembly, repair and reassembly.

d. Alignment, adjusting and checking.

e. Preventative maintenance schedule.

f. Recommended spare parts list and quantities.

g. Equipment parts list.

h. Local service center.

6. Servicing and Lubrication schedule.

a. List of lubricants required.

b. Lubrication procedures.

c. Lubrication schedule.

7. Internal and external wiring and piping diagrams numbered to correspond to the installation.

8. Description of sequence of operation by control supplier.

9. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.

a. Predicted life of parts subject to wear.

10. As-installed control diagrams by controls supplier.

11. Each Contractor's coordination drawings.

a. As-installed color coded piping diagrams.

12. Charts of valve tag numbers, with the location and function of each valve.

13. Other data as required under pertinent sections of Specifications.

C. Content, for each electrical system, as appropriate:

1. Description of system and component parts.

a. Function, normal operating characteristics, and limiting conditions.

b. Performance curves, engineering data and tests.

c. Complete nomenclature and commercial number of replacement parts.

2. Circuit directories of panel boards.

   a. Electrical service.

   b. Controls.

   c. Communications.

3. As-installed color-coded wiring diagrams.

4. Operating procedures:

   a. Routine and normal operating instructions.

   b. Sequences required.

   c. Special operating instructions.

5. Maintenance procedures:

   a. Routine operations.

   b. Guide to "trouble-shooting".

   c. Disassembly, repair and reassembly.

   d. Adjustment and checking.

6. Manufacturer's printed operating and maintenance instructions.

7. List of original manufacturer's recommended spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

8. Other data as required under pertinent sections of Specifications.

D. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.

E. Additional requirements for operating and maintenance data: The respective section of Specifications.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01782
WARRANTIES AND BONDS

PART 1 – GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. Compile specified warranties and bonds.

B. Compile specified service and maintenance contracts.

C. Co-execute submittals when so specified.

D. Review submittals to verify compliance with Contract Documents.

E. Submit to Engineer for review and transmittal to Owner.

1.02 RELATED DOCUMENTS

A. Bid Bond: Instructions to Bidders.

B. Performance and Payment Bonds: General Conditions and Supplemental General Conditions.

C. Guaranty: General Conditions and Supplemental General Conditions.

D. General Warranty of Construction: General Conditions.

E. Project Closeout: Section 01770.

F. Warranties and Bonds required for specific products: As listed herein.

G. Provisions of Warranties and Bonds, Duration: Respective specification sections for particular products.

1.03 SUBMITTALS REQUIREMENTS

A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers and subcontractors.

B. Furnish two (2) original signed copies.

C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.

1. Product, equipment or work item.

2. Firm name, address and telephone number.

3. Scope

4. Date of beginning of warranty, bond or service and maintenance contract.

5. Duration of warranty, bond or service and maintenance contract.

6. Provide information for Owner's personnel:

   a. Proper procedure in case of failure.

   b. Instances which might affect the validity of warranty or bond.

7. Contractor name, address and telephone number.

1.04 FORM OF SUBMITTALS

A. Prepare in duplicate packets.

B. Format:

1. Size 8-1/2 in. x 11 in., punch sheets for 3-ring binder.

   a. Fold larger sheets to fit into binders.

2. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS." List:

   a. Title of Project

   b. Name of Contractor

C. Binders: Commercial quality, three-ring, with durable and cleanable plastic covers.

1.05 TIME OF SUBMITTALS

A. For equipment or component parts of equipment put into service during progress of construction:

1. Submit documents within 10 days after inspection and acceptance.

B. Otherwise make submittals within 10 days after date of substantial completion, prior to final request for payment.

C. For items of work, where acceptance is delayed materially beyond the Date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing the date of acceptance as the start of the warranty period.

1.06 SUBMITTALS REQUIRED

A. Submit warranties, bonds (see section 00600), service and maintenance contracts as specified in the respective sections of the Specifications.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01785
PROJECT RECORD DOCUMENTS

PART 1 – GENERAL

1.01 MAINTENANCE OF DOCUMENTS

A. Maintain at job site, one copy of:

1. Contract Drawings
2. Specifications
3. Addenda
4. Reviewed Shop Drawings
5. Change Orders
6. Other Modifications to Contract

B. Store documents in approved location, apart from documents used for construction.

C. Provide files and racks for storage of documents.

D. Maintain documents in clean, dry, legible condition.

E. Do not use record documents for construction purposes.

F. Provide Owner with Construction / Conformance Contract Documents (Drawings and Specifications) before Construction begins.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 01300.

1.03 MARKING DEVICES

A. Provide colored pencil or felt-tip marking pen for all marking.

1.04 RECORDING

A. Label each document "PROJECT RECORD" in 2-inch high printed letters.

B. Keep record documents current.

C. Do not permanently conceal any work until required information has been recorded.

D. Contract Drawings: Legibly mark to record actual construction:

1. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.

2. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.

3. Field changes of dimension and detail.

4. Changes made by Change Order or Field Order.

5. Details not on original Contract Drawings.

E. Specifications and Addenda: Legibly mark up each section to record:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.

2. Changes made by Change Order or Field Order.

3. Other matters not originally specified.

F. Shop Drawings: Maintain as record documents; legibly annotate shop drawings to record changes made after review.

1.05 SUBMITTALS

A. At completion of project, deliver two hard copies and one CD with pdf of all record documents to Engineer.

B. Accompany submittal with transmittal letter, in duplicate, containing:

1. Date.

2. Project Title and Number.

3. Contractor's Name and Address.

4. Title and Number of each Record Document.

5. Certification that each Document as Submitted is Complete and Accurate.

6. Signature of Contractor, or His Authorized Representative.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 02221
ROCK REMOVAL

PART 1 – GENERAL

1.01 SUMMARY

A. The Contractor shall excavate rock or flowable fill, if encountered, as required to perform the required work, dispose of the excavated material, and furnish acceptable material for backfill in place of the excavated rock, as indicated on the Drawings and in the Specifications.

B. In General, if encountered, all rock and flowable fill will be removed as necessary for the installation of the facilities of this project. Including, but not limited to the wet well connection piping and hoist system within the building. Rock, if encountered during installation of this piping, drilled shafts, or grading, shall be removed as needed for a proper installation as shown on the Contract Documents. All rock removal is incidental to the cost of the project and will not be paid for as an extra.

C. In general, rock in pipe trenches shall be excavated so as to be not less than six (6) inches from the pipe after the pipe has been laid.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Excavation: Section 02225

B. Excavating, Backfilling, and Compacting for Utilities: Section 02225

1.03 REFERENCES

A. NFPA 495 - Code for the Manufacturer, Transportation, Storage and use of Explosive Materials.

B. Commonwealth of Kentucky Department of Mines and Minerals, Laws and Regulations Governing Explosives and Blasting.

1.04 SAFETY

A. Conform to Kentucky Department of Mines and Minerals code for explosive disintegration of rock.

B. Obtain permits from local authorities having jurisdiction before explosives are brought to site or drilling is started.

C. Conform to all federal, state, and local codes and regulations regarding safety.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Rock Definition

1. For mass excavation, competent rock is determined by the Owner's Geotechnical Engineer (or representative of) observing the teeth of a medium size excavator (such as a Cat 320 series) being dragged vertically across the top of the exposed rock. The equipment must meet the following specifications: 50,000 pounds (minimum weight), 150 HP (minimum horsepower), 2-foot minimum bucket width, using a rock bucket with rock teeth. The acceptance criteria is based upon removal of all loose soil, mud, and excess water in the bottom of the excavation.

PART 3 – EXECUTION

3.01 ROCK REMOVAL

A. Foundation bearing rock surfaces shall be benched to provide level bearing surfaces.

B. Unless otherwise noted, the Contractor may use blasting or mechanical methods for rock removal.

3.02 UTILITIES

A. The Contractor shall notify Kentucky Utilities distribution prior to any blasting occurring within 100 feet of the lines.

B. The Contractor shall provide Columbia Gas with a Blasting Data Sheet for review and approval, if any blasting will occur within 300 feet of an active gas line.

C. No blasting on the project.

3.03 ROCK REMOVAL FOR STRUCTURES AND PIPING

A. The Contractor shall removal all material for the structures to the elevations shown on the plans to verify all necessary rock removal has been completed.

B. Contractor shall not solely rely on rock contours shown on the plans or the geotechnical report for the extent of rock removal, the Contractor must expose all elevations shown on the Contract Documents to ensure no additional rock removal is necessary.

C. The Contractor shall complete a full topographic survey of the cleared area and submitted to the Engineer for approval prior to backfilling and grading per the Contract Documents.

D. The Contractor may backfill the area with rock fragments created during the blasting operation. No rock fragments shall have any dimension greater than 12 inches in any direction. Oversized rock shall be subjected to further size reduction until the fragments are less than 12 inches.

END OF SECTION

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SECTION 02225

EXCAVATING, BACKFILLING, AND COMPACTING FOR SEWERS

PART 1 – GENERAL

1.01 SUMMARY

A. Excavating of trenches.

B. Bedding of pipe.

C. Backfilling trenches.

D. Installing identification tape.

PART 2 – PRODUCTS

2.01 BEDDING AND BACKFILLING STONE

A. Crushed Stone material shall conform to the Kentucky Transportation Cabinet's Standard Specifications for Road and Bridge Construction, Current Edition, latest revision.

B. Bedding Stone: No. 9 Crushed Limestone

C. Backfill Stone: No. 9 Crushed Limestone or No. 57 Crushed Stone

PART 3 – EXECUTION

3.01 GENERAL REQUIREMENTS

A. Trenching may be accomplished by means of a backhoe, trenching machine, hydro-excavation or by hand depending on the construction area. At the Contractor's option, trenching by a trenching machine or by backhoe is acceptable.

B. Clearing - All trees, stumps, bushes, shrubbery, and abandoned concrete or masonry structures within the limits of the trench shall be removed by the Contractor and disposed of in a manner in accordance with federal, state and local regulations. All clearing work shall be considered as incidental to the cost of laying pipe.

C. Bracing and Sheeting - Bracing and sheeting shall be provided to adequately protect the workers during pipe line installation.

1. All requirements of the Occupational Safety and Health Act (OSHA) shall be met during trenching and backfill operations.

2. As backfill is placed, the sheeting shall be withdrawn in increments not exceeding one (1) foot and the void left by the withdrawn sheeting shall be filled and with #9 stone.

3. The Engineer will not be responsible for determining requirements for bracing or sheeting.

4. See notes on Drawings related to required sheathing submittal for the wet well connector piping excavation.

3.02 TRENCHING

A. General:

1. The Contractor shall perform all excavation of every description and of whatever substances encountered, including clearing over the pipeline route. All excavations for the pipeline shall be open cut except where noted for bore and jack.

B. Trench Width:

1. Trench widths shall be in accordance with LFUCG RMP Standard Drawings.

C. Trench Depth:

1. The trench shall be excavated to a minimum of six (6) inches below pipe grade as noted on LFUCG RMP Standard Drawings.

3.03 FORCE MAIN BEDDING

A. Refer to LFUCG Standard Drawings.

B. The trench shall be excavated to a depth to allow a minimum of 36 inches cover over the top of the pipe.

3.04 FORCE MAIN BACKFILLING

A. Refer to LFUCG Standard Drawings.

3.05 GRAVITY SEWER PIPE BEDDING

A. Refer to LFUCG Standard Drawings.

3.06 BACKFILLING

A. Refer to LFUCG Standard Drawings.

B. The required wet well connector piping backfill is dependent on the selected DIP Class by the Contractor. If the Contractor selects, Class 55 DIP (thickness of 0.59-inches), the required backfill is an ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51

Standard Laying Conditions, Trench Type 4. Should the Contractor select Class 200 DIP (thickness of 0.38-inches), the required backfill is an ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51 Standard Laying Conditions, Trench Type 5.

C. GRAVITY SEWER connector pipe shall be ductile iron pipe.

3.07 INSTALLING IDENTIFICATION TAPE

A. Detectable underground marking tape shall be installed over pipes (gravity sewers and force mains). Care shall be taken to ensure that the buried marking tape is not broken when installed and shall be Lineguard brand or equal encased aluminum foil, Type III. The identification tape is manufactured by Lineguard, Inc., P.O. Box 426, Wheaton, IL 60187 or equal.

B. The identification tape shall bear the printed identification of the plastic utility line below it, such as "Caution – Buried Below". Tape shall be reverse printed; surface printing will not be acceptable. The tape shall be visible in all types and colors of soil and provide maximum color contrast to the soil. The tape shall meet the APWA color code and shall be two (2) inches in width. Colors are green for sewer and brown for force main.

END OF SECTION

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SECTION 02240
DEWATERING

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor and equipment required to dewater all excavations.

B. Dewatering of all excavations shall be the responsibility of the Contractor, and no additional compensation will be allowed for same.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 GENERAL

A. Dewatering equipment shall be of adequate size and quantity to assure maintaining proper conditions for installing pipe, concrete, backfill or other material or structure in the excavation.

B. Dewatering shall include proper removal of any and all liquid, regardless of its source, from the excavation.

C. The site shall be kept free of surface water at all times. The Contractor shall install drainage ditches, dikes and shall perform all pumping and other work necessary to divert or remove rainfall and all other accumulations of surface water from the excavations. The diversion and removal of surface water shall be performed in a manner that will prevent flooding and/or damage to other locations within the construction area where it may be detrimental.

D. The Contractor shall provide, install and operate sufficient trenches, sumps, pumps, hose piping, well points, deep wells, etc., necessary to depress and maintain the ground water level below the base of the excavation during all stages of construction operations.

E. No groundwater from the excavated area shall be discharged into the sanitary sewer system.

F. Dewatering shall be in accordance with all state and local regulations/permits/plans.

G. Trench shall be dewatered as required and never shall the trench accumulate groundwater to a depth that will cause pipe to float.

END OF SECTION

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SECTION 02260
EXCAVATION SUPPORT AND PROTECTION

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. This Section includes, but is not limited to, the following:

1. Shoring and bracing necessary to protect existing buildings, streets, walkways, utilities, and other improvements and excavation against loss of ground or caving embankments. A shoring submittal is required as part of the wet well connector piping excavation.

2. Maintenance of shoring and bracing.

3. Removal of shoring and bracing, as required.

B. Types of shoring and bracing systems include, but are not limited to, the following:

1. Steel H-section (soldier) piles.

2. Timber lagging.

3. Steel sheet piles.

4. Portable steel trench box.

C. Building excavation is specified in another Division 2 Section.

1.02 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.03 QUALITY ASSURANCE

A. Engineer Qualifications: A professional engineer legally authorized to practice in jurisdiction where Project is located, and experienced in providing successful engineering services for excavation support systems similar in extent required for this Project.

B. Supervision: Engage and assign supervision of excavation support system to a qualified professional engineer foundation consultant.

C. Regulations: Comply with codes and ordinances of governing authorities having jurisdiction.

D. Layout drawings for excavation support system shall be prepared by, or under the supervision of, a qualified professional engineer. System design and calculations must be acceptable to local authorities having jurisdiction.

1.04 JOB CONDITIONS

A. Before starting work, verify governing dimensions and elevations. Verify condition of adjoining properties. Take photographs to record any existing settlement or cracking of structures, pavements, and other improvements. Prepare a list of such damages, verified by dated photographs, and signed by Contractor and others conducting investigation.

B. Survey adjacent structures and improvements, employing qualified professional engineer, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

C. During excavation, resurvey benchmarks weekly, maintaining accurate log of surveyed elevations for comparison with original elevations. Promptly notify Engineer if changes in elevations occur or if cracks, sags, or other damage is evident.

1.05 EXISTING UTILITIES

A. Protect existing active sewer, water, gas, electricity and other utility services and structures.

B. Notify municipal agencies and service utility companies having jurisdiction. Comply with requirements of governing authorities and agencies for protection, relocation, removal, and discontinuing of services.

PART 2 – PRODUCTS

2.01 MATERIALS

A. General: Provide adequate shoring and bracing materials which will support loads imposed. Materials need not be new, but should be in serviceable condition.

B. Structural Steel: ASTM A 36.

C. Steel Sheet Piles: ASTM A 328.

D. Timber Lagging: Any species, rough-cut, mixed hardwood, nominal 3 inches thick, unless otherwise indicated.

E. Portable Steel Trench Box shall be OSHA approved.

PART 3 – EXECUTION

3.01 SHORING

A. Wherever shoring is required, locate the system to clear permanent construction and to permit forming and finishing of concrete surfaces. Provide shoring system adequately anchored and braced to resist earth and hydrostatic pressures.

B. Shoring systems retaining earth on which the support or stability of existing structures is dependent must be left in place at completion of work.

3.02 BRACING

A. Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move a brace, install new bracing prior to removal of original brace.

B. Do not place bracing where it will be cast into or included in permanent concrete work, except as otherwise acceptable to Engineer.

C. Install internal bracing, if required, to prevent spreading or distortion of braced frames.

D. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

E. Remove sheeting, shoring, and bracing in stages to avoid disturbance to underlying soils and damage to structures, pavements, facilities, and utilities.

F. Repair or replace, as acceptable to Engineer, adjacent work damaged or displaced through installation or removal of shoring and bracing work.

END OF SECTION

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SECTION 02370
EROSION AND SEDIMENT CONTROL

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, and equipment required for installing, maintaining, amending, and removing temporary soil erosion, sediment, and pollutant controls as shown in the Erosion and Sediment Control Plan or Stormwater Pollution Prevention Plan (hereinafter referred to generally as the SWPPP) and as specified herein and as required by the LFUCG Land Disturbance Permit, Chapter 16-Article X, Division 5 of the LFUCG Code of Ordinances, and the KPDES General Permit for Stormwater Discharges Associated with Construction Activities (KYR10).

B. The Contractor shall take all site management measures necessary to minimize erosion and contain sediment, construction materials (including excavation and backfill), and pollutants (such as chemicals, fuels, lubricants, bitumen, raw sewage, and other harmful waste) on the site, and prevent them from being discharged offsite or into or alongside any body of water or into natural or man-made conveyances leading thereto.

C. The Contractor shall at all times minimize land disturbance and the period of time that the disturbed area is exposed without stabilization practices. In "critical areas" (within 25 feet of a perennial or intermittent stream, wetland, sinkhole, inlet or other waterbody) erosion prevention measures such as working during dry periods, use of sediment controls, and use of erosion control mats/blankets, mulch, or straw blown in and stabilized with tackifiers or by treading, etc. shall be implemented on disturbed areas within 24 hours or "as soon as practical" after completion of disturbance/grading or following cessation of activities.

D. Temporary erosion controls include, but are not limited to sodding, mulching, seeding, providing erosion control blankets and turf reinforcement mats on all disturbed surfaces including waste area surfaces and stockpile and borrow area surfaces; covering small disturbed areas with tarps or other materials; scheduling work to minimize erosion; and providing diversion or interceptor ditches to minimize the discharge of sediment.

E. Temporary sedimentation controls include, but are not limited to, silt fences, rock check dams, berms, traps, barriers, fiber logs, storm drain inlet filters, and appurtenances on sloped surfaces to minimize the discharge of sediment.

F. Contractor is responsible for providing and maintaining effective temporary erosion and sediment control measures prior to and during construction or until final controls become effective and the site is stabilized in accordance with state and local requirements.

G. Prior to construction, the Contractor shall obtain an LFUCG Land Disturbance Permit and shall obtain coverage under the KPDES General Permit for Stormwater Discharges

Associated with Construction Activities (KYR10) (see Article 3.24 in this Section) if required. The Contractor shall be responsible for placement of pollutant, erosion, and sedimentation controls as shown in the Stormwater Pollution Prevention Plan (SWPPP) prior to excavation, fill, or grade work. If during the course of construction, the state and/or LFUCG determine additional controls are required, the Contractor shall furnish, install, and maintain additional seeding, mulch, blankets, sediment barriers, diversion or other ditches, and/or other controls as necessary to control pollution, erosion, and sedimentation to the satisfaction of the regulatory agency.

H. The Contractor shall inspect and repair all erosion and sedimentation controls as follows:

1. At least once every seven (7) calendar days, and

2. Within 24 hours after any rainfall event of 0.5 inch or greater (or 4 inches of snow or greater).

I. Final stabilization practices on those portions of the project where land disturbance activities have permanently ceased shall be initiated within fourteen (14) days of the date of cessation of land disturbance activities. Temporary stabilization for those portions of the project where land disturbance has temporarily ceased (e.g., temporary seeding, mulching, etc.) shall be initiated within fourteen (14) days of the date of cessation of land disturbance activities.

J. Erosion and Sediment Control prevention measures shall be installed prior to removal of vegetation, grading, and/or stripping of topsoil. The Contractor is responsible for preparing and submitting the Kentucky Division of Water Notice of Intent and attachments and obtaining state permit approval, if applicable, prior to the beginning of any construction activities.

1.02 PERMITS AND NOTIFICATION REQUIREMENTS

A. The Contractor is responsible to submit a Stormwater Pollution Prevention Plan (SWPPP) for inclusion with permit applications. The Contractor may elect one of the following options to meet this requirement:

1. Utilize the SWPPP (which includes the Erosion and Sediment Control Plan) provided in the Construction Drawings and prepared by the Owner's Engineer as a basis for an updated SWPPP, and take sole responsibility for updating and implementing the SWPPP, or

2. Provide a SWPPP, including an Erosion and Sediment Control Plan, prepared by a professional engineer licensed in the Commonwealth of Kentucky, meeting all of the requirements of KYR10, Chapter 11 of the LFUCG Stormwater Manual, and Chapter 16-Article X, Division 5 of the LFUCG Code of Ordinances.

B. If applicable (i.e., for projects with a disturbed area of one acre or more), the Contractor shall submit a KPDES Notice of Intent specifically for Construction Activities (NOI-

SWCA) and receive notification of coverage before beginning any site disturbance, and shall implement erosion, sediment, and pollution control measures as may be required by state, local and federal agencies. Contractor shall submit a signed Notice of Intent form and required attachments to the Division of Water at least seven (7) days prior to beginning of construction activity. See Article 3.24 in this Section for detailed requirements.

C. A Land Disturbance Permit shall be obtained from the Lexington-Fayette Urban County Government Division of Engineering. See Article 3.25 in this Section for detailed requirements.

D. The Contractor shall comply with all additional requirements of LFUCG. It is the Contractor's responsibility to provide evidence to the Owner that all permits, including those associated with construction across or along a stream channel, if applicable, have been obtained prior to initiation of construction. Some permits are obtained during the design phase of the project. Typically, they should be included in the contract documents.

1.03 RELATED WORK

A. Section 02371 – Stormwater Pollution Prevention Plan (SWPPP)

B. Section 02373 – Stream Restoration

PART 2 – PART 2 – PRODUCTS

2.01 MULCH

A. Mulch or erosion control blankets / turf reinforcement mats (see Section 2.08) shall be used as a soil stabilization measure for any disturbed area inactive (i.e., not undergoing grading or excavation) for 14 days or longer. Areas requiring stabilization during December through February shall receive only mulch held in place with bituminous material. Mulching, blankets, or mats shall be used whenever permanent or temporary seeding is used. The anchoring of mulch, blankets, and mats shall be in accordance with the Construction Drawings except all mulch placed in December through February shall be anchored with bituminous materials regardless of the slope. Permanent mulches or mats shall be used in conjunction with planting trees, shrubs, and other ground covers that do not provide adequate soil stabilization.

B. Straw shall come from wheat, rye, or barley and may be spread by hand or machine. Straw shall be anchored. Straw shall be applied at two tons per acre or 90 pounds per 1,000 square feet. Straw shall be free from weeds and coarse matter.

C. Wood chips are appropriate for areas with less than five percent slopes, and do not require tacking. Wood chips shall be applied at 270 cubic yards per acre or 6 cubic yards per 1,000 square feet and approximately 2 inches deep. Wood chips shall be treated

with 20 pounds of nitrogen per acre or shall be treated with 12 pounds slow-release nitrogen per ton to prevent nutrient deficiency in plants.

D. Bark chips or shredded bark are appropriate for areas with less than five percent slopes, and shall be applied at 70 cubic yards per acre or 1.5 to 2 cubic yards per 1,000 square feet and about one-half inch thick. Bark does not require additional nitrogen fertilizer.

E. Manufacturer's recommendations shall be followed during application of manufactured wood fiber and recycled paper sold as mulch materials applied in a hydroseeder slurry with binders/tackifiers. Recycled paper (newsprint) or wood fiber shall be mixed at 50 pounds per 100 gallons of water and applied according to manufacturer's recommendations and model of hydroseeder in use.

F. Liquid mulch binders/tackifiers shall be applied according to manufacturer's recommendations. Chemical soil stabilizers or soil binders/tackifiers/emulsions shall not be used alone. Recommended buffer distances between applied products and waterbodies shall be strictly followed.

G. Gravel or stone aggregate may be used in relatively small areas when incorporated into an overall landscaping plan. Before the gravel or crushed stone is applied, it shall be washed.

2.02 TEMPORARY SEED

A. Temporary seeding shall be used for soil stabilization when grades are not ready for permanent seeding, except during December through February. The seed shall be applied within 14 days after grading has stopped. Only rye grain or annual rye grass seed shall be used for temporary seeding.

2.03 PERMANENT SEED

A. Permanent seeding shall be applied within 14 days after final grade has been reached, except during December through February. Permanent seeding shall also be applied on any areas that will not be disturbed again for a year even if final grades have not been reached. The use of mulch and erosion control blanket or turf reinforcement matting with permanent seeding shall be in accordance with applicable sections of this Specification. "Seed mats" may be used for permanent seeding in accordance with manufacturers' recommendations.

B. Permanent seeding shall be used on disturbed areas where permanent, long-lived vegetative cover is needed to stabilize the soil and on rough graded areas that will not be brought to final grade for one year or more.

C. The area to be seeded shall be protected from excess run-on and runoff as necessary with diversions, grassed waterways, terraces, or sediment ponds.

D. Contractor shall use the following Permanent Seed Mix, with the following exceptions:

1. If a property owner landscaping agreement differs from this specification, the property owner landscaping agreement shall be followed on that property, or

2. The Construction Drawings identify a different seed mix.

The Permanent Seed Mix shall consist of the following mix spread at a rate of 5 pounds/1,000 square feet:

Common Name	%	lbs per 1,000 sq. ft.
Tall Fescue (turf type)	75	3.75
Annual Rye	15	0.75
Bluegrass	10	0.50
TOTAL	100%	5

E. Vegetative cover alone shall not be used to provide erosion control cover and prevent soil slippage on a soil that is not stable due to its structure, water movement, or excessive slope.

F. Permanent seeding may be done at any time except December through February.

G. Soil material shall be capable of supporting permanent vegetation and have at least 25 percent silt and clay to provide an adequate amount of moisture holding capacity. An excessive amount of sand will not consistently provide sufficient moisture for good growth regardless of other soil factors.

H. Fertilizer shall be applied at a rate determined by a soil test obtained by the Contractor. Fertilizer shall not be applied within 50 feet of a stream or other waterbody. Lime shall be applied at a rate of 100 pounds per 1,000 square feet or two tons per acre of agricultural ground limestone, unless soil test results indicate differently.

2.04 SOD

A. Sod shall be used for disturbed areas that require immediate vegetative cover, *e.g.*, the area surrounding a drop inlet in a grassed waterway, the design flow perimeter of a grassed waterway that will convey flow before vegetation can be established, and the inlet of a culvert. Sod may be installed throughout the year. "Seed mats" and seed with geotextiles may be used in place of sod when done in accordance with manufacturers' recommendations.

B. Contractor shall use tall fescue sod, unless another species is specified in the Construction Drawings or unless the property owner landscaping agreement differs from this specification.

C. Sod shall not be used to provide erosion control and prevent soil slippage on a soil that is not stable due to its structure, water movement, or excessive slope.

D. Sod shall be installed within 48 hours of digging and removal from the field. Sod should not be used on slopes steeper than 2H:1V. If it is to be mowed, installation should be on slopes no greater than 3H:1V.

E. Soil material shall be capable of supporting permanent vegetation and shall consist of at least 25 percent silt and clay to provide an adequate amount of moisture holding capacity. An excessive amount of sand will not consistently provide sufficient moisture for the sod regardless of other soil factors.

F. Fertilizer shall be applied at a rate determined by a soil test obtained by the Contractor. Fertilizer shall not be applied within 50 feet of a stream or other waterbody. Lime shall be applied at a rate of 100 pounds per 1,000 square feet or two tons per acre of agricultural ground limestone, unless soil test results indicate differently.

G. The sod shall consist of strips of live, vigorously growing grasses. The sod shall be free of noxious and secondary noxious weeds and shall be obtained from good, solid, thick-growing stands. The sod shall be cut and transferred to the job in the largest continuous pieces that will hold together and are practical to handle.

H. The sod shall be cut with smooth clean edges and square ends to facilitate laying and fitting. The sod shall be cut to a uniform thickness of not less than three-fourth inch measured from the crown of the plants to the bottom of the sod strips for all grasses except bluegrass. Bluegrass sod shall be cut to a uniform thickness of not less than one and one-half inches.

I. The sod shall be mowed to a height of not less than two inches and no more than four inches prior to cutting.

J. The sod shall be kept moist and covered during hauling and preparation for placement on the sod bed.

K. Sod shall be kept watered after installation until the project is considered substantially complete.

2.05 ROAD/PARKING STABILIZATION

A. Gravel or paved material shall be used to stabilize permanent roads or parking areas or roads or parking areas used repeatedly by construction traffic. Stabilization shall be accomplished within 14 days of grading or initiation of use for construction traffic. Unstabilized roads are not acceptable except in instances where the road will be used less than one month.

B. Road/parking stabilization shall be used wherever roads or parking areas are constructed, whether permanent or temporary, for use by construction traffic.

C. Stabilization shall be accomplished with a minimum depth of six inches of crushed stone. Stabilized construction roadbeds shall be at least 14 feet wide for one-way traffic and at least 20 feet wide for two-way traffic.

D. Temporary roads shall follow the contour of the natural terrain to the extent possible. Slopes shall not exceed 10 percent.

E. Temporary parking areas shall be located on naturally flat areas to minimize grading. Grades shall be sufficient to provide drainage but shall not exceed 4 percent.

F. All cuts and fills shall be 2H:1V or flatter.

G. Drainage ditches shall be provided as needed.

H. Crushed stone shall be KYTC aggregate No. 2 (1.5 to 3 inches in diameter), or equivalent.

2.06 CONSTRUCTION ENTRANCE

A. A stabilized construction entrance shall be constructed wherever vehicles are leaving a construction site to enter a public road or at any unpaved entrance/exit location where there is a risk of transporting mud or sediment onto paved roads. A construction entrance shall be constructed at the beginning of the project before construction traffic begins to enter and exit the site.

B. A stabilized construction entrance shall be constructed of crushed stone a minimum of 6 inches thick laid over geotextile (filter fabric).

C. The width shall be at least 20 feet. At sites where traffic volume is high, the entrance shall be wide enough for two vehicles to pass safely. The length shall be at least 50 feet, and where practical, shall be extended to 100 feet. The entrance shall be flared where it meets the existing road to provide a turning radius.

D. Stormwater and wash water runoff from a stabilized construction entrance shall drain to a sediment trap or sediment pond. If conditions on the site are such that the majority of the mud is not removed by the vehicles traveling over the gravel, then the tires of the vehicles shall be washed before entering a public road.

E. Pipe placed under the entrance to handle runoff shall be protected with a mountable berm.

F. Dust control shall be provided in accordance with the applicable sections of this Specification.

G. Crushed stone shall be KYTC aggregate No. 2 (1.5 to 3 inches in diameter), or equivalent.

H. Geotextile filter fabric shall be KYTC Type III.

2.07 DUST CONTROL

A. Dust control measures shall be implemented on the site.

B. Construction activities shall be phased to minimize the total area unstabilized at any given time, thereby reducing erosion due to air and water movement.

C. Construction roads shall be watered as needed to minimize dust.

D. Existing trees, shrubs, and ground cover shall be retained as long as possible during the construction. Initial land clearing should be conducted only in those areas to be regraded or where construction is to occur. Areas to be cleared only for new vegetation or landscaping shall be stabilized with seed and mulch immediately following clearing.

E. Vegetative cover is the most effective means of dust and erosion control, when appropriate. See sections on Temporary Seed, Permanent Seed, Mulch, and Sod of this Specification.

F. When areas have been regraded and brought to final grade, they shall be stabilized using temporary or permanent seed and mulch or other measures.

G. Mulch with mulch binders may be used as an interim dust control measure in areas where vegetation may not be appropriate.

H. See sections on Temporary Seed, Permanent Seed, Sod, Mulch, Road/Parking Stabilization, and Construction Entrance of this Specification.

2.08 EROSION CONTROL BLANKETS AND TURF REINFORCEMENT MATS

A. Mulch netting, erosion control blankets (ECBs), or turf reinforcement matting (TRM) shall be used on sloping areas as indicated in the Construction Drawings. Mats or nets and permanent seeding may be used as an alternate to sod for culvert entrances and grassed waterways when selected and installed in accordance with manufacturer's recommendations. TRMs shall be used at the water line to control toe erosion along stream banks and wave action in wet ponds. Erosion control blankets may be used to stabilize small ditches and swales and on recently planted slopes to protect seedlings until they become established.

B. Effective ECB and TRM installation shall require firm, continuous contact between the materials and the soil. If there is no contact, the material will not hold the soil and erosion will occur underneath the material.

C. ECBs or TRMs shall be used in critical areas such as banks along waterways where concentrated flows are expected. Manufacturer's specifications shall be followed.

D. ECBs, TRMs, and netting shall be suitable for their intended purpose and shall be used as indicated in the Construction Drawings.

E. The ECB shall have a minimum useful life span of two (2) years. The material shall consist of interlocking, curled wood fibers and be capable of withstanding shear stresses up to 2.25 pounds per square foot and a velocity of nine (9) feet per second. The acceptable ECB shall be Curlex II as manufactured by American Excelsior Company or approved equal.

F. Product Documentation

The manufacturer shall provide the Engineer or other designated party with the QA/QC certifications for each shipment of ECB/TRM. The certification shall be signed by a responsible party employed by the manufacturer such as the QA/QC Manager, Production Manager, or Technical Services Manager. The QA/QC certifications shall include:

1. ECB/TRM lot and roll numbers (with corresponding shipping information)

2. Manufacturer's test data for raw materials used in the production.

3. Manufacturer's test data for finished production.

G. Product Labeling

1. Prior to shipment, the Manufacturer shall affix a label to each roll identifying the following characteristics:

2. Product identification information (manufacturer name and address, brand name, product code)

3. Lot number and roll number

4. Roll length and width

5. Total roll weight.

H. Packaging

1. The ECB/TRM shall be wound around a cardboard core to facilitate handling. The core is not intended to support the roll for lifting but should be sufficiently strong to prevent collapse during transit.

2. All rolls shall be labeled and bagged in packaging that is resistant to photodegradation by ultraviolet light.

I. The Contractor shall furnish the following to the Engineer:

1. Manufacturer's quality assurance/quality control certifications for each shipment to verify that the materials supplied for the project are in accordance with the requirements of this specification.

2. Manufacturer's warranty covering materials and workmanship.

2.09 TEMPORARY DIVERSION DITCH

A. Temporary diversion ditches shall be used to collect sediment-laden runoff from disturbed areas and direct it to a sediment pond where applicable. Temporary ditches are those expected to be in use for less than one year. Temporary diversion and/or other ditches require stabilization, with seed, blankets, mats, or mulch.

B. Temporary diversion ditches shall have stable outlets. The combination of conditions of site, slopes, and soils should be so that the ditch can be maintained throughout its planned life.

C. Temporary diversion ditches shall not be constructed below high sediment-producing areas unless land treatment practices or structural measures, designed to prevent damaging accumulations of sediment in the channels, are installed with or before the diversion.

D. A typical diversion cross section consists of a channel and a supporting ridge. In the case of an excavated-type diversion, the natural ground serves as the diversion ridge. Diversion cross sections shall be adapted to the equipment that will be used for their construction and maintenance.

E. The channel may be parabolic or trapezoidal in shape. V-shaped ditches shall not be constructed.

F. Diversions shall be located so that water will empty onto an established area such as a stable watercourse, waterway, or structure.

G. Any high sediment-producing area above a diversion shall be controlled by good land use management or by structural measures to prevent excessive sediment accumulation in the diversion channel.

H. Temporary diversions above steep slopes or across graded rights-of-way shall have a berm with a minimum top width of 2 feet, side slopes of 2:1 or flatter and a minimum height of 18 inches measured from the channel bottom.

I. Diversions installed to intercept flow on graded rights-of-way shall be spaced 200 to 300 feet apart.

J. A level lip spreader shall be used at diversion outlets discharging onto areas already stabilized by vegetation.

2.10 LEVEL SPREADER

A. Level spreaders shall be constructed at the outlets of temporary diversion ditches if they discharge to landscaped areas. Level spreaders shall also be constructed at outlets of permanent constructed waterways where they terminate on undisturbed areas.

B. The length of the level spreader shall be constructed as shown on the Construction Drawings.

2.11 PERMANENT CONSTRUCTED WATERWAY

A. Permanent constructed waterways shall be used to divert stormwater runoff from upland undisturbed areas around or away from areas to be disturbed during construction. A waterway expected to be in place for at least one year shall be considered permanent. Permanent waterways shall be lined with sod or permanent seeding and nets, ECBs, or TRMs.

2.12 PIPE SLOPE DRAIN

A. Pipe slope drains shall be used whenever it is necessary to convey water down a steep slope, which is not stabilized or which is prone to erosion, unless a paved ditch (flume) is installed.

B. Contractor shall use a 10-inch diameter pipe or larger to convey runoff from areas up to one-third acre; 12-inch or larger pipe for up to half-acre drainage areas; and 18-inch pipe for areas up to one acre, unless otherwise specified in the Construction Drawings. Multiple pipes shall be required for large areas, spaced as shown on the Construction Drawings.

C. The pipe shall be heavy duty flexible tubing designed for this purpose, *e.g.*, non-perforated, corrugated plastic pipe, or specially designed flexible tubing.

D. A standard flared end section or a standard T-section fitting secured with a watertight fitting shall be used for the inlet.

E. Extension collars shall be 12-inch long sections of corrugated pipe. All fittings shall be watertight.

2.13 IMPACT STILLING BASIN

A. Impact stilling basins or armoring shall be used at the outlet of culverts and storm sewers with calculated exit velocities greater than 15 feet per second when flowing full.

2.14 CHECK DAM

A. Check dams shall be limited to use in small, open channels that drain 10 acres or less.

B. Check dams shall not be used in streams.

C. Check dams can be constructed of stones, coir logs, or wood fiber logs.

D. If used, check dams shall be constructed prior to the establishment of vegetation.

E. The maximum height at the center of a check dam shall be three feet above the ground on which the rock is placed.

F. The center of the portion of the check dam above the flat portion of the channel shall be at least 1 foot lower than the outer edges. The outer edges of the check dam shall extend up the side slopes of the channel to a point 3 feet in elevation above the center portion of the check dam or to the top of the side slopes.

G. The maximum spacing between rock check dams in a ditch should be such that the toe of the upstream dam is at the same elevation as the top of the next downstream dam.

H. The spacing of coir and wood fiber check dams is one log every 100 feet for velocities of 5 fps, 50 feet for velocities between 5 and 7.5 fps, and 25 feet for velocities greater than 10 fps, unless otherwise shown in the Construction Documents.

I. Stone check dams shall be constructed of KYTC Class II channel lining.

J. Coir log or wood fiber log check dams shall be constructed of a single log with a diameter of at least 20 inches.

2.15 SEDIMENT TRAP

A. Sediment traps shall be installed below all disturbed areas of less than 5 acres that do not drain to a sediment pond.

B. Erosion control practices such as seeding, mulching, sodding, diversion dikes, etc., shall be used in conjunction with sediment traps to reduce the amount of sediment flowing into the trap. The amount of sediment entering a trap can be reduced by the use of stabilized diversion dikes and ditches.

C. The trap shall not be located in a stream. It shall be located to trap sediment-laden runoff before it enters the stream.

D. Trap depth shall be at least 2 feet at the inlet and 4 feet at the outlet. Effective trap width shall be at least 10 feet and trap length shall be at least 30 feet. Containment berms of earth or rock may be used. High velocity areas (e.g., overflows) shall be armored with rock, TRMs, or other suitable material.

E. The Construction Drawings shall indicate the final disposition of the sediment trap after the upstream drainage area is stabilized. The Construction Drawings shall indicate methods for the removal of excess water lying over the sediment, stabilization of the pond site, and the disposal of any excess material.

2.16 SEDIMENT POND

A. A sediment pond shall be installed at the outlet of a disturbed area of 5 acres or more. The maximum drainage area for a single pond is 100 acres.

B. Design and construction shall comply with all federal, state, and local laws, ordinances, rules, and regulations regarding dams.

C. Erosion control practices such as seeding, mulching, sodding, diversion dikes, etc., shall be used in conjunction with sediment ponds to reduce the amount of sediment flowing into the pond.

D. The pond shall not be located in a stream. It shall be located to trap sediment-laden runoff before it enters the stream.

E. Contractor shall construct the sediment pond as shown on the Construction Drawings.

F. Permanent ponds designed for stormwater detention or water quality treatment may serve as temporary sediment ponds if site conditions make the use of these structures desirable. At the time of conversion from a sediment pond to a permanent stormwater management pond, excess sediment shall be cleaned from the pond. If the pond is converted to a water quality basin, the sand in the sand filter outlet shall be replaced with clean sand unless it is shown to be clean.

G. The Construction Drawings shall indicate the final disposition of the sediment pond after the upstream drainage area is stabilized. The Construction Drawings shall indicate methods for the removal of excess water lying over the sediment, stabilization of the pond site, and the disposal of any excess material.

H. Vegetation shall be established upon completion of construction of the embankment, emergency spillway and other areas disturbed by construction.

2.17 SILT FENCE

A. Silt fence shall be installed down-slope of areas to be disturbed prior to clearing and grading. Silt fence shall be situated such that the total area draining to the fence is not greater than one-fourth acre per 100 feet of fence. Silt fence shall be used for storm drain drop inlet protection and around soil stockpiles.

B. Under no circumstances shall silt fences be constructed in streams or in swales or ditch lines or any area of concentrated flow.

C. Synthetic filter fabric shall be a pervious sheet of propylene, nylon, and polyester or ethylene yarn and shall be certified by the manufacturer or supplier as conforming to the following requirements:

PHYSICAL PROPERTY	REQUIREMENTS
Filtering Efficiency	80% (minimum)
Tensile Strength at 20%	50 pounds/linear inch (minimum)
Flow Rate	0.3 gallons/square foot/minute (minimum)

D. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0°F to 120°F.

E. Posts for synthetic fabric silt fences shall be either 2-inch by 2-inch wood or 1.33 pounds per linear foot steel with a minimum length of 5 feet. Steel posts shall have projections for fastening wire to them. Posts shall be no more than 6 feet apart.

F. Wire fence reinforcement for silt fences shall be a minimum of 36 inches in height, a minimum of 14 gauge and shall have a mesh spacing of no greater than 6 inches.

2.18 STORM DRAIN INLET PROTECTION

A. Storm drain inlet protection shall be utilized on drop inlets and curb inlets that receive sediment-laden runoff from disturbed areas.

B. Storm drain inlet protection shall only be used around drop inlets when the up-slope area draining to the inlet has no other or inadequate sediment control.

C. The drainage area shall be no greater than 1 acre.

D. The inlet protection device shall be constructed in a manner that will facilitate cleanout and disposal of trapped sediment and minimize interference with construction activities.

E. Inlet protection devices shall be constructed in such a manner that any resultant ponding of stormwater will not cause flooding or excessive inconvenience or damage to adjacent areas, roadways, properties, or structures.

F. Inlet protection devices are low flow filter devices, and as such shall be constructed in such a manner as to allow for higher flows to bypass into the storm drain system to prevent flooding of the roadway or downstream properties.

2.19 FILTER STRIP

A. Filter strips shall be used on each side of permanent constructed channels.

B. Filter strips shall only be used to remove sediment from overland flow. Filter strips are not effective in removing sediment from concentrated flows.

C. If vegetative filters are proposed as a sediment control device and they do not already exist, they shall be planted and established prior to initiating land disturbing activities.

D. The minimum filter strip width shall be 50 feet for streams, wetlands, and sinkholes. The minimum filter strip width shall be ten feet for constructed waterways.

E. Where a post development floodplain or wet weather conveyance is being protected, filter strips shall be provided on each side. When a wetland or sinkhole is being protected, filter strips shall be provided around the perimeter.

F. Contractor shall construct the filter strips as shown on the Construction Drawings.

G. Existing grass or grass/legume mixtures used as filter strips shall be dense and well established, with no bare spots. When establishing new seeding, consideration shall be given to wildlife needs and soil conditions on the site. The following chart provides a list of alternative grass and grass/legume mixtures:

SEEDING MIXTURE AND SITE SUITABILITY CHART

Seeding Mixture	Rate lbs/acre	Soil Suitability
Alfalfa *Or* Red Clover *Plus* Timothy *Or* Orchardgrass *Or* Bromegrass	10 10 4 6 6	Well-Drained
Ladino *Plus* Timothy *Or* Orchardgrass *Or* Bromegrass	0.5 4 6 8	Wet or Well-Drained

Notes:

1. All seeding shall be in accordance with the seeding sections of this Specification.

2. Well-drained sites include sites that are drained with tile as well as naturally well-drained and droughty sites. Wet sites include sites that are excessively wet only a portion of the growing season

2.20 STREAM CROSSING

A. Stream crossings shall be used in cases where construction traffic, permanent traffic, or utilities must cross existing post development floodplains. If the drainage area exceeds 1 square mile and a structure is necessary, the structure shall be designed by a professional engineer licensed in Kentucky, and shall be considered a permanent structure. Stream crossings shall be as close to perpendicular to the stream flow as possible.

B. Temporary stream crossings are applicable to flowing streams with drainage areas less than one square mile. Temporary stream crossings shall be planned to be in service for the shortest practical period of time and to be removed as soon as their function is completed.

C. All such structures, whether temporary or permanent, are subject to the rules and regulations of the U.S. Army Corps of Engineers for in-stream modifications (404 Permitting) and the Kentucky Division of Water (401 Certification). No stream crossing shall be installed without first obtaining all applicable local, state, and federal permits.

   Where culverts are to be installed, compacted soil or rock shall be used to form the crossing. The depth of soil or rock cover over the culvert shall be equal to one-half the diameter of the culvert or 12 inches, whichever is greater. The sides of the fill shall be protected from erosion using the mulching and seeding erosion control measures specified in this Specification.

D. All stream crossings shall be constructed in such a manner as to avoid flooding or excessive inconvenience or damage to adjacent areas, roadways, properties, or structures.

E. When using a culvert crossing, the top of the compacted earth fill shall be covered with at least six inches of KYTC No. 2 stone.

F. KYTC No. 2 stone shall also be used for the stone pads forming the crossing approaches.

2.21 PUMP-AROUND FLOW DIVERSION

A. A pump-around flow diversion shall be used to divert flow around construction activities occurring in a stream when those activities are reasonably expected to cause the erosion of sediment or deposition of sediment in the stream.

B. Check dams to form the diversion shall span the banks of the stream. Maintain 1-foot freeboard (minimum) on the upstream and downstream checks.

C. Check dams may be constructed of sandbags or may be a water-filled bladder such as an Aqua-Barrier.

D. The dewatering flow from the work area shall be treated in a sediment-trapping device prior to discharge to the stream.

E. Sandbags shall be woven polypropylene bags with approximate dimensions of 18-1/2 inches by 28 inches. Contractor shall tie the ends of filled bags closed using either draw strings or wire ties.

2.22 CONSTRUCTION DEWATERING

A. Sediment-laden water shall be pumped to a dewatering structure before it is discharged.

PART 3 – PART 3 – EXECUTION

3.01 GENERAL

A. Erosion and sediment control practices shall be consistent with the requirements of Chapter 11 of the LFUCG Stormwater Manual and other state and local regulatory agencies and in any case shall be adequate to minimize erosion of disturbed and/or regraded areas and discharge of sediment from the site.

B. Contractor is responsible for notifying and obtaining coverage from the Kentucky Division of Water concerning inclusion under the KPDES General Permit for Stormwater Discharges Associated with Construction Activities.

C. Gravity sewer lines, force mains, and water lines that cross streams shall be constructed by methods that maintain normal stream flow and allow for a dry excavation. Water pumped from the excavation shall be contained and allowed to settle prior to reentering the stream, or filtered through a sediment removal device. Excavation equipment and vehicles shall operate outside of the flowing portion of the stream. Spoil material from the line excavation shall not be allowed to enter the flowing portion of the stream. Clean Water Act Section 401 and 402 requirements enforced by the US Army Corps of Engineers and the Kentucky Division of Water and the provisions of this condition shall apply to all types of utility line stream crossings.

D. Removal of riparian vegetation in the utility line right-of-way shall be limited to that necessary for equipment access. Effective erosion and sedimentation control measures shall be employed at all times during the project to prevent degradation of Waters of the Commonwealth. Site regrading and reseeding shall be accomplished with 14 days after disturbance.

3.02 MULCH

A. Seed shall be applied prior to mulching except where seed is to be applied as part of a hydroseeder slurry containing mulch.

B. Lime and fertilizer (where needed) shall be incorporated and surface roughening accomplished as needed prior to mulching in accordance with applicable sections of this Specification.

C. Mulch materials shall be spread uniformly by hand or mechanically so the soil surface is covered. During or immediately following application, the mulch shall be anchored or otherwise secured to the ground according to one of the following methods:

1. Mechanical – Use a disk, crimper, or similar type tool set straight to punch or anchor the mulch material into the soil.

2. Mulch Tackifiers/Nettings/Emulsions – Use according to the manufacturer's recommendations. This is a superior method in areas of water concentration to hold mulch in place.

3. Wood Fiber – Wood fiber hydroseeder slurries may be used to tack straw mulch. This combination treatment is well suited to steep slopes and critical areas, and severe climate conditions.

D. Mulch shall be anchored using a mulch anchoring tool, a liquid binder/tackifier, or mulch nettings. Nets and mats shall be installed to obtain firm, continuous contact between the material and the soil. Without such contact, the material is useless and erosion occurs.

E. A mulch anchoring tool is a tractor-drawn implement that is typically used for anchoring straw and is designed to punch mulch approximately two inches into the soil surface. Machinery shall be operated on the contour and shall not be used on slopes steeper than 3H:1V.

F. When using liquid mulch binders and tackifiers, application shall be heaviest around edges of areas and at crests of ridges and banks to prevent wind blow. Remainder of area shall have binders/tackifiers spread uniformly in accordance with manufacturer's recommendations.

G. When using a mulch net, it shall be used in conjunction with an organic mulch and shall be installed immediately after the application and spreading of the mulch

H. Erosion control blankets and turf reinforcement mats are considered protective mulches and may be used alone on erodible soils and during all times of year. Blankets and mats shall be installed in accordance with manufacturer's recommendations.

I. Mulched areas shall be inspected at least weekly and after each rainfall of one-half inch or more. When mulch material is found to be loosened or removed, the mulch cover shall be replaced within 48 hours.

3.03 TEMPORARY SEED

A. The site shall be graded as needed to permit the use of conventional equipment for seedbed preparation, seeding, mulch application, and anchoring.

B. The needed erosion control practices, such as diversions, temporary waterways for diversion outlets, and sediment ponds, shall be installed prior to seeding.

C. Prior to seeding, lime and fertilizer (if needed) shall be worked into the soil with a disk harrow, springtooth harrow, or similar tools to a depth of two inches. On sloping areas, the final operation shall be on the contour.

D. The seed shall be applied uniformly with a cyclone seeder, drill, cultipacker, seeder, or hydroseeder (slurry may include seed and fertilizer) preferably on a firm, moist seedbed. Seed shall be sown no deeper than one-fourth inch to one-half inch.

E. The seedbed shall be firmed following seeding operations with a cultipacker, roller, or light drag.

F. On sloping land, seeding operations shall be on the contour wherever possible.

G. Mulch shall be applied, in the amounts described in the mulch section of this Specification, to protect the soil and provide a better environment for plant growth.

H. New seed shall have adequate water for growth, through either natural means or irrigation, until plants are firmly established.

I. Seeded areas shall be inspected at least weekly after planting and after each rainfall of one-half inch or more. Areas requiring additional seed and mulch shall be repaired within 48 hours.

J. If vegetative cover is not established within 21 days, the area shall be reseeded.

3.04 PERMANENT SEED

A. During site preparation, topsoil shall be stockpiled for use in establishing permanent vegetation.

B. The site shall be graded as needed to permit the use of conventional equipment for seedbed preparation, seeding, mulch application, and anchoring.

C. The needed erosion control practices, such as diversions, temporary waterways for diversion outlets, and sediment ponds, shall be installed prior to seeding.

D. Prior to seeding, lime and fertilizer shall be worked into the soil with a disk harrow, springtooth harrow, or similar tools to a depth of four inches. On sloping areas, the final operation shall be on the contour.

E. Where compacted soils occur, they shall be broken up sufficiently to create a favorable rooting depth of six to eight inches.

F. The seed shall be applied uniformly with a cyclone seeder, drill, cultipacker, seeder, or hydroseeder (slurry may include seed and fertilizer) preferably on a firm, moist seedbed. Seed shall be sown no deeper than one-fourth inch to one-half inch.

G. The seedbed shall be firmed following seeding operations with a cultipacker, roller, or light drag.

H. On sloping land, seeding operations shall be on the contour wherever possible.

I. Mulch shall be applied, in the amounts described in the mulch section of this Specification, to protect the soil and provide a better environment for plant growth.

J. New seed shall have adequate water for growth, through either natural means or irrigation, until plants are firmly established.

K. Seeded areas shall be inspected at least weekly after planting and after each rainfall of 0.5 inches or more. Areas requiring additional seed and mulch shall be repaired within 48 hours.

L. If vegetative cover is not established (>70%) within 21 days, the area shall be reseeded. If 40 to 70 percent groundcover is established, overseed and fertilize, using half of rates originally applied, and mulch. If less than 40 percent groundcover is established, follow original seedbed preparation methods, seeding and mulching specifications, and apply lime and fertilizer if needed according to soil tests.

3.05 SOD

A. The area to be sodded shall be protected from excess runoff, as necessary, with appropriate BMPs.

B. Prior to sodding, the soil surface shall be cleared of all trash, debris, and stones larger than one inch in diameter, and of all roots, brush, wire, and other objects that would interfere with the placing of the sod.

C. Compacted soils shall be broken up sufficiently to create a favorable rooting depth of six to eight inches.

D. Lime and fertilizer (if needed) shall be worked into the soil with a disk harrow, springtooth harrow, or other suitable field equipment to a depth of four inches.

E. After the lime and fertilizer have been applied and just prior to the laying of the sod, the soil in the area to be sodded shall be loosened to a depth of one inch. The soil shall be thoroughly dampened immediately after the sod is laid if it is not already in a moist condition.

F. No sod shall be placed when the temperature is below 32°F. No frozen sod shall be placed nor shall any sod be placed on frozen soil.

G. When sod is placed during the periods of June 15 to September 1 or October 15 to March 1, it shall be covered immediately with a uniform layer of straw mulch approximately one-half inch thick or so the green sod is barely visible through the mulch.

H. Sod shall be carefully placed and pressed together so it will be continuous without any voids between the pieces. Joints between the ends of strips shall be staggered.

I. On gutter and channel sodding, the sod should be carefully placed on rows or strips at right angles to the centerline of the channel (*i.e.*, at right angles to the direction of flow). The edge of the sod at the outer edges of all gutters shall be sufficiently deep so that surface water will flow over onto the top of the sod.

J. On steep graded channels, each strip of sod shall be staked with at least two stakes not more than 18 inches apart.

K. On slopes 3H:1V or steeper, or where drainage into a sod gutter or channel is one-half acre or larger, the sod shall be rolled or tamped and then chicken wire, jute, or other netting shall be pegged over the sod for protection in the critical areas. The netting and sod shall be staked with at least two stakes not more than 18 inches apart. The netting shall be stapled on the side of each stake within two inches of the top of the stake. The stake should then be driven flush with the top of the sod.

L. When stakes are required, the stakes shall be wood and shall be approximately ½ inch by ¾ inch by 12 inches. They shall be driven flush with the top of the sod with the flat side against the slope and on an angle toward the slope.

M. Sod shall be tamped or rolled after placing and then watered. Watering shall consist of a thorough soaking of the sod and of the sod bed to a depth of at least 4 inches. The sod should be maintained in a moist condition by watering for a period of 30 days.

N. In the absence of adequate rainfall, watering shall be performed daily or as often as necessary during the first week to maintain moist soil to a depth of 4 inches. Watering shall be done during the heat of the day to prevent wilting. After the first week, sod shall be watered as necessary to maintain adequate moisture content.

O. The first mowing of sod shall not be attempted until the sod is firmly rooted. No more than one-third of the grass leaf shall be removed by the initial and subsequent cuttings. Grass height shall be maintained between 2 inches and 3 inches.

P. Where sod does not establish properly, the sod should be replaced immediately. Areas requiring resodding should be prepared in the same manner as the original installation.

3.06 ROAD/PARKING STABILIZATION

A. The roadbed or parking surface shall be cleared of all vegetation, roots, and other objectionable material.

B. All roadside ditches, cuts, fills, and disturbed areas adjacent to parking areas and roads shall be stabilized with appropriate temporary or permanent vegetation according to the applicable sections of this Specification.

C. Geotextile filter fabric shall be applied beneath the stone for additional stability in accordance with fabric manufacturer's specifications.

D. Both temporary and permanent roads and parking areas may require periodic top dressing with new gravel. Seeded areas adjacent to the roads and parking areas shall be checked regularly to ensure that a vigorous stand of vegetation is maintained. Roadside ditches and other drainage structures shall be checked once each week to ensure that they do not have silt or other debris that reduces their effectiveness.

3.07 CONSTRUCTION ENTRANCE

A. Vegetation, roots, and all other obstructions shall be cleared in preparation for grading. Prior to placing geotextile (filter fabric), the entrance shall be graded and compacted to 80% of standard proctor density.

B. To reduce maintenance and loss of aggregate, the geotextile shall be placed over the existing ground before placing the stone for the entrance. Stone shall be placed to depth of 6 inches or greater for the entire width and length of the stabilized construction entrance.

C. If wash racks are used, they shall be installed according to manufacturer's specifications.

D. The stabilized construction entrance shall be inspected once each week and after there has been a high volume of traffic or a storm event greater than 0.2 inches.

E. The entrance shall be maintained in a condition that will prevent tracking or flow of sediments onto public rights-of-way. This may require periodic top dressing with additional stone, as conditions demand, and repair and/or cleanout of any structures used to trap sediment.

F. All materials spilled, dropped, washed, or tracked from vehicles onto roadways or into storm drains shall be removed immediately.

3.08 DUST CONTROL

A. See Articles on Temporary Seed, Permanent Seed, Sod, Mulch, Road/Parking Stabilization, and Construction Entrance of this Specification Section.

B. When construction is active on the site, dust control shall be implemented as needed.

C. When using tillage as a dust control measure, Contractor shall begin plowing on windward side of area. Chisel-type plows spaced about 12 inches apart, spring-toothed harrow, and similar plows are examples of equipment that may produce the desired effect.

D. The site shall be observed daily for evidence of windblown dust and reasonable steps shall be taken to reduce dust whenever possible. When construction on a site is inactive for a period, the site shall be inspected at least weekly for evidence of dust emissions or previously windblown sediments. Dust control measures shall be implemented or upgraded if the site inspection shows evidence of wind erosion.

3.09 EROSION CONTROL BLANKETS AND TURF REINFORCEMENT MATS

A. Blankets and mats shall be installed according to the manufacturer's recommendations. In the event that the manufacturer's recommendations conflict with any requirement of

this Specification, the most conservative requirement, in terms of protection of public health and the environment, shall govern.

B. Placement

1. The blankets and mats shall be unrolled in the direction of surface water flow.

2. When using two blankets or mats side by side, the seams shall not be placed in the center of a channel but shall be offset by a minimum of one (1) foot.

3. Blankets and mats shall be stapled in place using U-shaped staples of the size, and at the prescribed intervals and arrangement, specified by the manufacturer.

4. When blankets or mats are laid side by side, they shall be stapled so as to anchor the edge of each roll.

5. The overlap of blankets and mats shall be in accordance with the manufacturer's recommendations.

6. If blanket/mat is unrolled along (parallel) to the contour installation must begin at the lower elevation and progress up slope with the upper blanket overlapping the lower as with roofing shingles.

C. Damage Repair

1. The patch material used for the repair of a hole or tear shall be the same type of material as the damaged blanket/mat.

2. The patch shall extend at least 12 inches beyond any portion of the damaged blanket/mat.

3. The repair patch shall be stapled in place as per manufacturer's recommendations.

3.10 TEMPORARY DIVERSION DITCH

A. All dead furrows, ditches or other depressions to be crossed shall be filled before construction begins, or as part of construction, and the earth fill used to fill the depressions shall be compacted using the treads of the construction equipment. All old terraces, fencerows, or other obstructions that will interfere with the successful operation of the diversion shall be removed.

B. The base for the diversion ridge shall be prepared so that a good bond is obtained between the original ground and the fill material. Vegetation shall be removed and the base shall be thoroughly disked prior to placement of fill.

C. The earth materials used to construct the earth fill portions of the diversions shall be obtained from the diversion channel or other approved source.

D. The earth fill materials used to construct diversions shall be compacted by running the construction equipment over the fill in such a manner that the entire surface of the fill will be traversed by not less than one tread track of the equipment.

E. When an excess of earth material results from cutting the channel cross section and grade, it shall be deposited adjacent to the supporting ridge unless otherwise directed.

F. The completed diversion shall conform to the cross section and grade shown on the Construction Drawings.

G. Temporary or permanent seeding and mulch (or blanket/mat) shall be applied to the berm or ditch immediately following its construction. Contractor shall triple-seed areas below the flow line, and shall use erosion control blankets or turf reinforcement mats as needed.

H. Bare and vegetated diversion channels shall be inspected regularly to check for points of scour or bank failure; rubbish or channel obstruction; rodent holes, breaching, or settling of the ridge; and excessive wear from pedestrian or construction traffic.

I. Damaged channels or ridges shall be repaired at the time damage is detected. Sediment deposits shall be removed from diversion channels and adjoining vegetative filter strips regularly.

J. Diversions shall be reseeded as needed to establish vegetative cover.

3.11 LEVEL SPREADER

A. The minimum acceptable width shall be 6 feet. The depth of the level spreader as measured from the lip shall be at least 6 inches and the depth shall be uniform across the entire length of the measure.

B. The grade of the channel for the last 15 feet entering the level spreader shall be less than or equal to 1%.

C. The level lip of the spreader shall be constructed on zero percent grade to ensure uniform conversion of channel flow to sheet flow.

D. Level spreaders shall be constructed on undisturbed soil.

E. The entrance to the spreader shall be graded in a manner to ensure that runoff enters directly onto the zero percent graded channel.

F. Storm runoff converted to sheet flow shall discharge onto undisturbed areas stabilized with vegetation.

G. All disturbed areas shall be stabilized immediately after construction is completed in accordance with the mulching and vegetation requirements of this Specification.

H. The level spreader shall be inspected after each storm event and at least once each week. Any observed damage shall be repaired immediately.

3.12 PERMANENT CONSTRUCTED WATERWAY

A. All ditches or other depressions to be crossed shall be filled before construction begins or as part of construction, and the earth fill used to fill the depressions shall be compacted using the treads of the construction equipment. All old terraces, fence rows, or other obstructions that will interfere with the successful operation of the channel shall be removed.

B. The earth materials used to construct the earth fill portions of the channel shall be obtained from the excavated portion of the channel or other approved source.

C. The earth fill materials used to construct the channel shall be compacted by running the construction equipment over the fill in such a manner that the entire surface of the fill will be traversed by at least one tread track of the equipment.

D. The completed channel shall conform to the cross section and grade shown on the Construction Drawings.

E. Channels shall be inspected regularly to check for points of scour or bank failure; rubbish or channel obstruction; rodent holes; breaching; and excessive wear from pedestrian or construction traffic.

F. Channels shall be repaired at the time damage is detected. Sediment deposits shall be removed from adjoining vegetative filter strips when they are visible.

G. Channels shall be seeded and mulched as needed to establish vegetative cover. Blankets or mats may be used instead of mulch, according to manufacturer's specifications.

H. The subgrade of paved channels shall be constructed to the required elevations. All soft sections and unsuitable material shall be removed and replaced with suitable material. The subgrade shall be thoroughly compacted and shaped to a smooth, uniform surface. The subgrade shall be moist when pouring concrete.

I. Before permanent stabilization of the slope, the structure shall be inspected after each rainfall. Any damages to the paved channel or slope shall be repaired immediately.

3.13 PIPE SLOPE DRAIN

A. The pipe slope drain shall be placed on undisturbed or well-compacted soil.

B. Soil around and under the entrance section shall be hand-tamped in 4-inch to 8-inch lifts to the top of the dike to prevent piping failure around the inlet.

C. Filter fabric shall be placed under the inlet and extended 5 feet in front of the inlet and be keyed in 6 inches on all sides to prevent erosion.

D. Backfilling around and under the pipe with stable soil material hand compacted in lifts of 4 inches to 8 inches shall be done to ensure firm contact between the pipe and the soil at all points.

E. The pipe slope drain shall be secured to the slope using stakes at intervals of 10 feet or less.

F. All slope drain sections shall be securely fastened together and have watertight fittings.

G. The pipe shall be extended beyond the toe of the slope and discharged at a non-erosive velocity into a stabilized area or to a sediment trap or pond.

H. The pipe slope drain shall have a minimum slope of 3 percent or steeper.

I. The height at the centerline of the earth dike shall range from a minimum of 1.0 foot over the pipe to twice the diameter of the pipe measured from the invert of the pipe. It shall also be at least 6 inches higher than the adjoining ridge on either side. At no point along the dike will the elevation of the top of the dike be less than 6 inches higher than the top of the pipe.

J. All areas disturbed by installation or removal of the pipe slope drain shall be immediately stabilized.

K. The pipe slope drain shall be inspected after every rainfall and at least weekly. Any necessary repairs shall be made immediately.

L. Contractor shall check to see that water is not bypassing the inlet and undercutting the inlet or pipe. If necessary, Contractor shall install headwall or sandbags.

M. Contractor shall check for erosion at the outlet point and shall check the pipe for breaks or clogs. Contractor shall install additional outlet protection if needed and immediately repair the breaks and clean any clogs.

N. Contractor shall not allow construction traffic to cross the pipe slope drain and shall not place any material on it.

O. If a sediment trap has been provided, it shall be cleaned out when the sediment level reaches 1/3 the design volume.

P. The pipe slope drain shall remain in place until the slope has been completely stabilized or up to 30 days after permanent slope stabilization.

3.14 IMPACT STILLING BASIN

A. Construction specifications for impact stilling basins are provided in the Construction Drawings.

3.15 CHECK DAM

A. Stone shall be placed by hand or mechanically as necessary to achieve complete coverage of the ditch and to ensure that the center of the dam is at least 1 foot lower than the outer edges. Stone shall also be placed to extend 3 feet in elevation above the center portion of the check dam or to the top of the channel side slopes.

B. Coir and wood fiber logs shall be laid on the channel bottom.

C. Check dams shall be removed when their useful life has been completed. In temporary ditches and swales, check dams shall be removed and the ditch filled in when it is no longer needed. In permanent channels, check dams shall be removed when a permanent lining can be installed. In the case of grass-lined ditches, check dams shall be removed when the grass has matured sufficiently to protect the ditch or swale. The area beneath the check dams shall be seeded and mulched or sodded (depending upon velocity) immediately after check dams are removed.

D. If stone check dams are used in grass-lined channels that will be mowed, care shall be taken to remove all stone from the channel when the dam is removed. This shall include any stone that has washed downstream.

E. Regular inspections shall be made to ensure that the check dam is in good working order and the center of the dam is lower than the edges. Erosion caused by high flows around the edges of the dam shall be corrected immediately, and the dam shall be extended beyond the repaired area.

F. Check dams shall be checked for sediment accumulation after each rainfall. Sediment shall be removed before or when it reaches one-third of the original height.

G. Check dams shall remain in place and operational until the drainage area and channel are completely stabilized, or up to 30 days after the permanent site stabilization is achieved.

3.16 SEDIMENT TRAP

A. The area to be excavated shall be cleared of all trees, stumps, roots, brush boulders, sod, and debris. All channel banks and sharp breaks shall be sloped to no steeper than 1:1. All topsoil containing excessive amounts of organic matter shall be removed.

B. Seeding and mulching of the sediment trap berm and any material taken from the excavation shall comply with the applicable soil stabilization sections of this Specification.

C. Construction specifications for sediment traps are provided in the Construction Drawings.

D. Any material excavated from the trap shall be placed in one of the following ways so that it will not be washed back into the trap by rainfall:

1. uniformly spread to a depth not exceeding 3 feet and graded to a continuous slope away from the trap

2. uniformly placed or shaped reasonably well with side slopes assuming the natural angle of repose for the excavated material behind a berm width not less than 12 feet.

E. Sediment shall be removed from the trap when the capacity is reduced to one third of the design volume. Contractor shall follow the methods for disposing of sediment removed from the trap as shown in the Construction Drawings.

3.17 SEDIMENT POND

A. The foundation area shall be cleared of all trees, stumps, roots, brush boulders, sod, and debris. All channel banks and sharp breaks shall be sloped to no steeper than 1:1. All topsoil containing excessive amounts of organic matter shall be removed. The surface of the foundation area shall be thoroughly scarified before placement of the embankment material.

B. A cutoff trench shall be backfilled with suitable material. The trench shall be kept free of standing water during backfill operations.

C. The pipe conduit barrel shall be placed on a firm foundation. Selected backfill material shall be placed around the conduit in layers, and each layer shall be compacted to at least the same density as the adjacent embankment. All compaction within 2 feet of the pipe spillway shall be accomplished with hand-operated tamping equipment.

D. All borrow areas outside the pond and in the drainage area shall be graded and left in such a manner that water will not be ponded.

E. The material placed in the fill shall be free of all sod, roots, frozen soil, stones more than 6 inches in diameter, and other objectionable material. The placing and spreading of the fill material shall occur in approximately 6-inch horizontal layers or of such thickness that the required compaction can be obtained with the equipment used. Each layer shall be compacted in a way that will result in achieving 95 percent of the maximum standard dry density.

F. The distribution and gradation of materials throughout the fill shall be such that there will be no lenses, pockets, stakes, or layers of material differing substantially in texture or gradation from the surrounding material. Where it is necessary to use materials of

varying texture and gradation, the more impervious material shall be placed in the upstream and center portions of the fill.

G. The moisture content of fill material shall be such that the required degree of compaction can be obtained with the equipment used.

H. Fill shall not be placed on frozen, slick, or saturated soil.

I. The topsoil material saved in the site preparation shall be placed as a top dressing on the surface of the emergency spillways, embankments, and borrow areas. It shall be evenly spread.

J. A protective cover of herbaceous vegetation shall be established on all exposed surfaces of the embankment, spillway, and borrow areas to the extent practical under prevailing soil and climatic conditions.

K. Seedbed preparation, seeding, fertilizing, and mulching shall comply with the applicable sections of this Specification.

L. Any material excavated from the pond shall be placed in one of the following ways so that its weight will not endanger the stability of the side slopes and where it will not be washed back into the pond by rainfall:

1. uniformly spread to a depth not exceeding 3 feet and graded to a continuous slope away from the pond.

2. uniformly placed or shaped reasonably well with side slopes assuming the natural angle of repose for the excavated material behind a berm width not less than 12 feet.

M. Sediment shall be removed from the pond when the capacity is reduced to one third of the design volume. Contractor shall follow the methods for disposing of sediment removed from the pond as shown in the Construction Drawings.

3.18 SILT FENCE

A. This Article provides construction specifications for silt fences using synthetic fabric. See the Construction Drawings for additional detail.

B. Posts shall be spaced a maximum of 6 feet apart at the barrier location and driven securely into the ground (minimum of 12 inches). When necessary because of rapid runoff, post spacing shall not exceed 6 feet.

C. A trench shall be excavated at least 6 inches wide and 6 inches deep along the line of posts and upslope from the barrier.

D. Where used, the wire mesh support fence shall be fastened securely to the upslope side of the posts using heavy-duty wire staples at least 1 inch long, tie wires or hog rings. The

wire shall extend into the trench a minimum of 2 inches and shall not extend more than 36 inches above the original ground surface.

E. The filter fabric shall be stapled or wired to the fence, and 12 inches of the fabric shall be extended into the trench. The fabric shall not extend more than 30 inches above the original ground surface. Filter fabric shall not be stapled to existing trees.

F. At joints, filter fabric shall be lapped with terminating posts with a minimum overlap of 3 feet.

G. The trench shall be backfilled and soil compacted over the filter fabric.

H. Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized.

I. Silt fences and filter barriers shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs shall be made immediately. Knocked down fences shall be repaired at the end of each day.

J. Should the fabric on a silt fence or filter barrier decompose or become ineffective prior to the end of the expected usable life and if the barrier is still necessary, the fabric shall be replaced promptly.

K. Sediment deposits shall be removed after each storm event or when deposits reach approximately one-third the height of the barrier.

L. Any sediment deposits remaining in place after the silt fence or filter barrier is no longer required shall be dressed to conform to the existing grade, prepared, and seeded.

M. Silt fences shall be replaced every 6 months.

N. Silt fence shall terminate in a "J" hook to prevent bypassing at the end of a row.

3.19 STORM DRAIN INLET PROTECTION

A. All storm drains receiving sediment-laden flows from disturbed areas shall be protected. Approved inlet protection methods include net or sand bags filled 2/3 with rock, geotextile filtration products, and Contractor-fabricated structures.

B. For a silt fence drop inlet protection structure, the following specifications apply:

1. For stakes, Contractor shall use 2 x 4-inch wood (preferred) or equivalent metal with a minimum length of 3 feet.

2. Stakes shall be evenly spaced around the perimeter of the inlet a maximum of 3 feet apart and securely driven into the ground, approximately 18 inches deep.

3. To provide needed stability to the installation, Contractor shall frame with 2 x 4-inch wood strips around the crest of the overflow area at a maximum of 1.5 feet above the drop inlet crest and shall brace diagonally.

4. Contractor shall place the bottom 12 inches of the fabric in a trench and backfill the trench with at least 4 inches of crushed stone or 12 inches of compacted soil.

5. Contractor shall fasten fabric securely to the stakes and frame. Joints shall be overlapped to the next stake.

C. For sod drop inlet protection, sod shall be placed to form a turf mat covering the soil for a distance of 4 feet from each side of the inlet structure. Soil preparation and sod placement shall be in accordance with the section entitled Sod.

D. For gravel curb inlet protection, the following specifications apply:

1. Wire mesh with ½-inch openings shall be placed over the curb inlet opening so that at least 12 inches of wire extends across the concrete gutter from the inlet opening.

2. KYTC No. 2 Coarse Aggregate shall be piled against the wire so as to anchor it against the gutter and inlet cover and to cover the inlet opening completely.

3. This type of device shall never be used where overflow may endanger an exposed fill slope. Consideration shall also be given to the possible effects of ponding on traffic movement, nearby structures, working areas, and adjacent property.

E. For block and gravel curb inlet protection, the following specifications apply:

1. Two concrete blocks shall be placed on their sides abutting the curb at either side of the inlet opening to act as spacer blocks.

2. A 2-inch by 4-inch stud shall be cut and placed through the outer holes of each spacer block to help keep the front blocks in place.

3. Concrete blocks shall be placed on their sides across the front of the inlet and abutting the spacer blocks.

4. Wire mesh shall be placed over the outside of the concrete blocks to prevent stone from being washed through the holes in the blocks. Wire with ½-inch openings shall be used.

5. KYTC No. 2 Coarse Aggregate shall be piled against the wire to the top of the barrier.

F. For stone-filled corrugated pipe curb inlet protection, the following specifications apply:

1. Two concrete "L" blocks shall be placed on their sides, with one leg fitting into the mouth of the curb opening.

2. A 6-inch corrugated pipe shall be filled with stone and covered with a filter sock.

3. The stone-filled pipe will be placed in front of the two concrete "L" blocks, and extend a minimum of the width of the curb inlet opening on either side. The total length of the stone filled pipe shall be three times the width of the curb inlet opening.

G. The inlet protection structure shall be inspected after each rain, and repairs made as needed.

H. Sediment shall be removed and the device restored to its original dimensions when sediment has accumulated to one-third the design depth of the filter. Removed sediment shall be deposited in a suitable area and in such a manner that it will not erode.

I. If a stone filter becomes clogged with sediment so that it no longer adequately performs its function, the stone shall be pulled away from the blocks, cleaned, and replaced.

J. Structures shall be removed after the area draining to the inlet protection structure has been properly stabilized.

3.20 FILTER STRIP

A. When planting filter strips, Contractor shall prepare seedbed, incorporate fertilizer based on a soil test, and apply mulch consistent with the seeding sections of this Specification. Fertilizer shall not be applied within 50 feet of a stream or other waterbody. Filter strips using areas of existing vegetation shall be over seeded, as necessary, with the specified mixtures to obtain an equivalent density of vegetation. The over seeding shall be accomplished prior to any land disturbing activities.

B. Filter strips shall be inspected regularly to ensure that a healthy vegetative growth is maintained. Any bare spots or spots where sediment deposition could lead to the destruction of vegetation shall be repaired.

C. Filter strips shall be fertilized once each year in the fall.

D. Irrigation shall be used as necessary to maintain the growth of the vegetation in the filter strip.

E. Sediment shall be removed when it becomes visible in the filter.

F. Construction traffic shall not be driven on or over filter strips.

3.21 STREAM CROSSING

A. Clearing and excavation of the streambed and banks shall be kept to a minimum.

B. The structure shall be removed as soon as it is no longer necessary for project construction.

C. Upon removal of the structure, the stream shall immediately be reshaped to its original cross section and properly stabilized.

D. The approaches to the structure shall consist of stone pads with a minimum thickness of 6 inches, a minimum width equal to the width of the structure, and a minimum approach length of 25 feet on each side.

E. The structure shall be inspected after every rainfall and at least once a week and all damages repaired immediately.

3.22 PUMP-AROUND FLOW DIVERSION

A. Operations shall be scheduled such that diversion installation, in-stream excavation, in-stream construction, stream restoration, and diversion removal are completed during low-flow conditions and as quickly as possible. Contractor shall not construct in a stream when rainfall is expected during the time excavation will be occurring in the stream.

B. Check dams shall be installed across the stream during low flow conditions.

C. Stream flow shall be pumped around the check dams. Outlet protection shall be installed as required at the discharge point.

D. Contractor shall dewater the work area and pump into a sediment trapping device.

E. Contractor shall complete construction activities across the stream.

F. Contractor shall restore the streambed and banks.

G. Contractor shall remove sandbags and shut down pumping operation. (Salvage sandbags for future use if multiple stream crossings are required on the project.) Contractor shall remove all sandbags from the stream, including damaged and empty bags.

H. Pumps shall be manned around-the-clock when the pump-around diversion is in the stream.

I. This control provides short-term diversion of stream flow (typically 1 day to 3 days). Additional sandbags or pumps may be required to maintain 1-foot freeboard on the sandbag checks if flow conditions change.

J. Contractor shall add sandbags as required to seal leaks in check dams.

3.23 CONSTRUCTION DEWATERING

A. All dewatering discharges shall pass through a sediment removal device. Contractor shall follow the specifications for sediment traps and basins. The manufacturer's recommendations shall be followed for commercial products.

B. The dewatering structure shall be inspected frequently to ensure it is functioning properly and not overtopping. Accumulated sediment shall be spread out on site and stabilized or disposed of offsite.

3.24 KPDES GENERAL PERMIT FOR STORMWATER DISCHARGES FROM CONSTRUCTION ACTIVITIES

A. The Contractor is responsible for electronically filing the appropriate state Notice of Intent (NOI-SWCA) letter at least seven (7) days prior to start of construction activity. The Notice of Intent (NOI) is a Kentucky Pollution Discharge Elimination System (KPDES) permit application as provided by the Kentucky Revised Statutes, Chapter 224. This application is required to be submitted for construction projects that disturb one or more acres of land.

B. The NOI requires the inclusion of the descriptions of (but is not limited to) the following items:

1. Names and designated uses of any receiving waters

2. Anticipated number and locations of discharge points

3. Identification of planned construction in or along a waterbody

C. A topographic map showing project boundaries, areas to be disturbed, locations of anticipated discharge points and receiving waters is also required to be submitted with the NOI.

D. If the construction site is near a designated "High Quality/Impaired Waters" or a "Cold Water Aquatic Habitat Waters, Exceptional Waters, Outstanding National/State Resource Waters," additional items and/or individual permits will be required.

E. The NOI form requires an SIC code. The link to the SIC codes is http://www.osha.gov/pls/imis/sicsearch.html. The following are the typical construction SIC codes utilized:

1. 1542 – Building Construction, nonresidential, except industrial and warehouses

2. 1623 – Water Main Construction, Sewer Construction

3. 1629 – Water and Wastewater Treatment Plant Construction

4. 1711 – Water Pump Installation

5. 1781 – Drilling Water Wells

F. The Contractor is responsible for implementing the approved Stormwater Pollution Prevention Plan (SWPPP) prior to commencement of site disturbance. The SWPPP shall include erosion prevention measures and sediment and pollutant control measures which are installed and maintained to minimize discharges of sediments and other pollutants from a 2-year, 24-hour storm event. The SWPPP shall be kept at the site and available for review by LFUCG and state officials.

G. The Contractor is responsible for the description of procedures to maintain erosion and sediment control measures during the period of construction.

H. The Contractor is responsible for identifying each Contractor and Subcontractor who will install each SWPPP erosion and sediment control measure.

I. Each Contractor and Subcontractor shall sign a statement certifying the awareness of the requirements of the SWPPP-related documents. Certification is attached at the end of this section.

J. The Contractor shall not start land disturbing activities until written permit coverage is obtained from the Kentucky Division of Water.

K. The inspection by qualified personnel, provided by the Contractor, of the site as follows:

1. at least once every seven (7) calendar days, and

2. within 24 hours after any storm event of 0.5 inch or greater

L. The Contractor is responsible for completing and maintaining the required Self-Inspection Forms. A sample is included in this specification Section.

M. Amendments to the approved SWPPP shall be made and implemented as necessary through the course of the construction project if inspections or investigations by the Contractor's inspector, site staff, or by local, state, or federal officials determine that the existing sediment control measures, erosion control measures, or other site management practices are ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the construction site. All plan amendments shall be noted on the copy of the SWPPP maintained at the project site. Plan amendments that involve engineering design shall be prepared by an engineer licensed in Kentucky.

N. The Contractor shall submit the Notice of Termination (NOT) form to the Kentucky Division of Water, the LFUCG Division of Water Quality, and the LFUCG Division of Engineering when final stabilization has been achieved on all portions of the site and the erosion/sediment controls have been removed.

O. All subcontractors shall be required to comply with the requirements of the state permit and the Stormwater Pollution Prevention Plan (SWPPP).

P. Where to submit:

1. Complete KPDES FORM NOI-SW at the following website:
https://dep.gateway.ky.gov/eForms/default.aspx?FormID=7

2. Do not initiate work until receiving approval from the Kentucky Division of Water.

3. A complete copy of the NOI submittal shall also be provided to the following for approval/coverage verification:

Division of Water Quality
125 Lisle Industrial Avenue, Suite 180
Lexington, KY 40511

Division of Engineering
Lexington-Fayette Urban County Government
101 E. Vine St.
4th Floor
Lexington, KY 40507

3.25 LFUCG LAND DISTURBANCE PERMIT

A. The Contractor shall obtain a Land Disturbance Permit from the LFUCG Division of Engineering, after the LFUCG Division of Water Quality inspects the installation of the best management practices as required by the Stormwater Pollution Prevention Plan (SWPPP). The site grading plan shall show the original and finish grade contours. The grading plan shall be in conformance with the SWPPP and shall clearly show the initial phase of best management practices to be installed.

B. The Land Disturbance Permit checklist appears on the following page. It can be obtained from:

Division of Engineering
Lexington-Fayette Urban County Government
101 E. Vine St.
4th Floor
Lexington, KY 40507
(859) 258-3410
Attn: Land Disturbance Permit Section
https://www.lexingtonky.gov/new-development

C. All excess earthen/rock materials hauled off the site to a location in Fayette County shall be hauled to a site permitted by the Kentucky Division of Water and the LFUCG. The haul site shall be permitted in accordance with these specifications.

LFUCG Land Disturbance Permit Application & Erosion and Sediment Control Plan Checklist *v23Feb2018*

Permittee (Owner or Contractor):	Date:
Contact Person:	Contact Phone:
Site Address:	Zone:
Contractor Name: Reg #:	Contractor Phone:
Mailing Address:	Email:

Permitting Information and ESC Plan Narrative	**Yes**	**No**	**N/A**	**Page#**	**Notes**
KY DOW Construction NOI / KYR10 Permit					Required for disturbance ≥ 1 acre
US ACE Section 404 Permit					Required for stream crossings, wetland fills
KY DOW Stream Construction Permit / WQ Certif.					Required for stream crossings / encroachment
FEMA LOMR or CLOMR					If applicable
Project description and purpose					Brief summary
Land cover, soils, percent impervious area					Pre and post construction
Land cover / land use of adjacent property					Can designate on plan sheets
Work schedule with start/end dates					Sequencing, clearing, grading, revegetation
Phasing plan for large projects					25 acre limit on total disturbed area
BMP installation schedule					Can be included on plan sheets (see below)
Inspection and BMP maintenance schedule					Every 7 days, or every 14 days and after ½" rain
Material storage, waste & litter pollution prevention					Covered, away from drainage system, etc.
Fueling / vehicle maintenance pollution prevention					Conducted away from drainage system, etc.
Spill prevention, control, and countermeasures					If reportable quantities present at the site
Dust control plan					Consider if neighbors are present
Stabilized site exit inspection plan					For keeping offsite pavement clear of soil/debris
Stabilization plan and schedule for site areas					Seed/mulch/etc. within 14 days of inactivity
ESC Plan Site Map and Drawing Detail *(See LFUCG Stormwater Manual for BMP Design and Installation Information)*					
Plans stamped by a licensed professional					Required for engineered plan components
Location of the project; property lines					Include small locational map; street address
Limits of construction, disturbed area location/size					Flag off "no disturbance" areas
Topography and drainage patterns (pre and post)					1" = 50 ft; 2 ft contours
Buildings, utilities, paved areas, ditches, culverts					Show stormwater inlets within 100 ft of site
Retention ponds, detention basins, sediment traps					Stabilize immediately after construction
Access and haul roads					Consider dust control where neighbors present
Stabilized exit (50 ft #2 rock pad, shaker rack, etc.)					Must drain to a sediment control BMP
Silt fence or etc. at downslope perimeters					Super silt fence along critical areas
Diversion ditches/berms above disturbed areas					Stabilize immediately after construction
Protection for post-construction BMPs					Keep sediment out of post-construction BMPs
Slope stabilization (seed with mulch/blanket/mat)					See Figure 11-1 in Stormwater Manual
Inlet protection measures					Specify type(s) and location(s)
Outlet erosion protection measures					Specify type(s) and location(s)
Ditch stabilization (sod, or seed with blanket/mat)					Stabilize immediately after construction
Sediment basins (> 5 ac) and traps (< 5 ac)					Stabilize immediately after construction
Dewatering sites and methods					Must use sediment controls
50 ft natural vegetated buffer for all critical areas					Applies to streams, wetlands, sinkholes
Stream crossings					Crossing type, detail; USACE 404 permit req'd
Stockpile areas, equipment storage/fueling areas					Keep away from drainage system if possible
Waste and concrete wash water storage/disposal					Show initial area; can be moved as needed
LFUCG Use Only: *Review Date:* *Status – In Compliance: Yes No*					*Additional Info Needed: Yes No*
Reviewed By:					*Department: DOE DWQ DES*
Comments / Missing Items:					

Kentucky Best Management Practices Plan • Construction Site Inspection Report

Company:	**Site:**	**County:**
Site Operator:		**Date:**
Receiving Water:	**Total Site Area (acres):**	**# Disturbed Acres:**
Inspector Name:	**Inspector Qualifications:**	
Inspection Type: Weekly or ½ Inch Rain	**Days Since Last Rainfall** ____	**# Inches of Last Rainfall:** _____

Field Inspection Observations

BMP Category	Compliance Yes	No	N/A	Field Indicators for Compliance
Project Operations				Notice of Intent (KPDES permit) and other local/state permits on file BMP Plan on site and available for review Project timing/schedule and activities following BMP Plan Weekly inspection and rain-event reports on BMPs available for review Diversions, silt checks/traps/basins, and silt fences/barriers installed prior to clearing Grading and clearing conducted in phases to minimize exposed soil areas No vegetation removal or operations in stream or sinkhole buffer area (25-50 ft min) Rock pad in place on all construction site exits leading to paved roads No sediment, mud, or rock on paved public roads in project area Dust control if needed when working in residential areas during dry conditions
Drainage Management				Upland runoff diverted around bare soil areas with vegetated/lined ditches/berms Drainage channels exiting the site are lined with grass/blanket/rock and stabilized Discharges from dewatering operations cleaned in silt fence enclosure or other filter No muddy runoff leaving site after rains up to 1½ inches
Erosion Protection				Exposed soil seeded/mulched after 2 weeks if no work is planned for the next 7 days Soils on steep slopes seeded/mulched/blanketed as needed to prevent rutting
Sediment Barriers				Silt fence, rock filter, or other sediment barrier below all bare soil areas on slopes Barrier installed across slope on the contour, trenched in, posts on downhill side Multiple sediment barriers at least 125 ft apart on unseeded slopes steeper than 4:1 J-hook interceptors along silt fence where heavy muddy flows run along fencing No visible undercutting or bypassing or blowout of sediment barrier Accumulated sediment is less than halfway to the top of sediment barrier
Slope Protection				Slopes tracked, disked, or conditioned after final grade is established Slopes seeded, mulched, or blanketed within 21 days, no unmanaged rills or gullying Heavy downslope flows controlled by lined downdrain channels or slope drain pipes No muddy runoff from slopes into streams, rivers, lakes, or wetlands
Inlet Protection				Inlet dam/device or filtration unit placed at all inlets receiving muddy flows No visible undercutting, bypassing, or blowout of inlet protection dam or device Accumulated sediment is less than halfway to the top of the inlet protection dam/device
Outlet Protection				High flow discharges have rock or other flow dissipaters of adequate sizing at outlet Culvert outlets show no visible signs of erosion/scour, bank failure, or collapse
Ditch and Channel Stabilization				No unmanaged channel bank erosion or bottom scouring visible within or below site Ditches with slopes more than 3% have check dams spaced as needed, if not grassed Ditch check dams tied in to banks, with center 4" lower than sides, and no bypassing Ditches with slopes of up to 5% are thickly seeded with grass (minimum requirement) Ditches 5% to 15% are lined with thick grass and erosion control blankets as needed Ditches 15% to 33% are lined with thick grass and matting or other approved product Ditches exceeding 33% are paved or lined with rock or other approved product

Sediment Traps and Basins				Storage volume is at least 134 cubic yards for each acre of bare soil area drained Trap or basin is seeded/mulched and stabilized; no collapsing sidewalls or banks Outlet structure is stable and consists of rock-lined notched overflow or outlet riser Rock overflow is 6" lower in center to control overflow discharge Outlet riser pipe has concrete & rock base, ½ inch holes every 3" to 6", and trash rack Area near pipe outlet or overflow is stable, with no scour or erosion Sediment removed before trap or basin is halfway full; disposal is away from ditches
Maintenance of EPSC Management Practices				Sediment behind silt fence and other filters does not reach halfway to top Sediment traps and basins are less than half full of sediment Gullies repaired, silt fences and other controls inspected and repaired/replaced Written documentation of controls installed, inspection results, and repairs performed All controls removed and areas graded, seeded, and stabilized before leaving site
Materials Storage, Handling, and Cleanup				Materials that may leach pollutants stored under cover and out of the weather Fuel tanks located in protected area with double containment system Fuel and/or other spills cleaned up promptly; no evidence of unmanaged spills No evidence of paint, concrete, or other material washouts near drain inlets No storage of hazardous or toxic materials near ditches or water bodies
Waste Disposal				Trash, litter, and other debris in proper containers or properly managed No litter or trash scattered around on the construction site Provisions made for restroom facilities and/or other sanitary waste management Sanitary waste facilities clean and serviced according to schedule No disposal of any wastes into curb or other inlets, ditches, streams, or water bodies

Inspection Notes and Key Observations

List of Stabilized Areas: Vegetation is Established; Ditches are Stabilized; No Exposed Soil
Other Notes or Observations:
Corrective Actions Taken and/or Proposed Revisions to BMP Plan:

I certify under penalty of law that I understand the terms and conditions of the general Kentucky Pollutant Discharge Elimination System (KPDES) permit that authorizes the storm water discharges associated with industrial activity from the construction site identified as part of this certification.

Signature of Inspector: _____

Contractor and Subcontractor Certifications

SWPPP Files, Updates, and Amendments

This SWPP Plan and related documents (e.g., NOI, inspection reports, US ACE permits, etc.) will be kept on file at the construction site by _____ (name and title). The SWPPP will be updated by the Owner and/or Site Manager to reflect any and all significant changes in site conditions, selection of BMPs, the presence of any unlisted potential pollutants on site, or changes in the Site Manager, contractor, subcontractors, or other key information. Updates and amendments will be made in writing within 7 days and will be appended to the original BMP Plan and available for review.

Stormwater Pollution Prevention Plan Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signed: _____ Date: _____

Title: _____

I certify under penalty of law that I understand the terms and conditions of the general KPDES permit that authorizes the storm water discharges associated with the construction site activity identified as part of this certification.

Subcontractor Certification

The subcontractors below certify under penalty of law that they understand the terms and conditions of the general KPDES permit that authorizes the storm water discharges associated with the construction site activity identified as part of this certification.

Signed: _____ Date: _____

Title: _____

Signed: _____ Date: _____

Title: _____

Signed: _____ Date: _____

Title: _____

END OF SECTION

SECTION 02371

STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

PART 1 – GENERAL

1.01 GENERAL

A. The Contract Documents include a SWPPP that has been reviewed by LFUCG Division of Water Quality. This SWPPP shall be used for establishing quantities and a lump sum price for providing the Erosion and Sediment Control Measures. The included SWPPP is largely complete but will require additional information from the contractor such as concrete washout locations, inlet protection types, etc. prior to being approved by LFUCG Division of Water Quality.

B. The Contractor may use this SWPPP, with necessary additions, to obtain the required permits, i.e. Land Disturbance Permit. If Contractor chooses to use this SWPPP, the Contractor takes sole responsibility for the content of the SWPPP and the implementation of the SWPPP during construction. If Contractor chooses to use this SWPPP, the contractor will be required to submit the SWPPP with necessary additions to LFUCG Division of Water Quality for approval.

C. Contractor may also choose to prepare its own SWPPP and submit to LFUCG Division of Water Quality for approval. No additional payment will be allowed for the Erosion and Sediment Control and conformance with SWPPP pay item.

Construction Site Stormwater Pollution Prevention and Erosion and Sediment Control Plan

This Erosion and Sediment Control / Stormwater Pollution Prevention Plan (ESC/SWPPP) narrative and the attached plan sheets address requirements of the Kentucky Division of Water's KPDES Construction General Permit and the Lexington-Fayette Urban County Government's Erosion and Sediment Control (ESC) Plan, which is required by ordinance for certain projects and required to obtain an LFUCG Grading Permit.

Plan Preparer: Tyler Bridges, P.E. (502) 290-0640, TBridges@hazenandsawyer.com

Date: March 18, 2025 **LFUCG Checklist and KY DOW NOI Attached:** Yes X No:___

1. CONTACT INFORMATION AND SITE DESCRIPTION

Project Name and Location
East Hickman Pump Station
Phase II Improvements

Site Owner Name and Contact Information
Lexington-Fayette Urban County Government
Division of Water Quality
125 Lisle Industrial Avenue, Suite 180
Lexington, KY 40511
(859) 425-2438
rpeterson@lexingtonky.gov

Project Start and End Dates
Start: August 2025
End: December 2026

Description – Existing Site Conditions, Purpose, and Types of Soil Disturbing Activities
This project will consist of rehabilitating and improvement of the existing East Hickman Pump Station. The project site is located south of the Jacobson Reservoir and measures approximately 3 acres, with only approximately 0.2 acres of proposed disturb area. The area is in its entirety property of LFUCG. The majority of the surfaces along this project area are relatively flat. The project soils are comprised primarily of silt loam, silt clay loam, and urban land. The rehabilitation includes the installation of four new dry weather sanitary pumps, new grinders, and a new odor control system. The expansion consists of new concrete pads to support a super oxygenation system, an oxygen tank, an oxygen vaporizer, and an oxygen flow control panel. There are 9 threatened, endangered, or candidate species on the species list for this area, including: Clubshell, Gray Bat, Indiana Bat, Longsolid, Monarch Butterfly, Northern Long-Eared Bat, Pink Mucket, Short's Bladderpod, and the Tricolored Bat. There are no critical habitats within the project area. Soil disturbing activities will include installing downgradient straw wattle and other erosion and sediment controls; excavation for improvements; grading; and preparation for final seeding and landscaping.

Runoff Coefficient
There is a minimal increase in impervious area, so the runoff coefficient is not expected to change.

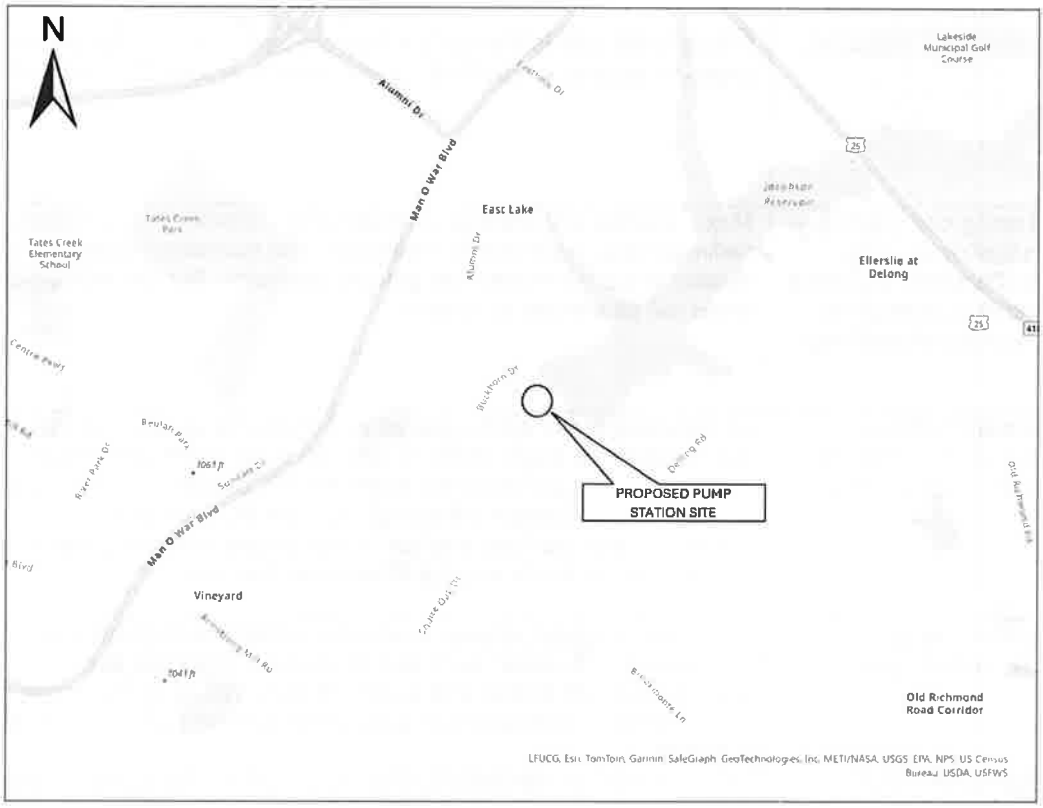
Site Area and Disturbed Acreage
Approximately 0.2 acres will be disturbed by construction activities.

Sequence of Major Activities

Construction Activity	Schedule Considerations
Work crew orientation	Pre-project briefing to review permits, plans, schedule, and staffing.
Install initial ESC measures	Downgradient silt fences will be installed below areas to be cleared, grubbed, graded, or cut/filled. Do-not- disturb areas will be marked off.
Land clearing and grading—site preparation (cutting, filling, and grading, sediment traps, barriers, diversions, drains, surface roughening)	Major clearing and grading will begin after installation of principal sediment and runoff control measures, and additional control measures will be installed as grading continues. Borrow and disposal areas will be cleared as needed.
Surface stabilization—temporary and permanent seeding, mulching, sodding, riprap	All disturbed areas will be graded and stabilized as soon as possible. Stabilization will begin within 14 days on areas of the site where construction has permanently or temporarily ceased. Temporary and permanent stabilization will comply with the Stormwater Manual. Erosion control blankets and turf reinforcement mats will be used on slopes in accordance with the Stormwater Manual.
Building construction—buildings, utilities, paving	During construction, erosion and sedimentation control measures will be installed as needed, such as construction entrances and downgradient silt fences and sediment traps. Areas at final grade not in the immediate construction area will be seeded/mulched as soon as possible.
Landscaping and final stabilization—topsoiling, trees and shrubs, permanent seeding, mulching, sodding.	This is the last construction phase. All remaining disturbed areas will be stabilized, including borrow and spoil areas. Temporary control structures will be removed and the area will be seeded and mulched.

2. SITE DESCRIPTION, MAPS, AND DRAWINGS (INCLUDED BELOW OR ATTACHED)

See the Vicinity Map below. Drawings are attached in the Appendix.



VICINITY MAP

Name of Receiving Waters
The entire site will drain into East Hickman Creek.

TMDLs and Pollutants of Concern in Receiving Waters
A portion of East Hickman Creek is listed on the Kentucky impaired water (303d) list.

Potential Sources of Pollutants
Sediment from land clearing and grading; concrete washout water; oil/fuel/grease from equipment; sanitary waste; trash/debris.

3. EROSION PREVENTION AND SEDIMENT CONTROL MEASURES

All erosion, sediment, stormwater, and housekeeping practices will be consistent with the LFUCG Stormwater Manual and KY Division of Water field and technical guidance, at a minimum.

Limits of Disturbance and Project Phasing
Without exception, no more than 25 acres will be disturbed at any one time. If 25 acres of disturbed area exist on the site, no new disturbed areas will be created until previously disturbed areas are temporarily or permanently stabilized on an acre-for-acre basis. Land disturbance activities will be phased to minimize the amount of soil exposed and the length of exposure time. The overall objective will be to achieve final

grades as quickly as possible, and to stabilize all areas with seed, mulch or blankets/mats within 14 days after final grade is achieved, or after grading work is suspended on that portion of the site.

Stabilization Practices
Temporary Stabilization – Top soil stockpiles and disturbed portions of the site where construction activity stops for 14 days or more will be stabilized with temporary seed or straw mulch no later than 14 days from the last construction activity in that area (portion) of the site. Seeding rates will be consistent with the KY EPSC Field Guide. Lime and fertilizer will be applied only when indicated by a soil test. After seeding, each area shall be covered by erosion blanket or mulched with at least two tons/acre of blown or hand-scattered straw. The straw will be netted down or crimped into place by a disk harrow with the blades set straight. Slopes will be covered with blankets or mats consistent with the LFUCG Stormwater Manual. Areas of the site which are to be paved will be temporarily stabilized by applying geotextile and stone sub-base until bituminous pavement can be applied. Dust will be controlled as needed in dry weather.

Permanent Stabilization – Disturbed portions of the site where construction activities are completed will be stabilized with permanent seed no later than 14 days after completion of grading in that area. Seed and mulch will be applied consistent with the KY EPSC Field Guide. Lime and fertilizer will be applied only if needed. After seeding, each area will be mulched with 4,000 pounds per acre of straw. The straw mulch will be netted down or crimped into place by a disk harrow with blades set straight. Slopes will be covered with erosion control blankets or turf reinforcement mats consistent with the LFUCG Stormwater Manual. Ditches will be triple-seeded and lined with erosion control blanket or turf reinforcement matting.

Slopes will be covered with erosion control blankets or turf reinforcement mats consistent with the LFUCG Stormwater Manual. Ditches will be triple-seeded and lined with erosion control blanket or turf reinforcement matting.

Structural Practices
Perimeter Protection Measures- will be used to detain and filter sheet and concentration flows. Silt fence or fiber rolls may be used to help control erosion on moderate slopes. They should be installed on level contours, spaced at 10- to 20-ft intervals. Silt fences shall be replaced every 6 months.

Site Runoff Management
Sediment will be prevented from leaving the site to the maximum extent practicable. Storm water from the disturbed area will sheet flow through erosion control measures located along the southwest of the project. Runoff along the linear excavation will flow through straw wattles.

4. OTHER CONTROL MEASURES

Offsite Vehicle Tracking
A stabilized #2 and larger rock construction exit with geotextile underliner will be installed to help reduce vehicle tracking of sediments at all exits onto paved roads. The stabilized exit will be 100 ft where possible, and at least 50 ft in length. The paved street adjacent to the site entrance will be swept/cleaned daily if necessary to remove any excess mud, dirt, or rock tracked from the site. The rock exit will be grubbed lightly or otherwise maintained as needed to clear (shake down) dry mud. Dump trucks hauling material from the construction site will be covered with a tarpaulin.

Streams and Wetlands
Since there are not many options available for the sewer's alignment, a 50 ft natural vegetated buffer will not be maintained adjacent to the top-of-bank at all streams, wetlands, and springs. Contractor to maximize buffer as much as possible. Any work within buffer will be completed as soon as possible and stabilized within 24 hours.

Waste Disposal
Waste Materials – All waste materials that may leach pollutants (paint and paint containers, caulk tubes, oil/grease containers, liquids of any kind, soluble materials, etc.) will be collected and stored in a covered metal dumpster rented. The dumpster will meet all Lexington and state solid waste management

regulations. Construction debris and other wastes that do not leach pollutants will be recycled or deposited in a covered or open-topped dumpster. The dumpster will be emptied when full, and the contents will be hauled to an approved site. No construction waste materials will be buried onsite. All personnel will be instructed regarding the correct procedure for waste disposal.

Hazardous Waste – All waste materials will be disposed of in the manner specified by local or state regulation or by the manufacturer.

Sanitary Waste – Portable toilets will be used on site for sanitary wastes. All sanitary waste will be collected from the portable units as needed to prevent excessive odors and overflows as required by local regulation. Portable units will be placed away from storm drain inlets, ditches, creeks, and other water bodies.

Timing of Control Measures
As indicated in the Sequence of Major Activities, the stabilized construction exit and silt fences / sediment barriers will be constructed prior to clearing or grading of any other portions of the site. Areas where construction activity temporarily ceases for more than 14 days will be stabilized with temporary seed and/or mulch within 14 days of the last disturbance. Once construction activity ceases permanently in an area, that area will be seeded and mulched within 14 days. Temporary controls in permanently stabilized areas, such as silt fences, will be removed. Controls will remain in place until all vegetation is established and ditches are stable.

5. OTHER STATE AND LOCAL PLANS

Certification of Compliance with Federal, State, and Local Regulations
This Stormwater Pollution Prevention Plan reflects Kentucky Division of Water and LFUCG requirements for stormwater management and erosion and sediment control, as established in LFUCG ordinances. To ensure compliance, this plan was prepared in accordance with the Kentucky BMP Planning and Technical Specifications Manual published by KY DOW and KY DOC and the LFUCG Stormwater Manual. There are no other local, state, or federal permits (e.g., Clean Water Act Section 404 dredge/fill permit, KY DOW Section 401 Water Quality Certification, KY DOW Floodplain Permit, etc.) needed for this project.

6. MAINTENANCE PROCEDURES

Stormwater, Erosion, and Sediment Control Maintenance Practices
Maintenance of all BMP's at the site will be handled by the Construction Site ESC/SWPPP Plan Manager, who has been trained on construction site BMP's at workshops sponsored by the KY DOW and the Kentucky Erosion Protection and Sediment Control (KEPSC) Program. Other workers on-site will be trained in BMP installation, maintenance, and good housekeeping by the Construction Site ESC/SWPPP Plan Manager. These are the inspection and maintenance practices that will be used to maintain erosion and sediment controls:

- Less than ½ of the site or 5 acres, whichever is less, will be cleared of vegetation at one time; areas at final grade will be seeded and mulched within 14 days.
- All measures will be maintained in good working order; if a repair is necessary, it will be initiated within 24 hours of being reported. This information will be logged on the ESC/SWPPP Plan.
- Silt fences/straw wattles will be inspected for bypassing, overtopping, undercutting, depth of sediment, tears, and to ensure attachment to secure posts. Bypasses will be repaired immediately.
- Built-up sediment will be removed from behind the silt fence/straw wattle before it has reached halfway up the height of the fence.
- Temporary and permanent seeding and mulching will be inspected for bare spots, washouts, and healthy growth. Bare or eroded areas will be repaired as needed.

7. INSPECTION PROCEDURES

Stormwater, Erosion, and Sediment Control Inspection Practices
Inspection of all BMP's at the site will be handled by the Construction Site ESC/SWPPP Plan Manager, who has been trained on inspecting construction site BMPs at workshops sponsored by the KY DOW and the Kentucky Erosion Protection and Sediment Control (KEPSC) Program.

- All erosion prevention and sediment control measures will be inspected at least once each week and following any rain of one-half inch or more.
- Inspections will be conducted by the Construction Site ESC/SWPPP Plan Manager, who has been trained by the KY DOW and KEPSC.
- Inspection reports will be written, signed, dated, and kept on file for two years.

8. NON-STORMWATER DISCHARGES

It is expected that the following non-storm water discharges will occur from the site during the construction period:

- Pavement wash waters (where no spills or leaks of toxic or hazardous materials have occurred).
- Uncontaminated groundwater and rain water (from dewatering during excavation).

All non-storm water discharges will be directed to a sediment basin, filter bag, or filter fence enclosure in a flat vegetated infiltration area prior to discharge, to remove sediment and other contaminants.

The materials or substances listed below are expected to be present onsite during construction:

- Concrete

Spill Prevention and Material Management Practices
The following material management practices will be used to reduce the risk of spills or other accidental exposure of materials and substances to exposure to the weather and/or runoff.

Good Housekeeping
The following good housekeeping practices will be followed onsite during the construction project.

- An effort will be made to store only enough product required to do the job
- Products and materials will be stored away from the surface drainage system
- All materials stored onsite will be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure
- Products will be kept in their original containers with the original manufacturer's label
- Substances will not be mixed with one another unless recommended by the manufacturer
- Whenever possible, all of the product will be used up before disposing of the container
- Manufacturers' recommendations for proper use and disposal will be followed
- The site superintendent will inspect daily to ensure proper used and disposal of materials onsite.
- Dust will be controlled by water sprayed from a tanker truck as needed during dry weather.

Hazardous Products
These practices will be used to reduce the risks associated with any and all hazardous materials.

- Products will be kept in original containers unless they are not resealable.
- Original labels and safety data sheets (SDS) will be reviewed and retained.

- If surplus product must be disposed of, manufacturers' or state/local recommended methods for proper disposal will be followed.

Petroleum Products
All onsite vehicles will be fueled and maintained off-site, monitored for leaks, and receive regular preventative maintenance to reduce the chance of leakage. Petroleum products stored onsite (oil, gas for tamp and pump) will be stored in tightly sealed containers, which are clearly labeled. Any asphalt substances used onsite will be applied according to the manufacturer's recommendations.

Fertilizers
If used, fertilizers used will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer will be covered with mulch or blankets or worked into the soil to limit exposure to storm water. Storage will be in a covered shed. The contents of any partially used bags of fertilizer will be transferred to a sealable plastic bin to avoid spills.

Paints
All containers will be tightly sealed and stored indoors or under roof when not being used. Excess paint or paint wash water will not be discharged to the drainage or storm sewer system but will be properly disposed of according to manufacturers' instructions or state and local regulations.

Concrete Truck Washout
Concrete truck mixers and chutes will not be washed on pavement, near storm drain inlets, or within 75 feet of any ditch, stream, wetland, lake, or sinkhole. Where possible, excess concrete and wash water will be discharged to areas prepared for pouring new concrete, flat areas to be paved that are away from ditches or drainage system features, or other locations that will not drain off site.

Spill Control Practices
In addition to the good housekeeping and material management practices discussed in the previous sections of this plan, the following practices will be followed for spill prevention and cleanup:

- Manufacturers' recommended methods for spill cleanup will be clearly posted. All personnel will be made aware of procedures and the location of the information and cleanup supplies.
- Materials and equipment necessary for spill cleanup will be kept in the material storage area. Equipment and materials will include but not limited to brooms, dust pans, mops, rags, gloves, kitty litter, sand, sawdust, and plastic and metal trash containers.
- All spills will be cleaned up immediately after discovery.
- The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contract with a hazardous substance.
- Spills of toxic or hazardous material will be reported to the appropriate state/local agency.
- The spill prevention plan will be adjusted as needed to prevent spills from reoccurring and improve spill response and cleanup.
- The site superintendent responsible for the day-to-day site operations, will be the spill prevention and cleanup coordinator. He will designate at least three other people onsite to receive spill prevention/cleanup training and assist in cleanups. Their names will be posted in the material storage area and in the office trailer outside.

9. CONTRACTOR AND SUBCONTRACTOR CERTIFICATIONS

ESC/SWPPP Files, Updates, and Amendments
This ESC/SWPP Plan and related documents (e.g., NOI, inspection reports, US ACE permits, etc.) will be kept on file at the construction site by the Site Manager. The ESC/SWPPP will be updated by the Owner and/or Site Manager to reflect any and all significant changes in site conditions, selection of BMPs, the presence of any unlisted potential pollutants on site, or changes in the Site Manager, contractor,

subcontractors, or other key information. Updates and amendments will be made in writing within 7 days and will be appended to the original plan and available for review.

Stormwater Pollution Prevention Plan Certification
I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signed: _____ Date: _____

I certify under penalty of law that I understand the terms and conditions of the general KPDES permit that authorizes the storm water discharges associated with the construction site activity identified as part of this certification.

PART 2 – Subcontractor Certification

The subcontractors below certify under penalty of law that they understand the terms and conditions of the general KPDES permit that authorizes the storm water discharges associated with the construction site activity identified as part of this certification.

Signed: _____ Date: _____

Signed: _____ Date: _____

Construction Site Inspection Report (SAMPLE – OR USE YOUR OWN)

Company:	**Site:**	**County:**
Site Operator:		**Inspection Date:**
Receiving Water:	**Total Site Area (acres):**	**# Disturbed Acres:**
Inspector Name:	**Inspector Qualifications:**	
Inspection Type: Weekly or ½ Inch Rain	**Days Since Last Rainfall____**	**# Inches of Last Rainfall: _____**

Field Inspection Observations

PART 3 – BMP Category	Compliance Poor Fair Good	Field Indicators for Compliance
Project Operations		Notice of Intent (KPDES permit) and other local/state permits on file ESC/SWPPP on site and available for review; project activities compliant with plan Weekly inspection and rain-event reports on BMPs available for review Diversions, silt checks/traps/basins, and silt fences/barriers installed prior to clearing Grading and clearing conducted in phases to minimize exposed soil areas No vegetation removal or operations in stream or sinkhole buffer area (25 ft min) Rock pad with underliner in place on all construction site exits leading to paved roads No sediment, mud, or rock on paved public roads in project area Dust control if needed when working in residential areas during dry conditions
Drainage Management		Upland runoff diverted around bare soil areas with vegetated/lined ditches/berms Drainage channels exiting the site are lined with grass/blanket/rock and stabilized Discharges from dewatering operations cleaned in silt fence enclosure or other filter No muddy runoff leaving site after rains up to 1½ inches
Erosion Protection		Exposed soil seeded/mulched after 2 weeks if no work is planned for the next 7 days Soils on steep slopes seeded/mulched/blanketed as needed to prevent rutting
Sediment Barriers		Silt fence, rock filter, or other sediment barrier below all bare soil areas on slopes Barrier installed across slope on the contour, trenched in, posts on downhill side Multiple sediment barriers at least 125 ft apart on unseeded slopes steeper than 4:1 J-hook interceptors along silt fence where heavy muddy flows run along fencing No visible undercutting or bypassing or blowout of sediment barrier Accumulated sediment is less than halfway to the top of sediment barrier
Slope Protection		Slopes tracked, disked, or conditioned after final grade is established Slopes seeded, mulched, or blanketed within 14 days, no unmanaged rills or gullying Heavy downslope flows controlled by lined downdrain channels or slope drain pipes No muddy runoff from slopes into streams, rivers, lakes, or wetlands
Inlet Protection		Inlet dam/device or filtration unit placed at all inlets receiving muddy flows No visible undercutting, bypassing, or blowout of inlet protection dam or device Accumulated sediment is less than halfway to the top of the inlet protection dam/device
Outlet Protection		High flow discharges have rock or other flow dissipaters of adequate sizing at outlet Culvert outlets show no visible signs of erosion/scour, bank failure, or collapse
Ditch and Channel Stabilization		No unmanaged channel bank erosion or bottom scouring visible within or below site Ditches with slopes more than 3% have check dams spaced as needed, if not grassed Ditch check dams tied in to banks, with center 4" lower than sides, and no bypassing Ditches with slopes of up to 5% are thickly seeded with grass (minimum requirement) Ditches 5% to 15% are lined with thick grass and erosion control blankets as needed Ditches 15% to 33% are lined with thick grass and matting or other approved product Ditches exceeding 33% are paved or lined with rock or other approved product

Sediment Traps and Basins	Storage volume is at least 134 cubic yards for each acre of bare soil area drained Trap or basin is seeded/mulched and stabilized; no collapsing sidewalls or banks Outlet structure is stable and consists of rock-lined notched overflow or outlet riser Rock overflow is 6" lower in center to control overflow discharge Outlet riser pipe has concrete & rock base, ½ inch holes every 3" to 6", and trash rack Area near pipe outlet or overflow is stable, with no scour or erosion Sediment removed before trap or basin is halfway full; disposal is away from ditches
Maintenance of EPSC Management Practices	Sediment behind silt fence and other filters does not reach halfway to top Sediment traps and basins are less than half full of sediment Gullies repaired, silt fences and other controls inspected and repaired/replaced Written documentation of controls installed, inspection results, and repairs performed All controls removed and areas graded, seeded, and stabilized before leaving site
Materials Storage, Handling, and Cleanup	Materials that may leach pollutants stored under cover and out of the weather Fuel tanks located in protected area with double containment system Fuel and/or other spills cleaned up promptly; no evidence of unmanaged spills No evidence of paint, concrete, or other material washouts near drain inlets No storage of hazardous or toxic materials near ditches or water bodies
Waste Disposal	Trash, litter, and other debris in proper containers or properly managed No litter or trash scattered around on the construction site Provisions made for restroom facilities and/or other sanitary waste management Sanitary waste facilities clean and serviced according to schedule No disposal of any wastes into curb or other inlets, ditches, streams, or water bodies

PART 4 – Inspection Notes and Key Observations

List of Stabilized Areas: Vegetation is Established; Ditches are Stabilized; No Exposed Soil
Other Notes or Observations:
Corrective Actions Taken and/or Proposed Revisions to ESC/SWPPP Plan:

I certify under penalty of law that I understand the terms and conditions of the general National Pollutant Discharge Elimination System (NPDES) permit that authorizes the storm water discharges associated with industrial activity from the construction site identified as part of this certification.

Signature of Inspector: _____ **Date:** _____

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SECTION 02374

ESC PERMITTING, INSPECTION, AND PERMITTING PROCEDURES

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Permitting, Inspection, and Enforcement Procedures for Erosion and Sediment Control on Capital Projects

Division of Water Quality

Lexington-Fayette
Urban County Government

September 2024

Permitting, Inspection, and Enforcement Procedures for Erosion and Sediment Control on Capital Projects

Division of Water Quality

Date of Original Publication:

October 2013

Date of Current Publication:

September 2024

This publication was developed by the Tetra Tech / Third Rock Consultants Stormwater Program Management Team under contract to LFUCG for purposes of implementing the stormwater provisions of its Clean Water Act Consent Decree and/or its Kentucky Division of Water (KDOW) Municipal Separate Storm Sewer System (MS4) Permit.

Permitting, Inspection, and Enforcement Procedures for Erosion, Sediment, and Stormwater Control on Division of Water Quality Capital Construction Projects

DWQ Remedial Measures Plan Projects
DWQ RMP Program Manager: Bob Peterson
DWQ Program Management Consultant: Hazen and Sawyer
Construction Contract Administrators (CA): DWQ Consultants
Resident Project Representative (RPR): DWQ Consultants
ESC Plan Reviewer: DWQ Stormwater Section – Amad Al-Humadi
Land Disturbance Permit (LDP) Issuer: DOE New Development
LFUCG Erosion and Sediment Control Compliance Inspector: RPR
Accela Data Entry: DWQ Compliance & Monitoring (C&M) – Kevin Lyne
Land Disturbance Permit (LDP) Permittee: Contractor

DWQ Wastewater Treatment Plant Capital Projects
DWQ Plant Engineer: Tiffany Rank
DWQ Project Manager: Varies
Construction Contract Administrators (CA): Rick Day, Rick Bowman
Resident Project Representatives (RPR): DWQ Consultant or DWQ Construction Management (Rick Day, Bill Warren, Phoebe Belew)
ESC Plan Reviewer: DWQ Stormwater Section – Amad Al-Humadi
Land Disturbance Permit (LDP) Issuer: DOE New Development
LFUCG Erosion and Sediment Control Compliance Inspector: RPR
Accela Data Entry: DWQ Construction Management – Brenda Whittington
Land Disturbance Permit (LDP) Permittee: Contractor

DWQ Stormwater and Sanitary Sewer Projects:
DWQ Section Managers: Mark Sanders, Chris Dent, Tiffany Rank, Bailee Young
Construction Contract Administrator (CA): Rick Day
Resident Project Representatives (RPR): DWQ Construction Management (Rick Day, Bill Warren, Phoebe Belew)
ESC Plan Reviewer: DWQ Stormwater Section – Rick Day or Amad Al-Humadi
Land Disturbance Permit (LDP) Issuer: DOE New Development
LFUCG Erosion and Sediment Control Compliance Inspector: RPR
Accela Data Entry: DWQ Construction Management – Brenda Whittington
Land Disturbance Permit (LDP) Permittee: Contractor

Permitting Procedures

1. Contractor shall develop a Stormwater Pollution Prevention Plan/Erosion and Sediment Control Plan (SWPPP/ESC Plan). A SWPPP/ESC Plan template is on the LFUCG website at https://www.lexingtonky.gov/new-development. On some projects, the construction contract documents may contain a SWPPP/ESC Plan prepared by LFUCG's consultant for purposes of establishing bid quantities. If the Contractor chooses to use this SWPPP/ESC Plan to obtain the required permits, the Contractor takes sole responsibility for the content of the SWPPP/ESC Plan and the implementation of the plan during construction.
2. Contractor must submit an application for a Land Disturbance Permit to the LFUCG Division of Engineering before beginning project construction. The permit application is available at https://aca3.accela.com/lexky/.
3. For projects with a disturbed area of ≥ 1 acre, the contractor must submit a Notice of Intent (NOI) to the KY Division of Water (KDOW) and obtain KYR10 Permit coverage before beginning construction of any kind on the site. The NOI can be submitted electronically at http://dep.ky.gov/formslibrary/Documents/KYR10PermitPage.pdf.
4. Contractor cannot start project work until they have obtained the LFUCG Land Disturbance Permit and KYR10 Permit coverage (if applicable – see above).
5. DWQ will review the SWPPP/ESC Plan, confirm that the Contractor has obtained KYR10 Permit coverage (if applicable – see above), and authorize the Contractor to install the initial BMPs.
6. Contractor then installs the initial BMPs, prior to project work (general excavation, grading, etc.).
7. DWQ inspects the installation of the initial BMPs and authorizes DOE New Development to issue the Land Disturbance Permit. Contractor then begins the project.

Contractor Responsibilities

Contractor shall:

1. Develop a SWPPP/ESC Plan, or review and agree to use the SWPPP/ESC Plan prepared by LFUCG's consultant, or amend it as needed.

2. Attend a pre-construction conference with LFUCG.

3. Post the LFUCG Land Disturbance Permit and KYR10 Permit (if applicable) on the project sign at the site, and keep a copy of the SWPPP/ESC Plan on site and available for review.

4. Follow the SWPPP/ESC Plan; revise and redline it as conditions change on the site.

5. Install and maintain BMPs to prevent sediment from washing into streets, storm sewers, and streams. All runoff from disturbed areas must pass through a BMP before leaving the site.

6. Maintain a 50-foot vegetative buffer strip along perennial and intermittent streams (including impounded streams), wetlands, sinkholes, and inlets.

7. If work must be done within 50 feet of a perennial or intermittent stream, wetland, sinkhole, or inlet, complete work as soon as possible and stabilize the area within 24 hours after completing work.

8. Conduct an ESC inspection at least once every 7 calendar days and within 24 hours after each rainfall of 0.5 inches or greater (or 4 inches of snow or greater).

9. Complete and sign the inspection form after each inspection. Keep the completed inspection forms on site and available for review. Keep a backup record of inspection forms (photos or scans).

10. Stabilize inactive portions of the site with straw, blanket, seed, or other cover within 14 days of no activity, and provide permanent stabilization within 14 days of reaching final grade.

11. If the project has a KYR10 Permit, file a Notice of Termination with the KY Division of Water and forward to the LFUCG Division of Engineering and LFUCG Division of Water Quality when construction has been completed and the site is stabilized. Final stabilization is defined as follows from KYR10: "All soil disturbing activities at the site have been completed and either of the two following criteria are met – a uniform (e.g., evenly distributed, without large bare areas) perennial vegetative cover with a density of 70 percent of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed."

12. Respond promptly to Verbal Warnings and Notices of Violation from LFUCG regarding correcting ESC problems.

Inspection Procedures for the Resident Project Representative

Weekly Field Inspections

1. Inspect the site each week and the next working day after a storm event of 0.5 inches or greater
2. Ensure the LFUCG Land Disturbance Permit and KYR10 Permit are posted at the site
3. Ensure SWPPP/ESC Plan is available for review
4. Ensure that the weekly and rain event completed inspection forms are available for review
5. Walk the perimeter of the entire site
6. Note downgradient controls:
    - Inspect ditches and sheet flow areas
    - Silt fences working?
    - Ditches vegetated / stabilized?
    - Significant sediment discharges?
7. Walk around internal disturbed areas
    - Idle for more than 14 days . . . stabilized?
8. Inspect all inlets and ditches
    - Inlets protected, ditches stabilized?
9. Check out material / fuel storage areas
    - Spills? Leaks? Leaching pollutants? Litter / waste managed?
10. Inspect concrete washout(s)
11. Inspect the construction entrance / exit
12. Inspect the 50-foot vegetative buffer strip adjacent to waterways. The buffer strip must be stabilized within 24 hours of any approved construction activity in the buffer strip.
13. Communicate inspection findings to Contractor, note issues that need attention
14. Complete the LFUCG inspection checklist
15. Submit an electronic copy of the completed checklist to the Project Manager and the Accela Data Entry Contact person on page 1 **the week of the inspection**.

Important Items for the Permittee / Contractor / RPR to Verify:

- Posted permits, plans, and inspection reports
- Graded / inactive areas stabilized with seed, mulch, blankets, mats, etc.
- Stabilized, non-eroding ditches
- Maintained silt fences and protected curb / drop inlets
- No mud on the street
- Trash and litter managed
- No disturbance in the 50-foot buffer zone adjacent to streams, wetlands, sinkholes, and inlets, unless approved; areas within the 50-foot buffer must be stabilized within 24 hours

Enforcement Procedures

1. The Contractor will be paid for erosion and sediment control based upon a schedule of values established within the Measurement and Payment section of the specifications (e.g., 25% paid once initial ESCs have been installed and LDP obtained, 50% paid in equal monthly payments for maintenance over the construction period, 25% paid for removal of ESCs and final stabilization). The intent of this provision is to pay the Contractor for ESC maintenance for each month that the BMPs are maintained and functioning properly.
2. The RPR shall follow the attached ***Compliance Assistance Guidance for DWQ Capital Project RPRs*** and implement the **Escalating Enforcement Process** described below.

Table 1 – ESC Escalating Enforcement Process

DWQ Capital Project	Escalating Enforcement Process
Remedial Measures Program	The RPR shall escalate the issue to the RMP Program Manager and RMP Program Management Consultant's Project Manager
Wastewater Treatment Plants Stormwater Section MS4/Water Quality Section Sanitary Sewers Capacity Assurance Program	The RPR shall escalate the issue to the DWQ Section Manager and the DWQ Construction Contract Administrator

3. DWQ will use all available means in the contract to obtain compliance, including:
   a. withholding payment
   b. notifying the Contractor that LFUCG intends to initiate the process for declaring that the Contractor is in default of the contract and specifying a deadline for addressing the ESC deficiencies
   c. initiating the process for calling the ESC Performance Bond
   d. issuing Notices of Violation (NOVs)
   e. stopping work

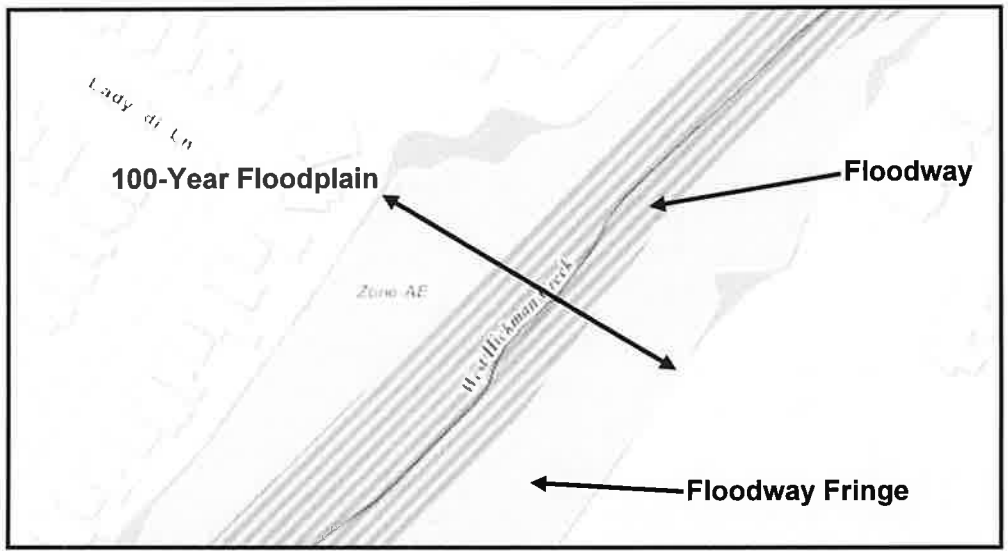
Compliance Assistance Guidance for DWQ Capital Project RPRs

Observed Condition	Verbal Warning to Correct within 3-5 days (See Note 1)	Verbal Warning to Correct within 24 hours (See Note 1)	Escalate the Issue Immediately in Accordance with Table 1
Construction Entrance to Public Road	Rock pad poorly installed/maintained	Rock pad not installed	
	Small amount of sediment on road	Rock pad completely covered with soil	
		Significant amount of sediment on road	
Unstabilized Areas	Flat inactive disturbed areas not stabilized in 14 days	Ditches not stabilized immediately after construction	
		Disturbed, inactive slopes not stabilized within 14 days	Disturbed, inactive slopes above waterways, wetlands, floodplains, critical areas[2] not stabilized within 24 hours
Inlet Protection	Sediment needs to be removed around inlet protection	Curb inlet protection not in place or improperly installed	Discharge of concrete wash water, chemicals, other pollutants into inlets, streams, wetlands, etc.
Silt Fencing	Does not match SWPPP/ESC Plan but critical areas[2] and roads are protected	Silt fence not installed per plan and critical areas[2] and roads are not protected	
	Does not comply with Stormwater Manual but is functional	Blowouts have occurred with discharge of sediment to critical areas[2]	Large quantities of sediment in critical areas[2]
	Needs maintenance/repair, but is not near an inlet or surface water	Not trenched in, is not functional	
		Silt fence needs repairs in critical areas[2]	
Soil Stockpiles	No perimeter controls, downstream BMPs in place	No perimeter controls, downstream BMPs not in place	
Permit Violations		Permit expired	Site not permitted (No LDP or KDOW NOI)
		Permit not posted or available on site	
		Contact name/phone not posted	
		No self-inspection reports; reports not on site	
		Self-inspection reports not current	
		SWPPP/ESC Plan not on site	
			Unapproved construction activities in 50-foot buffer zone around sinkholes, streams, wetlands, etc.
			Construction has started, BMPs not installed

1. Escalate the issue in accordance with Table 1 after the 2nd Verbal Warning.
2. Critical areas are areas within 25 feet of a stream, wetland, sinkhole, or inlet.

Policy for Storing Construction Material in the Floodway/Floodplain
Division of Water Quality Capital Projects
October 1, 2019

1. Excavated residual spoils from excavation may be stored in the floodway or floodway fringe under the following conditions:
   a. Spoil material may be stored no longer than 30 days in the floodway. Any material in the floodway after 30 days shall be removed.
   b. Spoil material may be stored in the floodway fringe (the area in the floodplain that is outside of the floodway) no longer than 180 days.
   c. Spoil material stored in the floodway or floodway fringe shall be enclosed by reinforced silt fence (Coir logs are not acceptable). Diversion berms/ditches shall be constructed upslope of stockpiles to minimize run-on water.
   d. Any evidence of erosion of the stored material shall be immediately mitigated.
2. Construction materials stored in the floodway shall be anchored to prevent floatation or displacement during a flood event.
3. Fuel tanks, lubricants, fertilizer, and chemical products or other potentially hazardous materials shall not be stored in the floodway or floodway fringe.
4. Prior to beginning construction, the contractor shall submit a Spoils Management Plan to LFUCG for review and acceptance. The plan shall be kept on site at all times.



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SECTION 02465
DRILLED CONCRETE PIERS AND SHAFTS

PART 1 – GENERAL

1.01 SUMMARY

A. The Contractor shall provide drilled cast-in-place concrete piers, and reinforcement steel and dowels, where required by the Contract Documents.

B. The Contractor, or Drilling Contractor, shall furnish all materials and labor, as required, to perform the load tests as specified herein.

1.02 SUBSURFACE CONDITIONS

A. A geotechnical engineering study has been performed for the Site. The soil report shall be available at the Engineer's office.

B. The Contractor shall visit the Site and shall satisfy itself as to all existing surface and subsurface conditions affecting its work. The information provided in the geotechnical engineering report is available to the Contractor to assist it, at its own risk, in its assessment of subsurface conditions at the Site. Prior to bidding, bidders may make their own subsurface investigations to satisfy themselves as to site and subsurface conditions, but such subsurface investigations shall be performed only under time schedules and arrangements approved in advance by Owner.

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Reference Specifications

01300	Submittal Procedures
03300	Cast-In-Place Concrete
03200	Reinforcement Bars
03600	Grouting
02240	Dewatering

B. Reference Standards

American Concrete Institute (ACI)	
ACI 336.3R-93(06)	Design and Construction of Drilled Piers
ACI 117	Specification for Tolerances for Concrete Construction and Materials
ACI 301	Specifications for Structural Concrete
ACI 309R	Guide for Consolidation of Concrete

ACI 318	Building Code Requirements for Structural Concrete
ASTM International (ASTM)	
ASTM A36	Structural Steel
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM D1143	Standard Test Method for Deep Foundation Elements Under Static Axial Compressive Load
ASTM D6760	Standard Test Method for Integrity of Concrete Deep Foundation by Ultrasonic Crosshole Testing
American Welding Society (AWS)	
AWS D1.1	Structural Welding Code, Steel
AWS D1.4	Structural Welding Code, Reinforcing Steel

1.04 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01300 – Submittal Procedures.

B. The Contractor shall submit detailed shop drawings for all items needed to install the piers in accordance with this Specification and with Section 03300 – Cast-In-Place Concrete, including, but not limited to, concrete mix design, reinforcement bars, and casings.

1. Steel casings: details of size, wall thickness, length, grade, and splice locations, if needed.

C. The Contractor shall submit a detailed description of procedures and equipment intended to be employed, including details of excavation, dewatering (if needed), soil removal, placement of reinforcement, and placement of concrete.

D. If welding of steel casings is needed, the Contractor shall submit welding procedures and qualifications of welders, in accordance with AWS D1.1 for structural steel.

E. Qualification Data for firm and personnel as defined herein to demonstrate their experience and capabilities. Include lists of completed projects with the project name, address, name of Owner, and other information pertinent to solidify qualifications.

F. Drilling Records

1. The Contractor shall submit copies of the drilling records for each pier, immediately after installation. The records shall include the following, at a minimum:

a. Job name, name of Contractor, and name of Drilling Superintendent,

b. Pier number and location,

c. Shaft diameter, bottom and top elevations, including elevations of casings left in place,

d. Drilling state and finish time,

e. Any variations from specified tolerances including surveyed and plumbness,

f. Description and elevations of any obstructions encountered and whether removal was obtained.

1.05 PREINSTALLATION CONFERENCE

A. At least 7 days prior to beginning pier installation, the Contractor shall chair a meeting to review the proposed excavation, inspection, and concrete and reinforcement placement methods and procedures to produce pier construction of the required quality. Also review requirements for submittals, status of coordinating work and availability of materials. Establish work progress schedule and procedures for bearing surface inspection, materials testing, and certifications.

B. The Contractor shall send a pre-installation conference agenda to all attendees 7 days prior to the scheduled date of the conference.

C. The Contractor shall require responsible representatives of every party who is concerned with the concrete work to attend the conference, including but not limited to the following:

1. Contractor's Superintendent

2. Laboratory responsible for field material testing

3. Drilled Pier Subcontractor

4. Ready-Mix Concrete Producer

5. Engineer

6. Owner's Representative

D. Minutes of the meeting shall be recorded, typed, and printed by the Contractor and distributed to all parties concerned within 5 days of the meeting. One copy of the minutes shall be transmitted to the following for information purposes:

1. Owner's Representative

2. Engineer

E. The Engineer shall be present at the conference. The Contractor shall notify the Engineer at least 7 days prior to the scheduled date of the conference.

1.06 QUALIFICATIONS

A. Drilled piers shall be installed by a Specialty Drilling Contractor with suitable equipment, competent personnel, and a reputation of satisfactory performance of the work. The Contractor shall have a minimum of 5 years successful experience and a minimum of 5 successful installation on projects of a similar size and scope to this project. Key personnel shall include experience with testing requirements as required herein.

1.07 DEFINITIONS

A. In the Contract Documents, where the terms "pier" (in reference to items below grade), "drilled pier," and "foundation pier" are used, they shall have equivalent meaning.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Concrete: Concrete shall be in accordance with Section 03300 - Cast-in-Place Concrete and this Section.

B. Reinforcement Steel: All reinforcement steel shall be in accordance with Section 03200 - Reinforcing Steel.

C. Structural Steel Casing: Structural steel casing shall be a minimum of 3/16-inch thick, ASTM A36 steel. Casings shall be smooth. No corrugated casing shall be permitted.

D. Access Tubes for Cross Sonic Logging (CSL) Testing:

1. Provide access tubes meeting the following requirements:

a. 2-inch ID schedule 40 steel pipe conforming to ASTM A53, Grade A or B, Type E, F, or S.

b. contains round, regular internal diameters free of defects or obstructions, including any at pipejoints.

c. capable of permitting the free, unobstructed passage of a 1.5-inch- diameter source and receiver probes; and

d. watertight and free from corrosion with clean internal and external faces to ensure passage of the probes and a good bond between the concrete and the tubes.

2. Provide watertight shoes on the bottom and removable watertight caps on the top of the tubes.

3. The Inspector will accept access tubes based on visual inspection, certification, and that the steel pipe meets the requirements above.

PART 3 – EXECUTION

3.01 SEQUENCING AND SCHEDULING

A. The Contractor shall schedule the drilling, placement of reinforcement steel, and placement of concrete, so that each excavated shaft is poured immediately after drilling is complete, and reinforcement steel has been placed and approved. All drilled holes shall be filled with concrete within 48 hours of drilling, unless a structural steel casing is provided for the full depth of the shaft.

B. Drilled holes shall be protected against any entrance of water or other debris by sandbagging, covering, or other means proposed by the Contractor. No drilling shall be permitted during periods of rainfall.

C. Excessive wheel loads and surface vibration shall not be allowed within the immediate vicinity of any drilled hole or freshly placed concrete.

3.02 EXCAVATION

A. Pier excavation shall be made by drilling. Required depths of piers shown on drawings are approximate. Piers shall extend a minimum of 1-feet into sound bedrock. Adequate depth of excavation shall be determined by the Engineer.

B. Prior to the placement of concrete, the bottom of the drilled holes shall be clean and free of debris. Bottom surfaces shall be flat and level.

C. Dewatering, if required, shall follow the requirements of Section 02240 – Dewatering.

D. The maximum variation in the center of any drilled pier from plumb shall be 6-inches. The maximum variation in location of any drilled pier at the ground surface shall be 3-inches.

E. Prior to drilling, the design center of each pier shall be located by survey, the use of off-set stakes and intersecting string lines. Stake locations shall be preserved until pier construction has been inspected and completed.

F. Drilling mud or chemical stabilizers shall not be used, except as permitted by the Engineer.

G. The bottom of each pier shall be inspected by the Inspector and meet or exceed the requirements below prior to placing concrete:

1. Provide 2-inch minimum diameter probe holes that extend 10 feet below the bottom of the drilled shafts. The results of the probe hole shall meet or exceed the following requirements:

    a. No weaknesses within 2 feet below the drilled pier bearing elevation.

    b. No individual seam or cavity greater than 1 inch in thickness, within 10 feet below the drilled pier bearing elevation.

    c. The cumulative thickness of weaknesses within 10 feet below the drilled pier bearing elevation should not exceed 2 inches.

3.03 REINFORCEMENT STEEL ASSEMBLY AND PLACEMENT

A. Reinforcement steel cages may be shop- or field-assembled. If not shop assembled, the cages shall be fully assembled at grade, prior to placement. Care shall be taken in placing the reinforcement cage not to disturb the sides of the excavation.

B. Each reinforcement steel cage shall be secured in place symmetrically about the centerline axis of the pier and blocked to stay clear of the walls of the excavation. Cages shall be securely held in place through the placement of concrete.

C. Welding of reinforcement is prohibited unless using ASTM A706

3.04 TESTING EQUIPMENT ASSEMBLY AND PLACEMENT

A. Access Tube Installation for Cross Sonic Logging (CSL) Testing

1. Install 6 access tubes as shown in the contract drawings in each of the drilled shafts having a diameter of 4 ft or less, unless directed by the Engineer to omit any access tubes.

2. Securely attach the CSL tubes that are along the inside periphery to the spiral reinforcement. Wire-tie the tubes a minimum of every 3 ft. so they will stay in position during placement of reinforcement and concrete. Place the tubes so they will be parallel with each other and as near to vertical as possible in the finished shaft. Even moderate bending of the tubes will result in large regional variations in the data.

3. Place the tubes from 6 inches above the shaft tip to at least 3 ft above the top of rebar cage, at least 3 ft above water level, at least to the top of concrete, and at least 3 ft above the top of casing. Under no circumstances may the tubes be allowed to come to rest on the bottom of the excavation.

4. Ensure that any joints in the tubes are watertight.

5. During placement of the reinforcement cage, exercise care so that the tubes will not be damaged to the extent that would prevent a 1.5-inch diameter probe from passing through them.

6. After placing the reinforcing cage and before beginning concrete placement, fill the tubes with clean potable water and cap or seal the tube tops to keep debris out of the tubes. Replace the watertight caps immediately after filling the tubes with water.

7. Before placing concrete, investigate at least one tube per shaft to make sure that there are no bends, crimps, obstructions, or other impediments to the free passage of the testing probes.

8. During removal of the caps from the tubes, exercise care so as not to apply excess torque, hammering, or other stresses which could break the bond between the tubes and concrete.

9. After concrete placement and before the beginning of CSL testing, inspect the access tubes and report any access tubes that the 1.5-inch diameter test probe cannot pass through to the Engineer. The Engineer will make an evaluation to determine if the CSL testing can be successfully performed without the tube(s); the Engineer may require the contractor to, at its own expense, replace one or more tubes with 2-inch-diameter holes cored through the concrete for the entire length of the shaft, excluding the bottom 6 inches. Unless directed otherwise by the Engineer, locate core holes approximately 6 inches inside the reinforcement such that it does not damage the reinforcement. For each core hole drilled, record a log with descriptions of inclusions and voids in the cored holes and submit a copy of the log and photographs to the Engineer. Preserve the cores, identify as to location, and make available for inspection by the Inspector.

10. Grouting

    a. After completion of the CSL testing, evaluation of results and upon being directed by the Engineer, remove the water from the access tubes and any cored holes, completely fill the tubes and holes with approved grout. Grouting requirements shall follow Section 03600 – Grouting. After grouting, cut the tubes flush with the tops of the drilled shafts.

3.05 CONCRETE PLACEMENT

A. Concrete shall be placed against undisturbed material, or against a structural steel casing, when a casing is required.

B. Concrete tests shall be performed in accordance with Section 03300 - Cast-in-Place Concrete.

C. Tolerances shall follow the requirements of Section 03300 – Cast-in-Place Concrete. Cut off elevations at the pier shall be flush with the existing finished floor elevation.

D. For surfaces exposed to air, curing shall be in accordance with "Method 2" in Section 03300 - Cast-in-Place Concrete.

3.06 TESTING

A. Cross Sonic Logging (CSL) Test

1. Provide access to the top of the shaft for testing personnel and equipment.

2. Perform CSL testing on all shafts, unless directed otherwise by the Engineer.

3. Perform CSL testing in general accordance with ASTM D6760.

4. Perform CSL testing on all completed shafts designated for testing by the Engineer, after the shaft concrete has cured at least 72 hours and has obtained a minimum strength of 2500 psi.

5. For drilled shafts with diameters over 4 ft or less, obtain a minimum of 21 CSL logs per shaft (6 perimeter, 3 major diagonal and 12 minor diagonal logs), unless otherwise directed by the Engineer.

6. If the CSL testing firm believes that additional testing is required (such as Angled CSL, Crosshole Tomography, Singlehole Sonic Logging, or Sonic Echo/Impulse Response, etc.), contact the Engineer immediately. The Engineer will determine if additional testing is required, and such testing, if not due to a drilled shaft defect, would be paid for using a change order.

7. Test Reports

a. Submit a test report prepared by the CSL Testing Firm within 5 business days of completion of testing which, as a minimum, contains:

1) Date of test.

2) Plan Shaft No. and Reference Elevation.

3) Schematic showing a plan view of the access tube locations.

4) CSL logs with reference elevations.

5) CSL logs presented for each tube pair tested with any discontinuity. zones indicated on the logs and discussed in the report as appropriate.

6) Analyses of initial pulse arrival time versus depth or velocity versus depth.

7) Analyses of pulse energy/amplitude versus depth.

8. Evaluation of CSL Test Results

a. The Engineer will evaluate the CSL test results in the test report to determine whether the drilled shaft integrity is acceptable. Within 5 business days after receiving a test report, the Engineer will report to the Contractor whether the construction is acceptable or additional analyses are needed.

b. Perform CSL testing on the first shaft constructed. Continue with subsequent drilled shaft rock socket excavation and concrete placement only after receiving written approval and acceptance of the first shaft of each specified diameter, based on the results and analysis of the CSL testing for the first shaft. Drilled shaft operations such as casing placement and overburden excavation will be allowed during the waiting period.

c. Continue with construction of the structure above the drilled shafts only after receiving written approval from the Engineer to do so, based on evaluation of the CSL test results.

d. If the CSL records are inconclusive (e.g. records do not clearly indicate discontinuity, good conditions or missing data), the Engineer may require additional testing, such as Angled CSL, or Singlehole Sonic Logging or concrete cores to sample the concrete in question to verify shaft conditions.

END OF SECTION

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SECTION 02532
SEWAGE COLLECTION LINES

PART 1 – GENERAL

1.01 SUMMARY

A. The Contractor shall furnish all labor, material, and equipment necessary to install gravity sewer piping together with all appurtenances as shown and detailed on the Drawings and specified herein.

PART 2 – PRODUCTS

2.01 DUCTILE IRON (DI) PIPE

A. Ductile iron pipe shall be furnished cement lined in accordance with ANSI/AWWA C104/A21.4 with bituminous seal coat unless otherwise noted on the drawings or in Bid Form. Ductile iron pipe shall be furnished with rubber gasket push-on joints except as may otherwise be noted on the drawings or in difficult working areas and with approval of the Engineer. **All DI pipe and fittings shall be lined with Protecto 401 coating, or approved equal as specified hereinafter.**

B. Thickness design of ductile iron shall conform in all aspects to the requirements of ANSI/AWWA C150/A 21.50 latest revision.

C. Manufacture and testing of ductile iron pipe shall conform in all aspects to the requirements of ANSI/AWWA C151/A 21.51 latest revision.

D. Pipe Coatings

1. Interior Lining

a. Condition of Ductile Iron Prior to Surface Preparation

All ductile pipe and fittings shall be delivered to the application facility without asphalt, cement lining, or any other lining on the interior surface. Because removal of old linings may not be possible, the intent of this specification is that the entire interior of the ductile iron pipe and fittings shall not have been lined with any substance prior to the application of the specified lining material and no coating shall have been applied to the first six (6) inches of the exterior of the spigot ends.

b. Lining Material

The interior of all ductile iron pipe and fittings shall be lined with Protecto 401 Ceramic Epoxy as manufactured by Induron Protective Coatings, Permox CTF as manufactured by The Permite Corporation, or Perma-Shield PL Series 431 as manufactured by Tnemec Company, Inc. Any request for substitution must be accompanied by a successful history of lining pipe and fittings for sewer service, a test report verifying appropriate properties to be used in wastewater piping, and a certification of the test results.

c. Application

1) Applicator

The lining shall be applied by a competent firm with a successful history of applying linings to the interior of ductile iron pipe and fittings.

2) Surface Preparation

Prior to abrasive blasting, the entire area to receive the protective compound shall be inspected for oil, grease, etc. Any areas where oil, grease, or any substance which can be removed by solvent is present, shall be solvent cleaned. After the surface has been made free of grease, oil, or other substances, all areas to receive the protective compounds shall be abrasively blasted using compressed air nozzles with sand or grit abrasive media. The entire surface to be lined shall be struck with the blast media so that all rust, loose oxides, etc., are removed from the surface. Only slight stains and tightly adhering annealing oxide may be left on the surface. Any area where rust reappears before lining must be reblasted.

3) Lining

After the surface preparation and within eight (8) hours of surface preparation, the interior of the pipe shall receive 40 mils nominal dry film thickness of epoxy. No lining shall take place when the substrate or ambient temperature is below 40 degrees Fahrenheit. The surface also must be dry and dust free. If flange pipe or fittings are included in the project, the lining shall not be used on the face of the flange.

4) Coating of Bell Sockets and Spigot Ends

Due to the tolerances involved, the gasket area and spigot end up to six (6) inches back from the end of the spigot end must be coated with 6 mils nominal, 10 mils maximum joint compound. The joint compound shall be applied by brush to ensure coverage. Care should be taken that the joint compound is smooth without excess buildup in the gasket

seat or on the spigot ends. Coating of the gasket seat and spigot ends shall be done after the application of the lining.

5) Number of Coats

The number of coats of lining material applied shall be as recommended by the lining manufacturer. However, in no case shall this material be applied above the dry thickness per coat recommended by the lining manufacturer in printed literature. The maximum or minimum time between coats shall be that time recommended by the lining material manufacturer. **No material shall be used for lining which is not indefinitely recoatable with itself without roughening of the surface.**

6) Touch-Up and Repair

Joint compound shall be used for touch-up or repair in accordance with manufacturer's recommendations.

d. Inspection and Certification

1) Inspection

a) All ductile iron pipe and fitting linings shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC-PA-2 Film Thickness Rating.

b) The interior lining of all pipe barrels and fittings shall undergo holiday inspection in accordance with American Waterworks Association Standard AWWA C210. Holiday inspection may be conducted any time after the coating has reached sufficient cure based on the coating manufacturer's recommendation.

c) Each pipe joint and fitting shall be marked with the date of application of the lining system along with its numerical sequence of application on that date and records maintained by the applicator of his work.

2) Certification

a) The pipe or fitting manufacturer must supply a certificate attesting to the fact that the applicator met the requirements of this specification, and that the material used was as specified.

e. Handling

1) Epoxy lined pipe and fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc., shall be placed inside the pipe and fittings for lifting, positioning, or laying.

2. Exterior Coating

a. Bituminous outside coating shall be in accordance with ANSI/AWWA C151/A 21.51 for pipe and ANSI/AWWA C110/A 21.10 for fittings.

E. Fittings and gaskets for mechanical and push-on joint ductile and cast iron pipe shall conform to the latest revisions of ANSI/AWWA C110/A 21.10 for mechanical and push-on joint fittings, ANSI/AWWA C111/A 21.11 for gaskets, and ANSI/AWWA C153/A 21.53 for mechanical and push-on joint compact fittings.

F. All ductile and cast iron fittings shall be ductile iron grade 70-50-05, 65-45-12, or 60-42-10 in compliance with AWWA C153 and AWWA C110.

G. Restrained joint pipe and fittings shall be a boltless system equal to "Field-Lok" restraining gaskets or "TRFLEX Joint" as manufactured by U.S. Pipe & Foundry Company.

H. Pipe shall be as manufactured by U.S. Pipe & Foundry Company, McWane Ductile, American Pipe Company, or equal.

I. Pipe or fitting shall have the ANSI/AWWA standard, pressure (or thickness) class of either 55 (with thickness of 0.59-inches) or Class 200 (with thickness 0.38-inches), diameter, DI or ductile noted, manufacturer, and country and year where cast on the outside of the body.

J. The required wet well connector piping backfill is dependent on the selected DIP Class by the Contractor. If the Contractor selects, Class 55 DIP (thickness of 0.59-inches), the required backfill is an ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51 Standard Laying Conditions, Trench Type 4. Should the Contractor select Class 200 DIP (thickness of 0.38-inches), the required backfill is an ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51 Standard Laying Conditions, Trench Type 5.

2.02 CONNECTION TO EXISTING GRAVITY PIPE

A. Connections between new and existing gravity pipe shall use a Fernco Strong Back, Straub-Flex coupling, Arpol or approved equal.

B. For pipes 12 inches in diameter and larger, concrete cradle shall be poured under each coupling. The length of the cradle (longitudinally along the pipe) shall be at least one pipe diameter and centered on the coupling. The depth of the cradle shall be half a pipe diameter (measured from the bottom of the cradle to the invert of the pipe). Cradles shall be formed and poured in place and reach from springline to springline.

2.03 UNDERGROUND WARNING TAPE

A. All pipe shall include detectable underground warning tape. Warning tape shall have a minimum thickness of 5 mils, constructed of a minimum 0.0003" (0.3 mils) aluminum foil laminated between polyester and polyethylene sheeting, color coded to sewer, and suitable for direct bury.

B. Warning tape installed per LFUCG standard drawings.

PART 3 – EXECUTION

3.01 PIPE LAYING

A. Excavation, trenching, backfilling, and bedding requirements are set forth in Section 02225.

B. All pipe shall be laid with ends abutting and true to the lines and grades indicated on the Drawings. The pipe shall be laid straight between changes in alignment and at uniform grade between changes in grade. Pipe shall be fitted and matched so that when laid in the trench, it will provide a smooth and uniform invert.

C. Before each piece of pipe is lowered into the trench, it shall be thoroughly swabbed out to insure its being clean. Any piece of pipe or fitting which is known to be defective shall not be laid or placed in the lines. If any defective pipe or fitting shall be discovered after the pipe is laid, it shall be removed and replaced with a satisfactory pipe or fitting without additional charge. In case a length of pipe is cut to fit in a line, it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe and beveled to match the factory bevel for insertion into gasketed joints. Bevel can be made with hand or power tools.

D. The interior of the pipe, as work progresses, shall be cleaned of dirt, jointing materials, and superfluous materials of every description. When laying of pipe is stopped for any reason, the exposed end of such pipe shall be closed with a plywood plug fitted into the pipe bell so as to exclude earth or other material and precautions taken to prevent flotation of pipe by runoff into trench.

E. All pipe shall be laid starting at the lowest point and installed so that the spigot ends point in the direction of flow.

F. Pipe will have the same material specification between manholes.

3.02 PIPE ASSEMBLY

A. All bell and spigot surfaces shall be cleaned immediately before homing the pipe. The bell or groove shall be lubricated in accordance with the manufacturer's recommendation. Each pipe unit shall then be carefully pushed into place without damage to pipe or gasket. All pipe shall be provided with home marks to insure proper

gasket seating. Details of gasket installation and pipe assembly shall follow the direction of the manufacturers of the joint material and of the pipe. The resulting joints shall be watertight and flexible. **No solvent cement joints shall be allowed.**

3.03 UTILITY CROSSING CONCRETE ENCASEMENT

A. At locations shown on the Drawings, required by the Specifications, or as directed by the Engineer, concrete encasement shall be used when the clearance between the proposed sanitary sewer pipe and any existing utility pipe is 18 inches or less. Utility pipe includes underground water, gas, telephone and electrical conduit, storm sewers, and any other pipe as determined by the Engineer.

B. There are two cases of utility crossing encasement. Case I is applicable when the proposed sanitary sewer line is below the existing utility line. Case II is applicable when the proposed sanitary sewer line is laid above the utility line. In either case, the concrete shall extend to at least the spring line of each pipe involved.

C. Concrete shall be Class A and shall be mixed sufficiently wet to permit it to flow between the pipes to form a continuous bridge. In tamping the concrete, care shall be taken not to disturb the grade or line of either pipe or damage the joints.

3.04 TESTING OF GRAVITY SEWER LINES

A. After the gravity piping system has been brought to completion, and prior to final inspection, the Contractor shall rod out the entire system by pushing through each individual line in the system, from manhole to manhole, appropriate tools for the removal from the line of any and all dirt, debris, and trash. If necessary during the process of rodding the system, water shall be turned into the system in such quantities to carry off the dirt, debris, and trash.

B. During the final inspection the Engineer will require all flexible sanitary sewer pipe (DI) to be mandrel deflection tested after installation.

1. The mandrel (go/no-go) device shall be cylindrical in shape and constructed with nine (9) evenly spaced arms of prongs. The mandrel dimension shall be 95 percent of the flexible pipe's published ASTM average inside diameter. Allowances for pipe wall thickness tolerances of ovality (from shipment, heat, shipping loads, poor production, etc.) shall not be deducted from the ASTM average inside diameter, but shall be counted as part of the 5 percent allowance. The contact length of the mandrel's arms shall equal or exceed the nominal diameter of the sewer to be inspected. Critical mandrel dimensions shall carry a tolerance ± 0.001 inch.

2. The mandrel inspection shall be conducted no earlier than 30 days after reaching final trench backfill grade provided, in the opinion of the Engineer, sufficient water densification or rainfall has occurred to thoroughly settle the soil throughout the entire trench depth. Short-term (tested 30 days after installation) deflection shall

not exceed 5 percent of the pipe's average inside diameter. The mandrel shall be hand pulled by the contractor through all sewer lines. Any sections of the sewer not passing the mandrel test shall be uncovered and the Contractor shall replace and recompact the embedment backfill material to the satisfaction of the Engineer. These repaired sections shall be retested with the go/no-go mandrel until passing.

3. The Engineer shall be responsible for approving the mandrel. Proving rings may be used to assist in this. Drawings of the mandrel with complete dimensioning shall be furnished by the Contractor to the Engineer for each diameter and type of flexible pipe.

C. Low-pressure air tests shall be performed on all gravity sanitary sewers to verify water tightness of pipe joints and connections. The Contractor shall perform testing on each manhole-to-manhole section of sewer line after placement of backfill.

1. Testing of Ductile Iron (DI) pipe sewer lines shall be performed in accordance with the current editions of ASTM F1417, "Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air," and UNI-B-6, "Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe," respectively.

2. All testing equipment shall be inspected by the Engineer to ensure that equipment is functioning properly.

3. The rate of air loss in the section under test shall be determined by the time-pressure drop method. The time required in minutes for the pressure in the section under test to decrease from 3.5 to 2.5 psig shall be not less than that indicated in the referenced standards.

4. Immediately following the low-pressure air test, the Contractor shall notify the Engineer of the test results. A Low-Pressure Air Test Report shall be completed by the Contractor during testing. The report shall be completed according to the procedures outlined in LFUCG's Construction Inspection Manual, current edition. A copy of the completed Low-Pressure Air Test Report shall be provided to the Engineer and LFUCG-Division of Water Quality for each test.

5. Pipes failing the pressure test will not be accepted and shall be repaired or replaced until a successful test is achieved.

6. When conducting a low-pressure air test, the Contractor shall securely install and brace all plugs prior to pressurizing the pipe. Personnel shall not be permitted to enter manholes when the sewer pipe is pressurized.

D. TV Survey

1. TV survey and cleaning shall be performed on all gravity sewers.

2. Hydraulic cleaning and vacuum must be done prior to TV survey.

3. TV survey must be of dry pipe.

4. TV survey shall be Pipe Assessment Certification Program (PACP) level of quality and TV equipment must include a slope-inclinometer.

5. Acceptance of TV survey, completed sewers, and the repairs needed are to be determined at sole discretion of LFUCG.

6. TV survey shall include:

   a. Video file and shall be re-named to LFUCG's assets.

   b. PACP database must be in Microsoft Access format, version 4.4.2 which includes photos embedded in database.

   c. Report shall be provided in electronic version in PDF format.

E. The Contractor shall furnish suitable test plugs, water pumps, and appurtenances, and all labor required to properly conduct the tests. Suitable bulkheads shall be installed, as required, to permit the test of the sewer. The Contractor shall construct weirs or other means of measurements as may be necessary.

F. Should the sections under test fail to meet the requirements, the Contractor shall do all work of locating and repairing the leaks and retesting as the Engineer may require without additional compensation.

END OF SECTION

SECTION 02700
ASPHALT PAVING

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The asphalt paving replacement work includes the construction of an aggregate base course, asphalt binder and wearing courses to match existing courses and as specified herein. This work is to replace paving disturbed by the construction and any damages to paving by Contractor's operations, as well as new pavement and driveways, within the limits shown on the plans.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract apply to the Work specified in this Section.

B. Section 02225 – Excavating, Backfilling and Compacting for Sewers

PART 2 – PRODUCTS

2.01 MATERIALS

A. All roads in Fayette County shall be constructed in accordance with the following sections of the Kentucky Transportation Cabinet's (KTC) Standard Specifications for Road and Bridge Construction. Items not covered by the KTC specifications shall require a special design by the Engineer and shall be approved by LFUCG.

1.	Embankment	Division 200
2.	Excavation	Division 200
3.	Subgrade	Division 200
4.	Dense Graded Aggregate	Division 300
5.	Bituminous Concrete (Asphalt)	Division 400
6.	Concrete Paving	Division 500
7.	Chemical Stabilization	Division 200

2.02 SUBGRADE

A. The subgrade shall be free from ruts, large stones, and excessive dust. The subgrade shall be subjected to a subgrade proof-roll test so that soft, wet, or pumping areas may

be identified. The minimum total weight of the loaded dump truck shall be 37 tons. The truck shall be operated at walking speed over the entire subgrade. Any excessive deflections such as rutting or pumping shall be stabilized as directed by the Engineer.

B. Typical treatments of soft or wet areas of the pavement subgrade include removal and replacement (undercutting), "working-in" No. 2 stone, or installation of a geogrid/geotextile system and crushed stone. The extent and performance requirements of such improvements shall be set forth in the Contract Documents or as directed by the Engineer. Other means to stabilize the subgrade such as lime stabilization or cement modification as described in KTC Section 304, may be necessary.

C. The pavement subgrade shall be compacted to a uniform density throughout according to the requirements of the Contract Documents. If the density of the subgrade has been diminished by exposure or weather, after having been previously compacted, it shall be recompacted to the required density and moisture content.

D. Subgrade drainage systems or perforated pipe underdrains shall be installed in accordance with LFUCG Standard Drawings where indicated on the Improvement Plans.

2.03 GRANULAR BASE COURSE

A. The granular base course shall consist of compacted dense-graded aggregate (DGA) meeting the requirements set forth in Kentucky Transportation Cabinet's (KTC) Standard Specifications for Road and Bridge Construction. The Contractor shall submit to the Engineer the results of physical tests performed on the material to verify that it meets the requirements referenced above.

B. The DGA (Zone 3 per LFUCG-RMP Standard Drawing 201-1) shall be applied in thicknesses of no less than 6 inches in thickness. Each lift of DGA shall be compacted to a density no less than 84 percent of the solid volume density based on the oven-dry bulk specific gravity as determined by KM 64-607. A field density test of DGA placement may be required if deemed necessary by Engineer. The tests shall be conducted at a frequency of one test per 2,000 square feet with a minimum of one test per shift during which DGA is placed. The DGA shall be compacted using a vibratory roller or vibratory plate. The DGA shall be placed to achieve a moisture content less than 5%, and shall be stable with no rutting or pumping.

C. Before arriving at the site, the DGA shall be adequately mixed with water in a pugmill. During transportation and storage on site, the DGA shall be covered to prevent loss of moisture. If drying of the DGA occurs, the Contractor shall add water to the DGA and shall thoroughly mix the material before its placement.

2.04 ASPHALT BASE AND SURFACE COURSES

A. The materials and methods for construction for the asphalt base course and surface course shall meet the requirement of Kentucky Transportation Cabinet's (KTC) Standard

Specifications for Road and Bridge Construction. The Contractor shall submit test results of the aggregate gradation and asphalt content to the Engineer.

B. The pavement course thicknesses, and construction tolerances shall be specified in the Contract Documents. The surface of each course shall be checked with templates, straightedges, and/or stringlines for uniformity. All irregularities exceeding the allowable tolerances must be repaired as required by the Contract Documents or as directed by the Engineer.

2.05 TACK COAT

A. The tack coat shall be type SS-1h. Before applying the tack coat the area to receive pavement shall be cleaned. The tack coat shall be applied well in advance of the paving operation to allow all water to evaporate before the surface course is placed. Work shall be planned so that no more tack coat than is necessary for the day's operation is placed on the surface.

END OF SECTION

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SECTION 03100
CONCRETE FORMWORK

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Provide materials, labor, and equipment required for the design and construction of all concrete formwork, bracing, shoring and supports in accordance with the provisions of the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03200 - Reinforcing Steel

B. Section 03250 - Concrete Accessories

C. Section 03290 - Joints in Concrete

D. Section 03300 - Cast-in-Place Concrete

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. Kentucky Building Code
2. ACI 318 - Building Code Requirements for Structural Concrete
3. ACI 301 - Specifications for Structural Concrete for Buildings
4. ACI 347 - Recommended Practice for Concrete Formwork
5. U.S. Product Standard for Concrete Forms, Class I, PS 1
6. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300, Submittals.

1. Manufacturer's data on proposed form release agent

2. Manufacturer's data on proposed formwork system including form ties

1.05 QUALITY ASSURANCE

A. Concrete formwork shall be in accordance with ACI 301, ACI 318, and ACI 347.

PART 2 – PRODUCTS

2.01 FORMS AND FALSEWORK

A. All forms shall be smooth surface forms unless otherwise specified.

B. Wood materials for concrete forms and falsework shall conform to the following requirements:

1. Lumber for bracing, shoring, or supporting forms shall be Douglas Fir or Southern Pine, construction grade or better, in conformance with U.S. Product Standard PS20. All lumber used for forms, shoring or bracing shall be new material.

2. Plywood for concrete formwork shall be new, waterproof, synthetic resin bonded, exterior type Douglas Fir or Southern Pine high density overlaid (HDO) plywood manufactured especially for concrete formwork and shall conform to the requirements of PS1 for Concrete Forms, Class I, and shall be edge sealed. Thickness shall be as required to support concrete at the rate it is placed, but not less than 5/8-inch thick.

C. Other form materials such as metal, fiberglass, or other acceptable material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line and grade indicated may be submitted to the Engineer for approval, but only materials that will produce a smooth form finish equal or better than the wood materials specified will be considered.

2.02 FORMWORK ACCESSORIES

A. Form ties shall be provided with a plastic cone or other suitable means for forming a conical hole to insure that the form tie may be broken off back of the face of the concrete. The maximum diameter of removable cones for rod ties, or of other removable form-tie fasteners having a circular cross-section, shall not exceed 7/8-inch, and all such fasteners shall be such as to leave holes of regular shape for reaming.

B. Form ties for water-retaining structures shall have integral waterstops. Removable taper ties may be used when acceptable to the Engineer. A preformed neoprene or polyurethane tapered plug sized to seat at the center of the wall shall be inserted in the hole left by the removal of the taper tie.

C. Form release agent shall be a blend of natural and synthetic chemicals that employs a chemical reaction to provide quick, easy and clean release of concrete from forms. It

shall not stain the concrete and shall leave the concrete with a paintable surface. Formulation of the form release agent shall be such that it would minimize formation of "bug holes" in cast-in-place concrete.

2.03 FORMWORK LINERS

A. Formwork liners for construction of fluted wall treatment shall be prefabricated plastic liners as manufactured by Greenstreak, Interform Company, or Symons Corporation.

B. Liners shall be fiberglass or ABS (acrylonitrile – butadiene – styrene) of such configuration as to obtain the fluted pattern shown or indicated on the Drawings.

C. For purposes of designating type and quality of material required, form liners shall be pattern 361 trapezoidal liners as manufactured by Greenstreak.

D. Preparation of forming materials, sealing of joints to prevent grout leakage and form release treatment (if required) shall be in strict compliance with the manufacturer's printed instructions and recommendations.

PART 3 – EXECUTION

3.01 FORM DESIGN

A. Forms and falsework shall be designed for total dead load, plus all construction live load as outlined in ACI 347. Design and engineering of formwork and safety considerations during construction shall be the responsibility of the Contractor.

B. Forms shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete. The maximum deflection of facing materials reflected in concrete surfaces exposed to view shall be 1/240 of the span between structural members.

C. All forms shall be designed for predetermined placing rates per hour, considering expected air temperatures and setting rates.

3.02 CONSTRUCTION

A. The type, size, quality, and strength of all materials from which forms are made shall be subject to the approval of the Engineer. No falsework or forms shall be used which are not clean and suitable. Deformed, broken or defective falsework and forms shall be removed from the work.

B. Forms shall be smooth and free from surface irregularities. Suitable and effective means shall be provided on all forms for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete. Joints between the forms shall be sealed to eliminate any irregularities. The arrangement of the facing

material shall be orderly and symmetrical, with the number of seams kept to a practical minimum.

C. Forms shall be true to line and grade, and shall be sufficiently rigid to prevent displacement and sagging between supports. Curved forms shall be used for curved and circular structures. Straight panels joined at angles will not be acceptable for forming curved structures. Forms shall be properly braced or tied together to maintain their position and shape under a load of freshly-placed concrete. Facing material shall be supported with studs or other backing which shall prevent both visible deflection marks in the concrete and deflections beyond the tolerances specified.

D. Forms shall be mortar tight so as to prevent the loss of water, cement and fines during placing and vibrating of the concrete. Specifically, the bottom of wall forms that rest on concrete footings or slabs shall be provided with a gasket to prevent loss of fines and paste during placement and vibration of concrete. Such gasket may be a 1 to 1-1/2 inch diameter polyethylene rod held in position to the underside of the wall form.

E. All vertical surfaces of concrete members shall be formed, and side forms shall be provided for all footings, slab edges and grade beams, except where placement of the concrete against the ground is called for on the Drawings. Not less than 1-inch of concrete shall be added to the thickness of the concrete member as shown where concrete is permitted to be placed against trimmed ground in lieu of forms. Such permission will be granted only for members of comparatively limited height and where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed.

F. All forms shall be constructed in such a manner that they can be removed without hammering or prying against the concrete. Wood forms shall be constructed for wall openings to facilitate loosening and to counteract swelling of the forms.

G. Adequate clean-out holes shall be provided at the bottom of each lift of forms. Temporary openings shall be provided at the base of column forms and wall forms and at other points to facilitate cleaning and observation immediately before the concrete is deposited. The size, number and location of such clean-outs shall be as acceptable to the Engineer.

H. Construction joints shall not be permitted at locations other than those shown or specified, except as may be acceptable to the Engineer. When a second lift is placed on hardened concrete, special precautions shall be taken in the way of the number, location and tightening of ties at the top of the old lift and bottom of the new to prevent any unsatisfactory effect whatsoever on the concrete. For flush surfaces at construction joints exposed to view, the contact surface of the form sheathing over the hardened concrete in the previous placement shall be lapped by not more than 1 inch. Forms shall be held against hardened concrete to prevent offset or loss of mortar at construction joints and to maintain a true surface.

I. The formwork shall be cambered to compensate for anticipated deflections in the formwork due to the weight and pressure of the fresh concrete and due to construction loads. Set forms and intermediate screed strips for slabs accurately to produce the designated elevations and contours of the finished surface. Ensure that edge forms and screed strips are sufficiently strong to support vibrating screeds or roller pipe screeds if the nature of the finish specified requires the use of such equipment. When formwork is cambered, set screeds to a like camber to maintain the proper concrete thickness.

J. Positive means of adjustment (wedges or jacks) for shores and struts shall be provided and all settlement shall be taken up during concrete placing operation. Shores and struts shall be securely braced against lateral deflections. Wedges shall be fastened firmly in place after final adjustment of forms prior to concrete placement. Formwork shall be anchored to shores or other supporting surfaces or members to prevent upward or lateral movement of any part of the formwork system during concrete placement. If adequate foundation for shores cannot be secured, trussed supports shall be provided.

K. Runways shall be provided for moving equipment with struts or legs. Runways shall be supported directly on the formwork or structural member without resting on the reinforcing steel.

3.03 TOLERANCES

A. Unless otherwise indicated in the Contract Documents, formwork shall be constructed so that the concrete surfaces will conform to the tolerance limits listed in ACI 117.

B. Structural framing of reinforced concrete around elevators and stairways shall be accurately plumbed and located within 1/4 in. tolerance from established dimensions.

C. The Contractor shall establish and maintain in an undisturbed condition and until final completion and acceptance of the project, sufficient control points and bench marks to be used for reference purposes to check tolerances. Plumb and string lines shall be installed before concrete placement and shall be maintained during placement. Such lines shall be used by Contractor's personnel and by the Engineer and shall be in sufficient number and properly installed. During concrete placement, the Contractor shall continually monitor plumb and string line form positions and immediately correct deficiencies.

D. Regardless of the tolerances specified, no portion of the building shall extend beyond the legal boundary of the building.

3.04 FORM ACCESSORIES

A. Suitable moldings shall be placed to bevel or round all exposed corners and edges of beams, columns, walls, slabs, and equipment pads. Chamfers shall be 3/4 inch unless otherwise noted.

B. Form ties shall be so constructed that the ends, or end fasteners, can be removed without causing appreciable spalling at the faces of the concrete. After ends, or end fasteners of form ties have been removed, the embedded portion of the ties shall terminate not less than 2 inches from the formed face of the concrete that is exposed to wastewater or enclosed surfaces above the wastewater, and not less than 1 inch from the formed face of all other concrete. Holes left by the removal of form tie cones shall be reamed with suitable toothed reamers so as to leave the surface of the holes clean and rough before being filled with mortar as specified in Section 03350 - Concrete Finishing. No form-tying device or part thereof, other than metal, shall be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete member. The use of snap-ties which cause spalling of the concrete upon form stripping or tie removal will not be permitted. No snap ties shall be broken off until the concrete is at least three days old. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste.

3.05 APPLICATION - FORM RELEASE AGENT

A. Forms for concrete surfaces that will not be subsequently waterproofed shall be coated with a form release agent. Form release agent shall be applied on formwork in accordance with manufacturer's recommendations.

3.06 INSERTS AND EMBEDDED ITEMS

A. Sleeves, pipe stubs, inserts, anchors, expansion joint material, waterstops, and other embedded items shall be positioned accurately and supported against displacement prior to concreting. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids.

3.07 FORM CLEANING AND REUSE

A. The inner faces of all forms shall be thoroughly cleaned prior to concreting. Forms may be reused only if in good condition and only if acceptable to the Engineer. Light sanding between uses will be required wherever necessary to obtain uniform surface texture. Unused tie rod holes in forms shall be covered with metal caps or shall be filled by other methods acceptable to the Engineer.

3.08 FORM REMOVAL AND SHORING

A. Forms shall not be disturbed until the concrete has attained sufficient strength. Sufficient strength shall be demonstrated by structural analysis considering proposed loads, strength of forming and shoring system, and concrete strength data. Shoring shall not be removed until the supported member has acquired sufficient strength to support its weight and the load upon it. Members subject to additional loads during construction shall be adequately shored to sustain all resulting stresses. Forms shall be removed in such manner as not to impair safety and serviceability of the structure. All

concrete to be exposed by form removal shall have sufficient strength not to be damaged thereby.

B. Provided the strength requirements specified above have been met and subject to the Engineer's approval, forms may be removed at the following minimum times. The Contractor shall assume full responsibility for the strength of all such components from which forms are removed prior to the concrete attaining its full design compressive strength. Shoring may be required at the option of the Engineer beyond these periods.

Ambient Temperature (°F) During Concrete Placement					
	Over 95°	70°-95°	60°-70°	50°-60°	Below 50°
Walls	5 days	2 days	2 days	3 days	Do not remove until directed by Engineer (7 days minimum)
Columns	7 days	2 days	3 days	4 days	
Beam Soffits	10 days	7 days	7 days	7 days	
Elevated Slabs	12 days	7 days	7 days	7 days	

C. When, in the opinion of the Engineer, conditions of the work or weather justify, forms may be required to remain in place for longer periods of time.

D. An accurate record shall be maintained by the Contractor of the dates of concrete placings and the exact location thereof and the dates of removal of forms. These records shall be available for inspection at all times at the site, and two copies shall be furnished the Engineer upon completion of the concrete work.

3.09 RESHORING

A. When reshoring is permitted or required the operations shall be planned in advance and subjected to approval by the Engineer.

B. Reshores shall be placed after stripping operations are complete but in no case later than the end of the working day on which stripping occurs.

C. Reshoring for the purpose of early form removal shall be performed so that at no time will large areas of new construction be required to support their own weight. While reshoring is under way, no construction or live loads shall be permitted on the new construction. Reshores shall be tightened to carry their required loads but they shall not be overtightened so that the new construction is overstressed. Reshores shall remain in place until the concrete has reached its specified 28-day strength, unless otherwise specified.

D. For floors supporting shores under newly placed concrete, the original supporting shores shall remain in place or reshores shall be placed. The shoring or reshoring system shall have a capacity sufficient to resist the anticipated loads and in all cases shall have a capacity equal to at least one-half of the capacity of the shoring system above. Reshores shall be located directly under a reshore position above unless other locations are permitted.

E. In multi-story buildings, reshoring shall extend over a sufficient number of stories to distribute the weight of newly placed concrete, forms, and construction live loads so the design superimposed loads of the floors supporting shores are not exceeded.

END OF SECTION

SECTION 03200
REINFORCING STEEL

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Provide all concrete reinforcing including all cutting, bending, fastening and any special work necessary to hold the reinforcing steel in place and protect it from injury and corrosion in accordance with the requirements of this section.

B. Provide deformed reinforcing bars to be grouted into reinforced concrete masonry walls.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03100 - Concrete Formwork

B. Section 03250 - Concrete Accessories

C. Section 03300 - Cast-in-Place Concrete

D. Section 03400 – Precast Concrete

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. Kentucky Building Code
2. CRSI - Concrete Reinforcing Institute Manual of Standard Practice
3. ACI SP66 - ACI Detailing Manual
4. ACI 315 - Details and Detailing of Concrete Reinforcing
5. ACI 318 - Building Code Requirements for Structural Concrete
6. WRI - Manual of Standard Practice for Welded Wire Fabric
7. ASTM A 185 - Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcing
8. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcing

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300, Submittals.

1. Detailed placing and shop fabricating drawings, prepared in accordance with ACI 315 and ACI Detailing Manual - (SP66), shall be furnished for all concrete reinforcing. These drawings shall be made to such a scale as to clearly show joint locations, openings, and the arrangement, spacing and splicing of the bars.

2. Mill test certificates - 3 copies of each.

3. Description of the reinforcing steel manufacturer's marking pattern.

4. Requests to relocate any bars that cause interferences or that cause placing tolerances to be violated.

5. Proposed supports for each type of reinforcing.

6. Request to use splices not shown on the Drawings.

7. Request to use mechanical couplers along with manufacturer's literature on mechanical couplers with instructions for installation, and certified test reports on the couplers' capacity.

8. Request for placement of column dowels without the use of templates.

9. Request and procedure to field bend or straighten partially embedded reinforcing.

1.05 QUALITY ASSURANCE

A. If requested by the Engineer, the Contractor shall provide samples from each load of reinforcing steel delivered in a quantity adequate for testing. Costs of initial tests will be paid by the Owner. Costs of additional tests due to material failing initial tests shall be paid by the Contractor.

PART 2 – PRODUCTS

2.01 REINFORCING STEEL

A. Bar reinforcing shall conform to the requirements of ASTM A 615 for Grade 60 Billet Steel reinforcing. All reinforcing steel shall be from domestic mills and shall have the manufacturer's mill marking rolled into the bar which shall indicate the producer, size, type and grade.

B. Welded wire fabric reinforcing shall conform to the requirements of ASTM A 185 and the details shown on the Drawings.

C. A certified copy of the mill test on each load of reinforcing steel delivered showing physical and chemical analysis shall be provided, prior to shipment. The Engineer reserves the right to require the Contractor to obtain separate test results from an independent testing laboratory in the event of any questionable steel. When such tests are necessary because of failure to comply with this Specification, such as improper identification, the cost of such tests shall be borne by the Contractor.

D. Field welding of reinforcing steel will not be allowed.

E. Use of coiled reinforcing steel will not be allowed.

2.02 ACCESSORIES

A. Accessories shall include all necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers and other devices to position reinforcing during concrete placement. Slab bolsters shall have gray plastic-coated legs.

B. Concrete blocks (dobies), used to support and position bottom reinforcing steel, shall have the same or higher compressive strength as specified for the concrete in which it is located.

2.03 MECHANICAL COUPLERS

A. Mechanical couplers shall develop a tensile strength which exceeds 125 percent of the yield strength of the reinforcing bars being spliced at each splice. The reinforcing steel and coupler used shall be compatible for obtaining the required strength of the connection.

B. Where the type of coupler used is composed of more than one component, all components required for a complete splice shall be supplied.

C. Hot-forged sleeve type couplers shall not be used. Acceptable mechanical couplers are Dayton Superior Dowel Bar Splicer System by Dayton Superior, Dayton, Ohio. Mechanical couplers shall only be used where shown on the Drawings or where specifically approved by the Engineer.

2.04 DOWEL ADHESIVE SYSTEM

A. Where shown on the Drawings, reinforcing bars anchored into hardened concrete with a dowel adhesive system shall use a two-component adhesive mix which shall be injected with a static mixing nozzle following manufacturer's instructions. All holes shall be drilled with a carbide bit unless otherwise recommended by the manufacturer. Thoroughly clean drill holes of all debris and drill dust with compressed air followed by a wire brush prior to installation of adhesive and reinforcing bar. Where depth of hole exceeds the length of the static mixing nozzle, a plastic extension hose shall be used to ensure proper adhesive injection from the back of the hole. Injection of adhesive into the hole shall utilize a piston plug to minimize the formation of air pockets. The embedment depth

of the bar shall be per manufacturer's recommendations, so as to provide a minimum allowable bond strength that is equal to 125 percent of the yield strength of the bar, unless noted otherwise on the Drawings. The adhesive system shall be "Epcon System C6 or G5" as manufactured by ITW Redhead. "SET Epoxy-Tie" or "SET-XP" as manufactured by Simpson Strong-Tie Co. or "PE-1000 SD" and "T308" by Powers Fasteners. Engineer's approval is required for use of this system in locations other than those shown on the Drawings. **Fast-set epoxy formulations shall not be acceptable.**

B. Where identified on the Contract Drawings or for installation of concrete where anchorage failure could present a life-threatening hazard, the adhesive system shall be "PE-1000 SD" by Powers Fasteners, "SET-XP" by Simpson Strong-Tie Co. or "Epcon System G5" as manufactured by ITW Redhead. Alternate adhesive systems shall be IBC compliant for use in both cracked and uncracked concrete in all Seismic Design Categories, must comply with the latest revision of ICC-ES Acceptance Criteria AC308, and shall have a valid ICC-ES report in accordance with the applicable building code. Installation of adhesive system shall be per manufacturer's recommendations and as required in Item A above.

PART 3 – EXECUTION

3.01 TEMPERATURE REINFORCING

A. Unless otherwise shown on the Drawings or in the absence of the concrete reinforcing being shown, the minimum cross sectional area of horizontal and vertical concrete reinforcing in walls shall be 0.0033 times the gross concrete area and the minimum cross sectional area of reinforcing perpendicular to the principal reinforcing in slabs shall be 0.0020 times the gross concrete area. Temperature reinforcing shall not be spaced further apart than five times the slab or wall thickness, nor more than 18 inches.

3.02 FABRICATION

A. Reinforcing steel shall be accurately formed to the dimensions and shapes shown on the Drawings and the fabricating details shall be prepared in accordance with ACI 315 and ACI 318, except as modified by the Drawings.

B. The Contractor shall fabricate reinforcing bars for structures in accordance with the bending diagrams, placing lists and placing Drawings.

C. No fabrication shall commence until approval of Shop Drawings has been obtained. All reinforcing bars shall be shop fabricated unless approved by the Engineer to be bent in the field. Reinforcing bars shall not be straightened or rebent in a manner that will injure the material. Heating of bars will not be permitted.

D. Welded wire fabric with longitudinal wire of W9.5 size or smaller shall be either furnished in flat sheets or in rolls with a core diameter of not less than 10 inches. Welded wire fabric with longitudinal wires larger than W9.5 size shall be furnished in flat sheets only.

3.03 DELIVERY, STORAGE AND HANDLING

A. All reinforcing shall be neatly bundled and tagged for placement when delivered to the job site. Bundles shall be properly identified for coordination with mill test reports.

B. Reinforcing steel shall be stored above ground on platforms or other supports and shall be protected from the weather at all times by suitable covering. It shall be stored in an orderly manner and plainly marked to facilitate identification.

C. Reinforcing steel shall at all times be protected from conditions conducive to corrosion until concrete is placed around it.

D. The surfaces of all reinforcing steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcing shall be reinspected and if necessary recleaned.

3.04 PLACING

A. Reinforcing steel shall be accurately positioned as shown on the Drawings and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. All reinforcing steel shall be supported by concrete, plastic or metal supports, spacers or metal hangers which are strong and rigid enough to prevent any displacement of the reinforcing steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used in sufficient numbers to support the reinforcing bars without settlement. In no case shall concrete block supports be continuous.

B. The portions of all accessories in contact with the formwork shall be made of plastic or steel coated with a 1/8 inch minimum thickness of plastic which extends at least 1/2 inch from the concrete surface. Plastic shall be gray in color.

C. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.

D. Reinforcing bars additional to those shown on the Drawings, which may be found necessary or desirable by the Contractor for the purpose of securing reinforcing in position, shall be provided by the Contractor at no additional cost to the Owner.

E. Reinforcing placing, spacing, and protection tolerances shall be within the limits specified in ACI 318 except where in conflict with the Building Code, unless otherwise specified.

F. Reinforcing bars may be moved within one bar diameter as necessary to avoid interference with other concrete reinforcing, conduits, or embedded items. If bars are

moved more than one bar diameter, or enough to exceed placing tolerances, the resulting arrangement of bars shall be as acceptable to the Engineer.

G. Welded wire fabric shall be supported on slab bolsters spaced not less than 30 inches on centers, extending continuously across the entire width of the reinforcing mat and supporting the reinforcing mat in the plane shown on the Drawings.

H. Reinforcing shall not be straightened or rebent unless specifically shown on the drawings or authorized in writing by the Engineer. Bars with kinks or bends not shown on the Drawings shall not be used. Coiled reinforcement shall not be used.

I. Dowel Adhesive System shall be installed in strict conformance with the manufacturer's recommendations. A representative of the manufacturer must be on site when required by the Engineer. At least 25 percent of the dowels installed shall be proof tested to 1.33 times the allowable load specified by the manufacturer, or as indicated on the Drawings. If the dowels are required to have a hook at the end to be embedded in the new work, an approved mechanical coupler shall be provided at a convenient distance from the face of existing concrete to facilitate the testing.

3.05 SPLICING

A. Reinforcing bar splices shall only be used at locations shown on the Drawings. When it is necessary to splice reinforcing at points other than where shown, the splice shall be as acceptable to the Engineer.

B. The length of lap for reinforcing bars, unless otherwise shown on the Drawings shall be in accordance with ACI 318 for a class B splice.

C. Laps of welded wire fabric shall be in accordance with ACI 318. Adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each 2 running feet. Wires shall be staggered and tied in such a manner that they cannot slip.

D. Mechanical splices shall be used only where shown on the drawings or when approved by the Engineer.

E. Couplers which are located at a joint face shall be a type which can be set either flush or recessed from the face as shown on the Drawings. The couplers shall be sealed during concrete placement to completely eliminate concrete or cement paste from entering. After the concrete is placed, couplers intended for future connections shall be plugged and sealed to prevent any contact with water or other corrosive materials. Threaded couplers shall be plugged with plastic plugs which have an O-ring seal.

3.06 INSPECTION

A. The Contractor shall advise the Engineer of his intentions to place concrete and shall allow him adequate time to inspect all reinforcing steel before concrete is placed.

B. The Contractor shall advise the Engineer of his intentions to place grout in masonry walls and shall allow him adequate time to inspect all reinforcing steel before grout is placed.

END OF SECTION

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SECTION 03250
CONCRETE ACCESSORIES

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish all materials, labor and equipment required to provide all concrete accessories including waterstops, expansion joint material, joint sealants, expansion joint seals, contraction joint inserts, epoxy bonding agent, and concrete anchors.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03100 - Concrete Formwork

B. Section 03290 - Joints in Concrete

C. Section 03300 - Cast-in-Place Concrete

D. Section 07900 - Joint Sealers

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. Federal Specification TT-S-00227 E (3)
2. ASTM C881 Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
3. ASTM D412 Standard Tests for Rubber Properties in Tension
4. ASTM D 624 Standard Test method for Rubber Property - Tear Resistance
5. ASTM D 638 Standard Test Method for Tensile Properties of Plastics
6. ASTM D1751 Standard Specifications for Preformed Expansion Joint fillers for Concrete Paving and Structural Construction (nonextruding and resilient bituminous types)
7. ASTM D 1752 Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300, Submittals.

1. Manufacturer's literature on all products specified herein including material certifications.

2. Proposed system for supporting PVC waterstops in position during concrete placement

3. Samples of products if requested by the Engineer.

PART 2 – PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) WATERSTOPS

A. PVC waterstops for construction joints shall be flat ribbed type, 6 inches wide with a minimum thickness at any point of 3/8 inches.

B. Waterstops for expansion joints shall be ribbed with a center bulb. They shall be 9 inches wide with a minimum thickness at any point of 3/8 inch unless shown or specified otherwise. The center bulb shall have a minimum outside diameter of 1 inch and a minimum inside diameter of 1/2 inch.

C. The waterstops shall be manufactured from virgin polyvinyl chloride plastic compound and shall not contain any scrap or reclaimed material or pigment whatsoever. The properties of the polyvinyl chloride compound used, as well as the physical properties of the waterstops, shall exceed the requirements of the U.S. Army Corps. of Engineers' Specification CRD-C572. The waterstop material shall have an off-white, milky color.

D. The required minimum physical characteristics for this material are:

1. Tensile strength - 1,750 psi (ASTM D-638).

2. Ultimate elongation - not less than 280% (ASTM D-638).

E. No reclaimed PVC shall be used for the manufacturing of the waterstops. The Contractor shall furnish certification that the proposed waterstops meet the above requirements.

F. PVC waterstops shall be as manufactured by DuraJoint, Vinylex Corp., Greenstreak, Inc.

G. All waterstop intersections, both vertical and horizontal, shall be made from factory fabricated corners and transitions. Only straight butt joint splices shall be made in field.

2.02 RETROFIT WATERSTOPS

A. Retrofit waterstops shall be used where specifically shown on Drawings for sealing joints between existing concrete construction and new construction.

B. Retrofit waterstops shall be PVC waterstops fabricated from material as described in Section 2.01 of this Specification.

C. Retrofit waterstop shall be attached to existing concrete surface as shown on Drawings.

D. Use of split waterstop in lieu of specially fabricated retrofit waterstop will not be acceptable.

E. Retrofit Waterstop manufacturer must provide a complete system including all Waterstop, stainless steel anchoring hardware, and epoxy for installation.

F. For construction joints, retrofit waterstop shall be style number 609 by Sika Greenstreak, RF-638 by BoMetals, Inc., Type 18 kit by DuraJoint Concrete Accessories, or approved equal. For expansion joints, retrofit waterstop shall be style number 667 by Sika Greenstreak, Type 18-9 kit by DuraJoint Concrete Accessories, or approved equal.

2.03 CHEMICAL RESISTANT WATERSTOPS

A. Where specifically noted on Contract Drawings, chemical resistant waterstops shall be used instead of PVC waterstops.

B. Chemical resistant waterstops for construction joints shall be ribbed with a center bulb. They shall be 6 inches wide with a minimum thickness at any point of 3/16 inches.

C. Chemical resistant waterstops for expansion joints shall be ribbed tear web. They shall be 9 inches wide with a tear web designed to accommodate 1 inch of free movement minimum.

D. Chemical resistant retrofit waterstop shall be a minimum of 2½" wide along the ribbed side and a minimum 5" wide along the side attached to the existing concrete surface. Retrofit waterstop shall include a centerbulb and shall have a minimum thickness of 3/16". Retrofit waterstop manufacturer shall provide a complete system including waterstop, stainless steel anchoring hardware and epoxy for installation.

E. Chemical resistant waterstops shall be manufactured from a fully crosslinked thermoplastic vulcanizate rubber.

F. Waterstops shall be TPE-R by BoMetals, Inc., Earth Shield TPV/TPE-R by JP Specialties, Inc., Westec TPE-R by Westec Barrier Technologies, or TPE-R by DuraJoint Concrete Accessories.

2.04 HYPALON RUBBER WATERSTOPS

A. Hypalon rubber waterstops shall be Sikadur Combiflex by Sika Corporation or approved equal. Minimum width of waterstop material shall be twelve (12) inches unless shown otherwise on Contract Drawings.

2.05 EXPANDING RUBBER WATERSTOP

A. Expanding rubber shall be designed to expand under hydrostatic conditions. Waterstops shall be Adeka Ultra Seal MC-2010M by Adeka Ultra Seal/OCM, Inc., or Hydrotite CJ-1020-2K by Sika Greenstreak, for concrete thickness greater than nine inches. For thicknesses less than nine inches, Adeka Ultra Seal KBA-1510FF or Hydrotite CJ-1020-2K shall be used.

B. Waterstop shall be a chemically modified natural rubber product with a hydrophilic agent.

C. Waterstop has a stainless steel mesh or coextrusion of non-hydrophilic rubber to direct expansion in the thickness direction and restrict the expansion in the longitudinal direction.

2.06 WATERSTOP ADHESIVE

A. Adhesive between waterstops and existing concrete shall be 20+F Contact Cement by Miracle Adhesives Corporation, Neoprene Adhesive 77-198 by JGF Adhesives, Sikadur 31 Hi-Mod Gel by Sika Corporation, DP-605 NS Urethane Adhesive by 3M Adhesive Systems.

2.07 JOINT SEALANTS

A. Joint sealants shall comply with Section 07900, Joint Sealers.

2.08 EXPANSION JOINT MATERIAL

A. Preformed expansion joint material shall be non-extruding, and shall be of the following types:

1. Type I - Sponge rubber, conforming to ASTM D1752, Type I.
2. Type II - Cork, conforming to ASTM D1752, Type II.
3. Type III - Self-expanding cork, conforming to ASTM D1752, Type III.
4. Type IV - Bituminous fiber, conforming to ASTM Designation D1751.

2.09 EXPANSION JOINT SEAL

A. Expansion Joint Seal System shall consist of a preformed neoprene profile, installed using the same dimensions as the joint gap, bonded with a two-component epoxy adhesive and pressurized during the adhesive cure time.

B. The expansion joint system shall be Hydrozo/Jeene Structural Sealing joint system by Hydrozo/Jeene, Inc, or equal.

2.10 CONTRACTION JOINT INSERTS

A. Contraction joint inserts shall be ZipCap Control Joint former by Greenstreak Plastic Products.

2.11 EPOXY BONDING AGENT

A. Epoxy bonding agent shall conform to ASTM C881 and shall be Sikadur 32 Hi-Mod, Sika Corporation, Lyndhurst, N.J.; Euco #452 Epoxy System, Euclid Chemical Company, Cleveland, OH, Concresive LV1 by BASF Construction Chemicals.

2.12 EPOXY RESIN BINDER

A. Epoxy resin binder shall conform to the requirements of ASTM C-881, Type III, Grade 3, Class B and C for epoxy resin binder and shall be Sikadur 23, Low-Mod-Gel, manufactured by the Sika Corporation, Lyndhurst, N.J., Flexocrete Gel manufactured by Tamms Industries Co. or Euco #352 Gel, Euclid Chemical Company, Concresive Paste LPL or SPL by BASF Construction Chemicals.

2.13 CONCRETE ANCHORS

A. Mechanical Anchors:

1. Wedge Anchors: Wedge anchors shall be "Kwik Bolt TZ" by Hilti, Inc., "TruBolt +" by ITW Redhead, "Strong-Bolt" or "Strong-Bolt 2" by Simpson Strong-Tie Co. or "Powerstud SD-1" or "Powerstud SD-2" by Powers Fasteners.

2. Screw Anchors: Screw anchors shall be "Kwik HUS-EZ" and "KWIK HUS-EZ-I" by Hilti, Inc., "Titen HD" by Simpson Strong-Tie Co., or "Wedge-Bolt +" by Powers Fasteners. Bits specifically provided by manufacturer of chosen system shall be used for installation of anchors.

3. Sleeve Anchors: Sleeve anchors shall be "HSL-3 Heavy Duty Sleeve Anchor" by Hilti, Inc. or "Power-Bolt +" by Powers Fasteners.

4. Undercut Anchors: Undercut anchors shall be "HDA Undercut Anchor" by Hilti, Inc., "Torq-Cut Undercut Anchor" by Simpson Strong-Tie Co., "Atomic + Undercut Anchor" by Powers Fasteners

B. Adhesive Anchors:

1. Adhesive anchors shall be "Epcon G5" by ITW Redhead, "HIT HY-150 Max SD" by Hilti, Inc., "SET-XP" by Simpson Strong-Tie Co., or "Powers 1000+" by Powers Fasteners.

2. Adhesive anchor systems shall be IBC compliant and capable of resisting short term wind and seismic loads (Seismic Design Categories A through F) as well as long term and short term sustained static loads in both cracked and uncracked concrete in all Seismic Design Categories. Structural adhesive anchor systems shall comply with the latest revision of ICC-ES Acceptance Criteria AC308, and shall have a valid ICC-ES report in accordance with the applicable building code. **No "or equal" products will be considered unless prequalified and approved by the Engineer and Owner.**

C. Concrete Anchor Materials:

1. Concrete anchors used to anchor structural steel shall be a threaded steel rod per manufacturer's recommendations for proposed adhesive system, but shall not have a yield strength (fy) less than 58 ksi nor an ultimate strength (fu) less than 72.5 ksi, unless noted otherwise. Where steel to be anchored is galvanized, concrete anchors shall also be galvanized unless otherwise indicated on the Drawings.

2. Concrete anchors used to anchor aluminum, FRP, or stainless steel shall be Type 304 stainless steel unless noted otherwise. All underwater concrete anchors shall be Type 316 stainless steel.

3. Nuts, washers, and other hardware shall be of a material to match the anchors.

2.14 MASONRY ANCHORS

A. Anchors for fastening to solid or grout-filled masonry shall be adhesive anchors as specified above for concrete anchors.

B. Anchors for fastening to hollow masonry or brick shall be adhesive anchors consisting of threaded rods or bolts anchored with an adhesive system dispensed into a screen tube inserted into the masonry. The adhesive system shall use a two-component adhesive mix and shall inject into the screen tube with a static mixing nozzle. Thoroughly clean drill holes of all debris and drill dust with nylon (not wire) brush prior to installation of adhesive and anchor. Contractor shall follow manufacturer's installation instructions. The adhesive system shall be "Epcon System A7 or C6" as manufactured by ITW Ramset/Redhead, "HIT HY-70 System" as manufactured by Hilti, Inc., "SET Epoxy-Tie" or "AT Acrylic-Tie" as manufactured by Simpson Strong-Tie Co., or "AC100+ Gold by Powers Fasteners.

C. Masonry anchors used to anchor steel shall be a threaded steel rod per manufacturer's recommendations for proposed adhesive system, but shall not have a yield strength (fy) less than 58 ksi nor an ultimate strength (fu) less than 72.5 ksi, unless noted otherwise. Where steel to be anchored is galvanized, masonry anchors shall also be galvanized.

D. Masonry anchors used to anchor aluminum, FRP, or stainless steel shall be Type 304 stainless steel unless noted otherwise. All underwater anchors shall be Type 316 stainless steel.

2.15 MANHOLE STEPS

A. Manhole or access steps shall be plastic, constructed of copolymer polypropylene meeting the requirements of ASTM D 2146 for Type II, Grade 16906 material. Step shall be reinforced with ASTM A 615, Grade 60, #4 deformed steel reinforcing bar, be 9" deep, 14" wide, provided with notched tread ridge, foot retainer lugs on each side of tread and penetration stops for press fit installation. Plastic steps shall be PS2-PF as manufactured by M.A. industries, Inc., Peachtree City, Georgia. Steps shall be installed by drilling 1" diameter holes, minimum 3-3/4 inches deep into the wall, and then driving steps into hole to the penetration stop, resulting in a press fit condition.

2.16 PRESSURE RELIEF VAVLES

A. Tank pressure relief valves shall be 6" diameter Neenah Foundry Company R-5001-1, American Valve & Hydrant B315.1, or equal, floor type, with outside hooks or inside self-contained lock; quantity and spacing as shown on structural drawings. No part of pressure relief valves shall project above the neat line of the tank floor to prevent fouling of scraper mechanisms where used.

PART 3 – EXECUTION

3.01 PVC AND CHEMICAL RESISTANT WATERSTOPS

A. PVC and chemical resistant waterstops shall be provided in all construction and expansion joints in water bearing structures and at other such locations as required by the Drawings.

B. Waterstops shall be carefully positioned so that they are embedded to an equal depth in concrete on both sides of the joint. They shall be kept free from oil, grease, mortar or other foreign matter. To ensure proper placement, all waterstops shall be secured in correct position at 12" on center along the length of the waterstop on each side, prior to placing concrete. Such method of support shall be submitted to the Engineer for review and approval. Grommets or small pre-punched holes as close to the edges as possible will be acceptable for securing waterstops.

C. Splices in PVC waterstops and chemical resistant waterstops shall be made with a thermostatically controlled heating element. Splices in chemical resistant waterstops

may also be made with adhesive system approved by manufacturer of waterstop. Only straight butt joint splices will be allowed in the field. Factory fabricated corners and transitions shall be used at intersections. Splices shall be made in strict accordance with the manufacturer's recommended instructions and procedures. At least three satisfactory sample splices shall be made on the site. The Engineer may require tests on these splices by an approved laboratory. The splices shall exhibit not less than 80 percent of the strength of the unspliced material.

D. All splices in waterstops will be subject to rigid review for misalignment, bubbles, inadequate bond, porosity, cracks, offsets, and other defects which would reduce the potential resistance of the material to water pressure at any point. All defective joints shall be replaced with material which will pass said review and all faulty material shall be removed from the site and disposed of by the Contractor at no additional cost to the Owner.

E. Retrofit waterstops shall be installed as shown on Contract Drawings using approved waterstop adhesive and Type 316 stainless steel batten bars and expansion anchors.

F. Waterstop installation and splicing defects which are unacceptable include, but are not limited to the following:

1. Tensile strength not less than 80 percent of parent material.

2. Overlapped (not spliced) Waterstop.

3. Misalignment of Waterstop geometry at any point greater than 1/16 inch.

4. Visible porosity or charred or burnt material in weld area.

5. Visible signs of splice separation when splice (24 hours or greater) is bent by hand at sharp angle.

3.02 HYPALON RUBBER AND EXPANDING RUBBER WATERSTOPS

A. Waterstops shall be installed only where shown on the Drawings.

B. Waterstops shall be installed in strict accordance with manufacturer's recommendations.

3.03 WATERSTOP ADHESIVE

A. Adhesive shall be applied to both contact surfaces in strict accordance with manufacturer's recommendations.

B. Adhesive shall be used where waterstops are attached to existing concrete surfaces.

3.04 INSTALLATION OF EXPANSION JOINT MATERIAL AND SEALANTS

A. Type I, II, or III shall be used in all expansion joints in structures and concrete pavements unless specifically shown otherwise on the Drawings. Type IV shall be used in sidewalk and curbing and other locations specifically shown on the Drawings.

B. All expansion joints exposed in the finish work, exterior and interior, shall be sealed with the specified joint sealant. Expansion joint material and sealants shall be installed in accordance with manufacturer's recommended procedures and as shown on the Drawings.

C. Expansion joint material that will be exposed after removal of forms shall be cut and trimmed to ensure a neat appearance and shall completely fill the joint except for the space required for the sealant. The material shall be held securely in place and no concrete shall be allowed to enter the joint or the space for the sealant and destroy the proper functions of the joint.

D. A bond breaker shall be used between expansion joint material and sealant. The joint shall be thoroughly clean and free from dirt and debris before the primer and the sealant are applied. Where the finished joint will be visible, masking of the adjoining surfaces shall be carried out to avoid their discoloration. The sealant shall be neatly tooled into place and its finished surfaces shall present a clean and even appearance.

E. Type 1 joint sealant shall be used in all expansion and contraction joints in concrete, except where Type 7 or Type 8 is required as stated below, and wherever else specified or shown on the Drawings. It shall be furnished in pour grade or gun grade depending on installation requirements. Primers shall be used as required by the manufacturer. The sealant shall be furnished in colors as directed by the Engineer.

F. Type 8 joint sealant shall be used in all concrete pavements and floors subject to heavy traffic and wherever else specified or shown on the Drawings.

G. Type 7 joint sealant shall be used for all joints in chlorine contact tanks and wherever specified or shown on the Drawings.

3.05 EXPANSION JOINT SEAL

A. The expansion joint seal system shall be installed as shown on the Drawings in strict accordance with the manufacturer's recommendations.

3.06 CONTRACTION JOINT INSERTS

A. For contraction joints in slabs, inserts shall be floated in fresh concrete during finishing.

B. For contraction joints in walls, inserts shall be secured in place prior to casting wall.

C. Inserts shall be installed true to line at the locations of all contraction joints as shown on the Drawings.

D. Inserts shall extend into concrete sufficient depth as indicated on the Drawings or specified in Section 03290, Joints in Concrete.

E. Inserts shall not be removed from concrete until concrete has cured sufficiently to prevent chipping or spalling of joint edges due to inadequate concrete strength.

3.07 EPOXY BONDING AGENT

A. The Contractor shall use an epoxy bonding agent for bonding all fresh concrete to existing concrete as shown on the Drawings.

B. Bonding surface shall be clean, sound and free of all dust, laitance, grease, form release agents, curing compounds, and any other foreign particles.

C. Application of bonding agent shall be in strict accordance with manufacturer's recommendations.

D. Fresh concrete shall not be placed against existing concrete if epoxy bonding agent has lost its tackiness.

3.08 EPOXY RESIN BINDER

A. Epoxy resin binder shall be used to seal all existing rebar cut and burned off during demolition operations. Exposed rebar shall be burned back 1/2-inch minimum into existing concrete and the resulting void filled with epoxy resin binder.

3.09 ANCHOR INSTALLATION

A. Concrete Anchors and Masonry Anchors

1. Overhead adhesive anchors, and base plates or elements they are anchoring, shall be shored as required and securely held in place during anchor setting to prevent movement during anchor installation. Movement of anchors during curing is prohibited.

2. The Contractor shall verify that all concrete and masonry anchors have been installed in accordance with the manufacturer's recommendations and that the capacity of the installed anchor meets or exceeds the specified safe holding capacity.

3. Concrete anchors shall not be used in place of anchor bolts without Engineer's approval.

4. All stainless steel threads shall be coated with antiseize lubricant.

B. Concrete Anchors

1. Concrete at time of anchor installation shall be a minimum age of 21 days.

2. All concrete anchors shall be installed in strict conformance with the manufacturer's printed installation instructions. A representative of the manufacturer shall be on site when required by the Engineer.

3. All holes shall be drilled with a carbide bit unless otherwise recommended by the manufacturer. No cored holes shall be allowed unless specifically approved by the Engineer. If coring holes is allowed by the manufacturer and approved by the Engineer, cored holes shall be roughened in accordance with manufacturer requirements. Thoroughly clean drill holes of all debris and drill dust with compressed air followed by a wire brush prior to installation of adhesive and threaded rod/bolt unless otherwise recommended by the manufacturer. Degree of hole dampness shall be in strict accordance with manufacturer recommendations. Where depth of hole exceeds the length of the static mixing nozzle, a plastic extension hose shall be used to ensure proper adhesive injection from the back of the hole. Injection of adhesive into the hole shall utilize a piston plug to minimize the formation of air pockets. Wipe rod free from oil that may be present from shipping or handling.

C. Other Bolts

1. All dissimilar metal shall be connected with appropriate fasteners and shall be insulated with a dielectric or approved equal.

2. All stainless steel bolts shall be coated with antiseize lubricant.

END OF SECTION

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SECTION 03290
JOINTS IN CONCRETE

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Provide all materials, labor and equipment required for the construction of all joints in concrete specified herein and shown on the Drawings.

B. Types of joints in concrete shall be as follows:

1. Construction Joints - Joints between adjacent concrete placements continuously connected with reinforcement.

2. Expansion Joints - Joints in concrete which allow thermal expansion and contraction of concrete. Reinforcement terminates within concrete on each side of joint.

3. Contraction Joints - Joints formed in concrete to provide a weakened plane in concrete section to control formation of shrinkage cracks.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03100 - Concrete Formwork

B. Section 03250 - Concrete Accessories

C. Section 03300 - Cast-in-Place Concrete

D. Section 07900 - Joint Sealers

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. ACI 301 - Specifications for Structural Concrete for Buildings

2. ACI 318 - Building Code Requirements for Structural Concrete

3. ACI 350 - Code Requirements for Environmental Engineering Concrete Structures

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300, Submittals.

1. Layout drawings showing location and type of all joints to be placed in each structure.

2. Details of proposed joints in each structure.

PART 2 – MATERIALS

2.01 MATERIALS

A. All materials required for joint construction shall comply with Section 03250 - Concrete Accessories, and Section 07900 - Joint Sealers.

PART 3 – EXECUTION

3.01 CONSTRUCTION JOINTS

A. Construction joints shall be as shown on the Drawings. Otherwise, Contractor shall submit description of the joint and its location to Engineer for approval.

B. Unless noted otherwise on the Drawings, construction joints shall be located near the middle of the spans of slabs, beams, and girders unless a beam intersects a girder at this point. In this case, the joints in the girders shall be offset a distance equal to twice the width of the beam. Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and the top of footings or floor slabs unless noted otherwise on Drawings. Beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as slabs. Joints shall be perpendicular to the main reinforcement.

C. Maximum distance between horizontal joints in slabs and vertical joints in walls shall be 45'-0". For exposed walls with fluid or earth on the opposite side, the spacing between vertical and horizontal joints shall be a maximum of 25'-0".

D. All corners shall be part of a continuous placement, and should a construction joint be required, the joint shall not be located closer than five feet from a corner.

E. All reinforcing steel and welded wire fabric shall be continued across construction joints. Keys and inclined dowels shall be provided as shown on the Drawings or as directed by the Engineer. Longitudinal keys shall be provided in all joints in walls and between walls and slabs or footings, except as specifically noted otherwise on the Drawings. Size of keys shall be as shown on the Drawings.

F. All joints in water bearing structures shall have a waterstop. All joints below grade in walls or slabs which enclose an accessible area shall have a waterstop.

3.02 EXPANSION JOINTS

A. Size and location of expansion joints shall be as shown on the Drawings.

B. All expansion joints in water-bearing structures shall have a center-bulb type waterstop. All expansion joints below grade in walls or slabs which enclose an accessible area shall have a center-bulb type waterstop. Waterstop shall be as shown on Drawings and specified in Section 03250, Concrete Accessories.

3.03 CONTRACTION JOINTS

A. Location of contraction joints shall be as shown on the Drawings.

B. Contraction joints shall be formed with contraction joint inserts as specified in Section 03250, Concrete Accessories.

C. Sawcutting of contraction joints in lieu of forming will not be allowed unless otherwise noted on the Drawings. Where sawcutting is allowed, joints shall be sawed as soon as the concrete can support foot traffic without leaving any impression, normally the same day as concrete is placed and in no case longer than 24 hours after concrete is placed.

D. Unless noted otherwise on Drawings, depth of contraction joints shall be 1-1/2 inches in reinforced concrete and 1/3 of concrete thickness in unreinforced concrete.

3.04 JOINT PREPARATION

A. No concrete shall be allowed to enter the joint or the space for the sealant and destroy the proper functions of the joint.

B. The surface of the concrete at all joints shall be thoroughly cleaned and all laitance removed by wire brushing, air or light sand blasting.

C. The joint shall be thoroughly clean and free from dirt and debris before the primer and the sealant are applied. Where the finished joint will be visible, masking of the adjoining surfaces shall be carried out to avoid their discoloration. The sealant shall be neatly tooled into place and its finished surface shall present a clean and even appearance.

D. All joints shall be sealed as shown on the Drawings and specified in Section 03250, Concrete Accessories.

END OF SECTION

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SECTION 03300

CAST-IN-PLACE CONCRETE (WWS & PS)

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Provide all labor, equipment, materials and services necessary for the manufacture, transportation and placement of all plain and reinforced concrete work, as shown on the Drawings or as ordered by the Engineer.

B. All water holding structures shall be tested for leakage by the Contractor. The contractor shall provide at his own expense all labor, material, temporary bulkheads, pumps, water measuring devices, etc., necessary to perform the required tests. Each unit shall be tested separately and the leakage tests shall be made prior to backfilling and before equipment is installed. Testing water shall be from any potable non-potable, or natural moving source such as a river or stream, but not from any still water source such as a lake or pond, and not from any wastewater source other than the discharge from a permitted wastewater treatment facility.

C. The requirements in this section shall apply to the following types of concrete:

1. Class A1 Concrete: Normal weight structural concrete to be used in all structures, sidewalks and pavements, except where noted otherwise in the Contract Documents. All concrete shall be Class A1 concrete unless another class is specifically called for on Contract Documents or specified herein.

2. Class A2 Concrete: Normal weight structural concrete to be used for interior slabs where a concrete hardener is required for application after placement of slab.

3. Class A3 Concrete: Normal weight structural concrete to be used where specifically called for on Contract Drawings or where specifically requested by Contractor and approved by Engineer. Class A3 concrete shall be similar to Class A1 except Class A3 concrete shall contain a mandatory addition of high range water reducer to aid in placement of concrete.

4. Class A4 Concrete: Normal weight structural concrete to be used where specifically called for on Contract Drawings or areas where specifically requested by Contractor and approved by Engineer. Class A4 concrete is identical to Class A1 concrete except that coarse aggregate specified in Article 2.05 below shall be Size #8 in accordance with ASTM C33. Class A4 concrete may also require a mandatory addition of high range water reducer to aid in placement of concrete.

5. Class B Concrete: Normal weight structural concrete used for duct bank encasements, catch basins, fence and guard post embedment, concrete fill, and other areas where specifically noted on Contract Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03100 - Concrete Formwork

B. Section 03200 - Reinforcing Steel

C. Section 03250 - Concrete Accessories

D. Section 03290 - Joints in Concrete

E. Section 03350 - Concrete Finishes

F. Section 03370 - Concrete Curing

G. Section 03600 - Grout

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the Specifications, all work herein shall conform to or exceed the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. Kentucky Building Code

2.	ACI 214	Recommended Practice for Evaluation of Strength Test Results of Concrete
3.	ACI 301	Specifications for Structural Concrete for Buildings
4.	ACI 304	Guide for Measuring, Mixing, Transporting, and Placing Concrete
5.	ACI 305	Hot Weather Concreting
6.	ACI 306	Cold Weather Concreting
7.	ACI 309	Recommended Practice for Consolidation of Concrete
8.	ACI 318	Building Code Requirements for Structural Concrete
9.	ACI 350	Code Requirements for Environmental Engineering Concrete Structures
10.	ACI 350.1	Specification for Tightness Testing of Environmental Engineering Concrete Structures
11.	ASTM C 31	Standard Methods of Making and Curing Concrete Test Specimens in the Field

12. ASTM C 33 Standard Specification for Concrete Aggregates

13. ASTM C 39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

14. ASTM C42 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

15. ASTM C 88 Standard Test Method for Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate

16. ASTM C 94 Standard Specification for Ready-Mixed Concrete

17. ASTM C 114 Standard Test Method for Chemical Analysis of Hydraulic Cement

18. ASTM C 136 Standard Method for Sieve Analysis of Fine and Coarse Aggregate

19. ASTM C 138 Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete

20. ASTM C 143 Standard Test Method for Slump of Portland Cement Concrete

21. ASTM C 150 Standard Specification for Portland Cement

22. ASTM C 172 Standard Method of Sampling Fresh Concrete

23. ASTM C 192 Standard Method of Making and Curing Concrete Test Specimens in the Laboratory

24. ASTM C 231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

25. ASTM C 260 Standard Specification for Air-Entraining Admixtures for Concrete

26. ASTM C 295 Standard Guide for Petrographic Examination of Aggregates for Concrete

27. ASTM C 457 Standard Recommended Practice for Microscopical Determination of Air-Void Content and Parameters of the Air-Void System in Hardened Concrete

28. ASTM C 494 Standard Specification for Chemical Admixtures For Concrete

29. ASTM C 595 Standard Specification for Blended Hydraulic Cements

30. ASTM C 618 Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete

31. ASTM C 989 Standard Specification for Slag Cement for Use in Concrete and Mortars

32. ASTM C1077 Recommended Practice for Labs Testing Concrete

33. ASTM C 1567 Standard Test Method for Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300, Submittals.

1. Sources of all materials and certifications of compliance with specifications for all materials.

2. Certified current (less than 1 year old) chemical analysis of the Portland Cement or Blended Cement to be used.

3. Certified current (less than 1 year old) chemical analysis of fly ash or slag cement to be used.

4. Aggregate test results showing compliance with required standards, i.e., sieve analysis, aggregate soundness tests, petrographic analysis, mortar bar expansion testing per ASTM C 1567, etc.

5. Manufacturer's data on all admixtures stating compliance with required standards.

6. Concrete mix design for each class of concrete specified herein.

7. Field experience records and/or trial mix data for the proposed concrete mixes for each class of concrete specified herein.

8. Testing procedures for structures to be leak tested.

9. Testing report upon completion of leak testing. Report shall include test summary, test data and calculations.

1.05 QUALITY ASSURANCE

A. Tests on materials used in the production of concrete shall be required as specified in PART 2 -- PRODUCTS. These tests shall be performed by an independent testing laboratory approved by the Engineer at no additional cost to the Owner.

B. Trial concrete mixes shall be tested when required in accordance with Article 3.01 at no additional cost to the Owner.

C. Field quality control tests, as specified in Article 3.10, unless otherwise stated, will be performed by a testing laboratory employed by the Owner. However, the Contractor shall be charged for the cost of any additional tests and investigation on work performed which does not meet the Specifications. Any individual who samples and tests concrete to determine if the concrete is being produced in accordance with this Specification shall be certified as a Concrete Field Testing Technician, Grade I, in accordance with ACI CP-2. Testing laboratory shall conform to requirements of ASTM C-1077.

PART 2 – PRODUCTS

2.01 HYDRAULIC CEMENT

A. Portland Cement

1. Portland Cement shall be Type II conforming to ASTM C 150. Type I cement may be used provided either fly ash or slag cement is also included in the mix in accordance with Articles 2.02 or 2.03 respectively.

2. When potentially reactive aggregates as defined in Article 2.05 are to be used in concrete mix, cement shall meet the following requirements:

   a. For concrete mixed with only Portland Cement, the total alkalies in the cement (calculated as the percentage of NA_2O plus 0.658 times the percentage of K_2O) shall not exceed 0.40%.

   b. For concrete mixed with Portland Cement and an appropriate amount of fly ash (Article 2.02) or slag cement (Article 2.03) the total alkalies in the Portland Cement (calculated as the percentage of NA_2O plus 0.658 times the percentage of K_2O) shall not exceed 0.85%.

3. When non-reactive aggregates as defined in Article 2.05 are used in concrete mix, total alkalies in the cement shall not exceed 1.0%.

4. The proposed Portland Cement shall not contain more than 8% tricalcium aluminate and more than 12% tetracalcium aluminoferrite.

B. Blended Cement

1. Blended cements shall be Type IP (Portland Fly Ash Cement) or Type IS (Portland Slag Cement) conforming to ASTM C 595.

2. Type IP cement shall be an interground blend of Portland Cement and fly ash in which the fly ash constituent is between 15% and 25% of the weight of the total blend.

3. Type IS cement shall be an interground blend of Portland Cement and slag cement in which the slag constituent is between 35% and 50% of the weight of the total blend.

4. Fly ash and slag cement used in the production of blended cements shall meet the requirements of Articles 2.02 and 2.03, respectively.

5. When reactive aggregates as defined in Article 2.05 are used in concrete mix, the total alkalies in the Portland Cement (calculated as the percentage of Na_2O plus 0.658 times the percentage of K_2O) shall not exceed 0.85%. The percentage of fly ash or slag cement shall be set to meet provisions of Article 2.05.G.2.

C. Different types of cement shall not be mixed nor shall they be used alternately except when authorized in writing by the Engineer. Different brands of cement or the same brand from different mills may be used alternately. A resubmittal will be required if different cements are proposed during the Project.

D. Cement shall be stored in a suitable weather-tight building so as to prevent deterioration or contamination. Cement which has become caked, partially hydrated, or otherwise damaged will be rejected.

2.02 FLY ASH

A. Fly ash shall meet the requirements of ASTM C 618 for Class F, except that the loss on ignition shall not exceed 4%. Fly ash shall also meet the optional physical requirements for uniformity as shown in Table 3 of ASTM C 618.

B. For fly ash to be used in the production of type IP cement, the Pozzolan Activity Index shall be greater than 75% as specified in Table 3 of ASTM C 595.

C. Where reactive aggregates as defined in Article 2.05 are used in concrete mix, the fly ash constituent shall be between 15% and 25% of the total weight of the combined Portland Cement and fly ash. The percentage of fly ash shall be set to meet the provisions of Article 2.05.G.2.

D. For concrete to be used in environmental concrete structures, i.e. process structures or fluid containing structures, inclusion of fly ash or slag cement in the concrete mix, is mandatory.

E. Additional fly ash shall not be included in concrete mixed with Type IS or IP cement.

2.03 SLAG CEMENT

A. Slag cement shall meet the requirements of ASTM C 989 including tests for effectiveness of slag in preventing excessive expansion due to alkali-aggregate reactivity as described in Appendix X-3 of ASTM C 989.

B. Where reactive aggregates as defined in Article 2.05 are used in concrete mix, the slag cement constituent shall be between 35% and 40% of the total weight of the combined Portland Cement and slag. The percentage of slag cement shall be set to meet the provisions of Article 2.05.G.2.

C. For concrete to be used in environmental concrete structures, i.e. process structures or fluid containing structures, inclusion of fly ash or slag cement in the concrete mix, is mandatory.

D. Additional slag cement shall not be included in concrete mixed with type IS or IP cement.

2.04 WATER

A. Water used for mixing concrete shall be clear, potable and free from deleterious substances such as objectionable quantities of silty organic matter, alkali, salts and other impurities.

B. Water shall not contain more than 100 PPM chloride.

C. Water shall not contain more than 500 PPM dissolved solids.

D. Water shall have a pH in the range of 4.5 to 8.5.

2.05 AGGREGATES

A. All aggregates used in normal weight concrete shall conform to ASTM C 33.

B. Fine Aggregate (Sand) in the various concrete mixes shall consist of natural or manufactured siliceous sand, clean and free from deleterious substances, and graded within the limits of ASTM C 33.

C. Coarse aggregates shall consist of hard, clean, durable gravel, crushed gravel or crushed rock. Coarse aggregate shall be size #57 or #67 as graded within the limits given in ASTM C 33 unless otherwise specified.

D. For Class A4 concrete, coarse aggregate shall be Size #8M in accordance with ASTM C33.

E. Aggregates shall be tested for gradation by sieve analysis tests in conformance with ASTM C 136.

F. Aggregates shall be tested for soundness in accordance with ASTM C 88. The loss resulting after five cycles shall not exceed 10 percent for fine or coarse aggregate when using magnesium sulfate.

G. Non-reactive aggregates shall meet the following requirements:

1. A petrographic analysis in accordance with ASTM C295 shall be performed to identify the constituents of the fine and coarse aggregate. Non-reactive aggregates shall meet the following limitations:

    a. Optically strained, microfractured, or microcrystalline quartz, 5.0%, maximum.

    b. Chert or chalcedony, 3.0%, maximum.

    c. Tridymite or cristobalite, 1.0%, maximum.

    d. Opal, 0.5%, maximum.

    e. Natural volcanic glass in volcanic rocks, 3.0%, maximum.

2. Proposed concrete mix including proposed aggregates shall be evaluated by ASTM C-1567. Mean mortar bar expansions at 16 days shall be less than 0.08%. Tests shall be made using exact proportion of all materials proposed for use on the job in design mix submitted.

H. All aggregates shall be considered reactive unless they meet the requirements above for non-reactive aggregates. Aggregates with a lithology essentially similar to sources in the same region found to be reactive in service shall be considered reactive regardless of the results of the tests above.

I. Contractor shall submit a new trial mix to the Engineer for approval whenever a different aggregate or gradation is proposed.

2.06 ADMIXTURES

A. Air entraining agent shall be added to all concrete unless noted otherwise. The agent shall consist of a neutralized vinsol resin solution or a purified hydrocarbon with a cement catalyst which will provide entrained air in the concrete in accordance with ASTM C 260. The admixture proposed shall be selected in advance so that adequate samples may be obtained and the required tests made. Air content of concrete, when placed, shall be within the ranges given in the concrete mix design.

B. The following admixtures are required or used for water reduction, slump increase, and/or adjustment of initial set. Admixtures permitted shall confirm to the requirements of ASTM C 494. Admixtures shall be non-toxic after 30 days and shall be compatible with and made by the same manufacturer as the air-entraining admixtures.

1. Water reducing admixture shall conform to ASTM C 494, Type A and shall contain no more than 0.05% chloride ions. Acceptable products are "Eucon Series" by the Euclid Chemical Company, "Pozzolith Series" by BASF, and "Plastocrete Series" by Sika Corporation.

2. High range water reducer shall be sulfonated polymer conforming to ASTM C 494, Type F or G. The high range water reducer shall be added to the concrete at either the batch plant or at the job site and may be used in conjunction with a water reducing admixture. The high range water reducer shall be accurately measured and pressure injected into the mixer as a single dose by an experienced technician. A standby system shall be provided and tested prior to each day's operation of the job site system. Concrete shall be mixed at mixing speed for a minimum of 100 mixer revolutions after the addition of the high range water reducer. Acceptable products are "Eucon 37" or Plastol 5000 by the Euclid Chemical Company, "Rheobuild 1000 or Glenium Series" by BASF, and "Daracem 100 or Advaflow Series" by W.R. Grace.

3. A non-chloride, non-corrosive accelerating admixture may be used where specifically approved by the Engineer. The admixture shall conform to ASTM C 494, Type C or E, and shall not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures. Acceptable products are "Accelguard 80/90 or NCA" by the Euclid Chemical Company and "Daraset" by W.R. Grace.

4. A water reducing retarding admixture may be used where specifically approved by the Engineer. The admixture shall conform to ASTM C494, Type D and shall not contain more than 0.05% chloride ions. Acceptable products are "Eucon NR or Eucon Retarder 100" by the Euclid Chemical Company, "Pozzolith Retarder" by BASF, and "Plastiment" by Sika Corporation.

C. Admixtures containing calcium chloride, thiocyanate or more than 0.05 percent chloride ions are <u>not</u> permitted. The addition of admixtures to prevent freezing is not permitted.

D. The Contractor shall submit manufacturer's data including the chloride ion content of each admixture and certification from the admixture manufacturer that all admixtures utilized in the design mix are compatible with one another and properly proportioned prior to mix design review by the Engineer.

2.07 CONCRETE MIX DESIGN

A. The proportions of cement, aggregates, admixtures and water used in the concrete mixes shall be based on the results of field experience or preferably laboratory trial mixes in conformance with Section 5.3. "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318 and ACI 350. When trial mixes are used they shall also conform to Article 3.01 of this Section of the Specifications. If field experience records are used, concrete strength results shall be from concrete mixed with all of the ingredients proposed for use on job used in similar proportions to mix proposed for use on job. Contractor shall submit verification confirming this stipulation has been followed. Field experience records and/or trial mix data used as the basis for the proposed concrete mix design shall be submitted to the Engineer along with the proposed mix.

B. Structural concrete shall conform to the following requirements. Cementitious materials refer to the total combined weight of all cement, fly ash, and slag cement contained in the mix.

1. Compressive Strength (28 day)

a.	Concrete Class A1, A2, A3, A4	4,500 psi (minimum) 6,500 psi (maximum)
b.	Class B	3,000 psi (minimum)

2. Maximum water/cementitious materials ratio, by weight

a.	Concrete Class A1, A2, A3, A4	0.42
b.	Class B	0.50

3. Slump range

a. 4" nominal unless high range water reducing admixture is used.

b. 3" maximum before addition of high range water reducing admixture.

4. Air Content

a.	Concrete Class A1, A3, A4	6% ±1.5%
b.	Class A2, B	3% Max

PART 3 – EXECUTION

3.01 TRIAL MIXES

A. When trial mixes are used to confirm the quality of a proposed concrete mix in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318 and ACI 350, an independent testing laboratory designated by the Contractor and acceptable to the Engineer shall test a trial batch of each of the preliminary concrete mixes submitted by the Contractor. The trial batches shall be prepared using the aggregates, cement and admixtures proposed for the project. The trial batch materials shall be of a quantity such that the testing laboratory can obtain enough samples to satisfy requirements stated below. Tests on individual materials stated in PART 2 -- PRODUCTS should already be performed before any trial mix is done. The cost of laboratory trial batch tests for each specified concrete mix will be borne by the Contractor and the Contractor shall furnish and deliver the materials to the testing laboratory at no cost to the Owner.

B. An independent testing laboratory shall prepare a minimum of fifteen (15) standard test cylinders in accordance with ASTM C 31 in addition to conducting slump (ASTM C 143), air content (C 231) and unit weight (C 138) tests. Compressive strength test on the cylinders shall subsequently be performed by the same laboratory in accordance with ASTM C 39 as follows: Test 3 cylinders at age 7 days; test 3 cylinders at age 21 days; test 3 cylinders at age 28 days and test 3 cylinders at 56 days. The cylinders shall be carefully identified as "Trial Mix, Contract No. _____, Product _____." If the average 28-day compressive strength of the trial mix is less than that specified, or if any single cylinder falls below the required strength by more than 500 psi, the mix shall be corrected, another trial batch prepared, test cylinders taken, and new tests performed as before. Any such additional trial batch testing required shall be performed at no additional cost to the Owner. Adjustments to the mix shall be considered refinements to the mix design and shall not be the basis for extra compensation to the Contractor.

3.02 PRODUCTION OF CONCRETE

A. All concrete shall be machine mixed. Hand mixing of concrete will not be permitted. The Contractor may supply concrete from a ready mix plant or from a site mixed plant. In selecting the source for concrete production the Contractor shall carefully consider its capability for providing quality concrete at a rate commensurate with the requirements of the placements so that well bonded, homogenous concrete, free of cold joints, is assured.

B. Ready-Mixed Concrete

1. At the Contractor's option, ready-mixed concrete may be used meeting the requirements for materials, batching, mixing, transporting, and placing as specified herein and in accordance with ASTM C 94.

2. Truck mixers shall be equipped with electrically-actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the resettable, recording type, and shall be mounted in the driver's cab. The counters shall be actuated at the time of starting mixers at mixing speeds.

3. Each batch of concrete shall be mixed in a truck mixer for not less than 100 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolutions of mixing.

4. Truck mixers and their operation shall be such that the concrete throughout the mixed batch, as discharged, is within acceptable limits of uniformity with respect to consistency, mix and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than one inch when the specified slump is 3 inches or less, or if they differ by more than 2 inches when the specified slump is more than 3 inches, the mixer shall not be used on the

work unless the causing condition is corrected and satisfactory performance is verified by additional slump tests. All mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.

5. Ready-mixed concrete shall be delivered to the site for the work and discharge shall be completed before the drum has been revolved 300 revolutions and within the time requirements stated in Article 3.03 of this Section.

6. Each and every concrete delivery shall be accompanied by a delivery ticket containing at least the following information:

   a. Date and truck number

   b. Ticket number

   c. Mix designation of concrete

   d. Cubic yards of concrete

   e. Cement brand, type and weight in pounds

   f. Weight in pounds of fine aggregate (sand)

   g. Weight in pounds of coarse aggregate (stone)

   h. Air entraining agent, brand, and weight in pounds and ounces

   i. Other admixtures, brand, and weight in pounds and ounces

   j. Water, in gallons, stored in attached tank

   k. Water, in gallons, maximum that can be added without exceeding design water/cement ratio

   l. Water, in gallons, actually used (by truck driver)

   m. Time of loading

   n. Time of delivery to job (by truck driver)

7. Any truck delivering concrete to the job site, which is not accompanied by a delivery ticket showing the above information will be rejected and such truck shall immediately depart from the job site.

8. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-

mixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the Engineer.

C. Site Mixed Concrete

1. Scales for weighing concrete ingredients shall be accurate when in use within ±0.4 percent of their total capacities. Standard test weights shall be available to permit checking scale accuracy.

2. Operation of batching equipment shall be such that the concrete ingredients are consistently measured within the following tolerances:

a.	Cement, fly ash, or slag cement	± 1 percent
b.	Water	± 1 percent
c.	Aggregates	± 2 percent
d.	Admixtures	± 3 percent

3. Each batch shall be so charged into the mixer that some water will enter in advance of the cement and aggregates. Water shall continue for a period which may extend to the end of the first 25 percent of the specified mixing time. Controls shall be provided to prevent batched ingredients from entering the mixer before the previous batch has been completely discharged.

4. The concrete shall be mixed in a batch mixer capable of thoroughly combining the aggregates, cement, and water into a uniform mass within the specified mixing time, and of discharging the concrete without harmful segregation. The mixer shall bear a manufacturer's rating plate indicating the rate capacity and the recommended revolutions per minute and shall be operated in accordance therewith.

5. Mixers with a rate capacity of 1 cu.yd. or larger shall conform to the requirements of the Plant Mixer Manufacturers' Division of the Concrete Plant Manufacturers' Bureau.

6. Except as provided below, batches of 1 cu. yd. or less shall be mixed for not less than 1 minute. The mixing time shall be increased 15 seconds for each cubic yard or fraction thereof of additional capacity.

7. Shorter mixing time may be permitted provided performance tests made in accordance with of ASTM C 94 indicate that the time is sufficient to produce uniform concrete.

8. Controls shall be provided to insure that the batch cannot be discharged until the required mixing time has elapsed. At least three-quarters of the required mixing time shall take place after the last of the mixing water has been added.

9. The interior of the mixer shall be free of accumulations that will interfere with mixing action. Mixer blades shall be replaced when they have lost 10 percent of their original height.

10. Air-entraining admixtures and other chemical admixtures shall be charged into the mixer as solutions and shall be measured by means of an approved mechanical dispensing device. The liquid shall be considered a part of the mixing water. Admixtures that cannot be added in solution may be weighed or may be measured by volume if so recommended by the manufacturer.

11. If two or more admixtures are used in the concrete, they shall be added separately to avoid possible interaction that might interfere with the efficiency of either admixture or adversely affect the concrete.

12. Addition of retarding admixtures shall be completed within 1 minute after addition of water to the cement has been completed, or prior to the beginning of the last three-quarters of the required mixing, whichever occurs first. Retarding admixtures shall not be used unless approved by the Engineer.

13. Concrete shall be mixed only in quantities for immediate use and within the time and mixing requirements of ASTM C 94.

3.03 CONCRETE PLACEMENT

A. No concrete shall be placed prior to approval of the concrete mix design. Concrete placement shall conform to the recommendations of ACI 304.

B. Prior to concrete placement, all reinforcement shall be securely and properly fastened in its correct position. Formwork shall be clean, oiled and form ties at construction joints shall be retightened. All bucks, sleeves, castings, hangers, pipe, conduits, bolts, anchors, wire, and any other fixtures required to be embedded therein shall be in place. Forms for openings to be left in the concrete shall be in place and anchored by the Contractor. All loose debris in bottoms of forms or in keyways shall be removed and all debris, water, snow, ice and foreign matter shall be removed from the space to be occupied by the concrete. The Contractor shall notify the Engineer in advance of placement, allowing sufficient time for a concurrent inspection and for any corrective measures which are subsequently required.

C. On horizontal joints where concrete is to be placed on hardened concrete, flowing concrete containing a high range water reducing admixture shall be placed with a slump not less than 8 inches for the initial placement at the base of the wall. This concrete shall be worked well into the irregularities of the hard surface.

D. All concrete shall be placed during the daylight hours except with the consent of the Engineer. If special permission is obtained to carry on work during the night, adequate lighting must be provided.

E. When concrete arrives at the project with slump below that suitable for placing, as indicated by the Specifications, water may be added to bring the concrete within the specified slump range provided that the design water-cement ratio is not exceeded. The water shall be incorporated by additional mixing equal to at least half of the total mixing required. Water may be added only to full trucks. On-site tempering shall not relieve the Contractor from furnishing a concrete mix that meets all specified requirements.

F. Concrete shall be conveyed as rapidly as practicable to the point of deposit by methods which prevent the separation or loss of the ingredients. It shall be so deposited that rehandling will be unnecessary. Discharge of the concrete to its point of deposit shall be completed within 90 minutes after the addition of the cement to the aggregates. In hot weather, or under conditions contributing to quick stiffening of the concrete, the time between the introduction of the cement to the aggregates and discharge shall not exceed the requirements stated in Article 3.09 of this Section.

G. Where concrete is conveyed to position by chutes, a practically continuous flow in the chute shall be maintained. The angle and discharge arrangement of the chute shall be such as to prevent segregation of the concrete ingredients. The delivery end of the chute shall be as close as possible to the point of deposit and in no case shall the free pour from the delivery end of the chute exceed five feet, unless approved otherwise by Engineer.

H. Special care must be exercised to prevent splashing of forms or reinforcement with concrete, and any such splashes or accumulations of hardened or partially hardened concrete on the forms or reinforcement above the general level of the concrete already in place must be removed before the work proceeds. Concrete shall be placed in all forms in such way as to prevent any segregation.

I. Placing of concrete shall be so regulated that the pressure caused by the wet concrete shall not exceed that used in the design of the forms.

J. All concrete for walls shall be placed through openings in the form spaced at frequent intervals or through tremies (heavy duct canvas, rubber, etc.), equipped with suitable hopper heads. Tremies shall be of variable lengths so the free fall shall not exceed five (5) feet and a sufficient number shall be placed in the form to ensure the concrete is kept level at all times.

K. When placing concrete which is to be exposed, sufficient illumination shall be provided in the interior of the forms so the concrete, at places of deposit, is visible from deck and runways.

L. Concrete shall be placed so as to thoroughly embed all reinforcement, inserts, and fixtures.

M. When forms are removed, surfaces shall be even and dense, free from aggregate pockets or honeycomb. To achieve this, concrete shall be consolidated using mechanical vibration, supplemented by forking and spading by hand in the corners and angle of forms and along form surfaces while the concrete is plastic under the vibratory action. Consolidation shall conform to ACI 309.

N. Mechanical vibration shall be applied directly to the concrete, unless otherwise approved by the Engineer. The bottom of vibrators used on floor slabs must not be permitted to ride the form supporting the slab. Vibration shall be applied at the point of deposit and in the area of freshly placed concrete by a vertical penetration of the vibrator. Vibrators shall not be used to move concrete laterally within the forms.

O. The intensity of vibration shall be sufficient to cause settlement of the concrete into place and to produce monolithic joining with the preceding layer. It shall be of sufficient duration to accomplish thorough compaction and complete embedment of reinforcement and fixtures with a vibrator transmitting not less than 7,500 impulses per minute. Since the duration of vibration per square foot of surface is dependent on the frequency (impulses per minute), size of vibrator, and slump of concrete, the length of time must therefore be determined in the field. Vibration, however, shall not be continued in any one location to the extent that pools of grout are formed.

P. Care shall be taken to prevent cold joints when placing concrete in any portion of the work. The concrete placing rate shall be such as to ensure that each layer is placed while the previous layer is soft or plastic, so that the two layers can be made monolithic by penetration of the vibrators. Maximum thickness of concrete layers shall be 18 inches. The surface of the concrete shall be level whenever a run of concrete is stopped.

Q. To prevent featheredges, construction joints located at the tops of horizontal lifts near sloping exposed concrete surfaces shall be inclined near the exposed surface, so the angle between such inclined surface and the exposed concrete surface will be not less than 50°.

R. In placing unformed concrete on slopes, the concrete shall be placed ahead of a non-vibrated slip-form screed extending approximately 2-1/2 feet back from its leading edge. The method of placement shall provide a uniform finished surface with the deviation from the straight line less than 1/8 inch in any concrete placement. Concrete ahead of the slip-form screed shall be consolidated by internal vibrators so as to ensure complete filling under the slip-form. Prior to placement of concrete on sloped walls or slabs, the Contractor shall submit a plan specifically detailing methods and sequence of placements, proposed concrete screed equipment, location of construction joints and waterstops, and/or any proposed deviations from the aforementioned to the Engineer for review and approval.

S. Concrete shall not be placed during rains sufficiently heavy or prolonged to wash mortar from coarse aggregate on the forward slopes of the placement. Once placement of

concrete has commenced in a block, placement shall not be interrupted by diverting the placing equipment to other uses.

3.04 PLACING FLOOR SLABS ON GRADE

A. The subgrade for slabs on ground shall be well drained and of adequate and uniform loadbearing nature. The in-place density of the subgrade soils shall be at least the minimum required by the specifications. No foundation, slab, or pavement concrete shall be placed until the depth and character of the foundation soils have been inspected and approved by the Engineer.

B. The subgrade shall be free of frost before concrete placing begins. If the temperature inside a building where concrete is to be placed is below freezing it shall be raised and maintained above 50°F long enough to remove all frost from the subgrade.

C. The subgrade shall be moist at the time of concreting. If necessary, it shall be dampened with water in advance of concreting, but there shall be no free water standing on the subgrade nor any muddy or soft spots when the concrete is placed.

D. Thirty-pound felt paper shall be provided between edges of slab-on-grade and vertical and horizontal concrete surfaces, unless otherwise indicated on the Drawings.

E. Contraction joints shall be provided in slabs-on-grade at locations indicated on the Drawings. Contraction joints shall be installed as per Section 03290 - Joints in Concrete.

F. Floor slabs shall be screeded level or pitched to drain as indicated on the Drawings. Finishes shall conform with the requirements of Section 03350 - Concrete Finishes.

3.05 ORDER OF PLACING CONCRETE

A. In order to minimize the effects of shrinkage, the concrete shall be placed in units as bounded by construction joints shown on the Drawings and maximum lengths as indicated on Drawings. Where required on the Drawings and wherever else practical, the placing of such units shall be done in a strip pattern in accordance with ACI 302.1. A minimum of 72 hours shall pass prior to placing concrete directly adjacent to previously placed concrete.

3.06 CONCRETE WORK IN COLD WEATHER

A. Cold weather concreting procedures shall conform to the requirements of ACI 306.

B. The Engineer may prohibit the placing of concrete at any time when air temperature is 40°F. or lower. If concrete work is permitted, the concrete shall have a minimum temperature, as placed, of 55°F. for placements less than 12" thick, 50°F. for placements 12" to 36" thick, and 45°F for placements greater than 36" thick. The temperature of the concrete as placed shall not exceed the aforementioned minimum values by more than 20°F, unless otherwise approved by the Engineer.

C. All aggregate and water shall be preheated. Precautions shall be taken to avoid the possibility of flash set when aggregate or water are heated to a temperature in excess of 100°F. in order to meet concrete temperature requirements. The addition of admixtures to the concrete to prevent freezing is not permitted. All reinforcement, forms, and concrete accessories with which the concrete is to come in contact shall be defrosted by an approved method. No concrete shall be placed on frozen ground.

3.07 CONCRETE WORK IN HOT WEATHER

A. Hot weather concreting procedures shall conform to the requirements of ACI 305.

B. When air temperatures exceed 85°F., or when extremely dry conditions exist even at lower temperatures, particularly if accompanied by high winds, the Contractor and his concrete supplier shall exercise special and precautionary measures in preparing, delivering, placing, finishing, curing and protecting the concrete mix. The Contractor shall consult with the Engineer regarding such measures prior to each day's placing operation and the Engineer reserves the right to modify the proposed measures consistent with the requirements of this Section of the Specifications. All necessary materials and equipment shall be on hand an in position prior to each placing operation.

C. Preparatory work at the job site shall include thorough wetting of all forms, reinforcing steel and, in the case of slab pours on ground or subgrade, spraying the ground surface on the preceding evening and again just prior to placing. No standing puddles of water shall be permitted in those areas which are to receive the concrete.

D. The temperature of the concrete mix when placed shall not exceed 90°F.

E. Temperature of mixing water and aggregates shall be carefully controlled and monitored at the supplier's plant, with haul distance to the job site being taken into account. Stockpiled aggregates shall, if necessary, be shaded from the sun and sprinkled intermittently with water. If ice is used in the mixing water for cooling purposes, it must be entirely melted prior to addition of the water to the dry mix.

F. Delivery schedules shall be carefully planned in advance so that concrete is placed as soon as practical after it is properly mixed. For hot weather concrete work (air temperature greater than 85°F), discharge of the concrete to its point of deposit shall be completed within 60 minutes from the time the concrete is batched.

G. The Contractor shall arrange for an ample work force to be on hand to accomplish transporting, vibrating, finishing, and covering of the fresh concrete as rapidly as possible.

3.08 QUALITY CONTROL

A. Field Testing of Concrete

1. The Contractor shall coordinate with the Owner's testing firm personnel as required for concrete testing.

2. The Owner will identify a sampling and testing firm.

3. Per the Contract Documents, the Contractor shall schedule the presence of the sampling technician. The number of sampling technicians required to be on-site shall be as directed/approved by the Resident Project Representative (RPR). The RPR shall consult with the Owner should there be any questions.

4. The RPR shall have designated authority to accept or reject all concrete.

5. The first truck is defined as the first truck as accepted by the RPR.

6. Concrete for testing shall be supplied by the Contractor at no additional cost to the Owner, and the Contractor shall provide assistance to the testing laboratory in obtaining samples. The Contractor shall dispose of and clean up all excess material.

7. For every placement of concrete that is 10 cubic yards or less, the following tests shall be performed (as described in paragraphs B through E below):

    a. Consistency

    b. Unit Weight

    c. Air content

    d. Compressive Strength

    e. Temperature

8. For every placement of concrete that is larger than 10 cubic yards, the following tests shall be performed for every 50 cubic yards (as described in paragraphs B through E below):

    a. Consistency – test the first truck and one additional truck randomly selected by the Owner's Resident Project Representative (RPR).

    b. Unit Weight – test one truck randomly selected by the RPR

    c. Air content - test the first truck and one additional truck randomly selected by the RPR.

    d. Compressive Strength - test one truck randomly selected by the RPR

    e. Temperature - test one truck randomly selected by the RPR

1) The sampling of concrete is approved at the truck discharge. If a concrete pump is employed, the Contractor is advised that 1.5-3.0% air is lost in pumping and such should be accounted for at the point of testing. Therefore, the air content should be adjusted to ensure that the air content meets the specification at the point of placement.

2) The first truck is defined as the first truck as accepted by the RPR. The RPR shall have the authority of the Owner to accept or reject all concrete.

9. Sampling is at the discretion of the RPR.

10. Additional testing may be required as deemed necessary by the Owner.

B. Consistency

1. The consistency of the concrete will be checked by the Owner's testing firm by standard slump cone tests. The Contractor shall make any necessary adjustments in the mix as the Owner or Engineer may direct and shall upon written order suspend all placing operations in the event the consistency does not meet the intent of the specifications. No payment shall be made for any delays, material or labor costs due to such eventualities.

2. Slump tests shall be made in accordance with ASTM C 143.

3. Concrete with a specified nominal slump shall be placed having a slump within 1" (higher or lower) of the specified slump. Concrete with a specified maximum slump shall be placed having a slump less than the specified slump.

C. Unit Weight

1. Samples of freshly mixed concrete shall be tested for unit weight by the Owner's testing firm in accordance with ASTM C 138.

D. Air Content

1. Samples of freshly mixed concrete will be tested for entrained air content by the Owner's testing firm in accordance with ASTM C 231.

2. In the event test results are outside the limits specified, additional testing shall occur. Upon discovery of incorrect air entrainment, the concrete shall be removed from the jobsite.

E. Compressive Strength

1. Samples of freshly mixed concrete will be taken by the Owner's testing firm and tested for compressive strength in accordance with ASTM C 172, C 31 and C 39, except as modified herein.

2. Each sampling shall consist of at least five (5) 6x12 cylinders or (8) 4x8 cylinders. Each cylinder shall be identified by a tag, which shall be hooked or wired to the side of the container. The Owner's testing firm will fill out the required information on the tag, and the Contractor shall satisfy himself that such information shown is correct.

3. The Contractor shall be required to furnish labor to the Owner for assisting in preparing test cylinders for testing. The Contractor shall provide approved curing boxes for storage of cylinders on site. The insulated curing box shall be of sufficient size and strength to contain all the specimens made in any four consecutive working days and to protect the specimens from falling over, being jarred or otherwise disturbed during the period of initial curing. The box shall be erected, furnished and maintained by the Contractor. Such box shall be equipped to provide the moisture and to regulate the temperature necessary to maintain the proper curing conditions required by ASTM C 31. Such box shall be located in an area free from vibration such as pile driving and traffic of all kinds and such that all specimen are shielded from direct sunlight and/or radiant heating sources. No concrete requiring inspection shall be delivered to the site until such storage curing box has been provided. Specimens shall remain undisturbed in the curing box until ready for delivery to the testing laboratory but not less than sixteen hours.

4. The Contractor shall be responsible for maintaining the temperatures of the curing box during the initial curing of test specimens with the temperature preserved between 60°F and 80°F as measured by a maximum-minimum thermometer. The Contractor shall maintain a written record of curing box temperatures for each day curing box contains test specimens. Temperature shall be recorded a minimum of three times a day with one recording at the start of the work day and one recording at the end of the work day.

5. When transported, the cylinders shall not be thrown, dropped, allowed to roll, or be damaged in any way.

F. Evaluation and Acceptance of Concrete

1. Evaluation and acceptance of the compressive strength of concrete shall be according to the requirements of ACI 214, ACI 318, and ACI 350.

2. The strength level of concrete will be considered satisfactory if all of the following conditions are satisfied.

   a. Every arithmetic average of any three consecutive strength tests equals or exceeds the minimum specified 28-day compressive strength for the mix (see Article 2.07).

   b. No individual compressive strength test results falls below the minimum specified strength by more than 500 psi.

c. No more than 10% of the compressive tests have strengths greater than the maximum strength specified.

3. In the event any of the conditions listed above are not met, the mix proportions shall be corrected for the next concrete placing operation.

4. In the event that condition 2B is not met, additional tests in accordance with Article 3.10, paragraph H shall be performed.

5. When a ratio between 7-day and 28-day strengths has been established by these tests, the 7-day strengths shall subsequently be taken as a preliminary indication of the 28-day strengths. Should the 7-day test strength from any sampling be more than 10% below the established minimum strength, the Contractor shall:

   a. Immediately provide additional periods of curing in the affected area from which the deficient test cylinders were taken.

   b. Maintain or add temporary structural support as required.

   c. Correct the mix for the next concrete placement operation, if required to remedy the situation.

6. All concrete which fails to meet the ACI requirements and these specifications is subject to removal and replacement at no additional cost to the Owner.

G. Additional Tests

1. In the event the 28-day test cylinders fail to meet the minimum strength requirements as outlined in Article 3.10, paragraph F, the Contractor shall have concrete core specimens obtained and tested from the affected area immediately.

   a. Three cores shall be taken by the Owner's testing firm for each sample in which the strength requirements were not met.

   b. The concrete in question will be considered acceptable if the average compressive strength of a minimum of three test core specimens taken from a given area equal or exceed 85% of the specified 28-day strength and if the lowest core strength is greater than 75% of the specified 28-day strength.

2. Concrete placed with compressive strengths greater than the maximum strength specified shall be removed and replaced or repaired as deemed necessary by the Engineer.

3.09 WATERTIGHTNESS TESTING OF CONCRETE STRUCTURES (FOR PRESTRESSED CONCRETE TANK TESTING, REFER TO SECTION 13200)

A. TEST PREPARATION

1. The design capability of the structure to withstand testing shall be verified for the pressures to be applied. Another type of test shall not be substituted for hydrostatic tightness testing without approval of the Engineer.

2. The structure shall not be tested before all elements of the structure which resist any portion of the retained liquid pressure are in place and the concrete has attained its specified compressive strength.

3. Unless otherwise specified, coatings shall not be applied until after the hydrostatic tightness testing is complete. Liners that are mechanically locked to the surface during the placement of the concrete shall be installed before the hydrostatic tightness testing. Interior liners shall be visually examined for deficiencies (pinholes, tears and partially fused splices) and must pass integrity testing. Deficiencies shall be prepared.

4. Clean the exposed concrete surfaces of the structure, including the floor, of all foreign material and debris. Prior to testing, standing water in or outside of the structure that would interfere with the inspection of the exposed concrete surfaces of the structure shall be removed.

5. The concrete surfaces and concrete joints shall be thoroughly inspected for potential leakage points. Areas of potential leakage shall be repaired before filling the containment structure with water.

6. All openings, fittings, and pipe penetrations in the structure shell shall be inspected at both faces of the concrete, if practical. Defective or cracked concrete shall be repaired prior to testing. All structural penetrations and inlet/outlets shall be securely sealed to prevent the loss of water from the structure during the test. All structural penetrations shall be monitored before and during the test to determine the watertightness of these appurtenances. If the structure is to be filled using the inlet/outlet pipe, positive means shall be provided to check that water is not entering or leaving through this pipe once the structure is filled to the test level. Leakage at these inlet/outlets shall be repaired prior to testing. No allowance shall be made in test measurements for uncorrected known points of leakage

7. The flow from any underdrain system, if a system is provided, shall be monitored during this same period, and any increase in flow shall be recorded and considered for information as a part of the hydrostatic tightness testing.

8. The ground water level shall be brought to a level below the top of the base slab and kept at that elevation or at a lower elevation during the test.

9. No backfill shall be placed against the walls or on the wall footings of the structure to be tested unless otherwise specified.

B. PROCEDURE

1. The initial filling of a new structure should not exceed a rate of 4 ft/h. Filling shall be continued until the water surface is at the design maximum liquid level, or either 1 in. below any fixed overflow level in covered containment structure or 4 in. in open structure, whichever is lower.

2. The exterior surfaces of the structure shall be inspected during the period of filling the structure. If any flow of water is observed from the structure exterior surfaces, including joints or cracks, the defect causing the leakage shall be repaired prior to testing.

3. Watertightness Test - Part 1: Qualitative Criteria

    a. The water shall be kept at the test level for at least 3 days prior to Part 2 of the testing.

    b. The exterior surfaces of the structure shall be observed in both the early mornings and later afternoons during the 3-day period before Part 2 of the test. If any water is observed on the structure exterior surfaces, including joints, repaired honeycombed areas and cracks, where moisture can be picked up on a dry hand, the containment structure shall be considered to have failed Part 1 of the test.

    c. Wet areas on top of wall footing shall not be cause to fail Part 1 of the test unless the water can be observed to be flowing.

    d. Part 2 of the test may begin prior to completion of repairs for Part 1. However, all defects causing the failure of Part 1 shall be repaired before the structure is accepted.

4. Watertightness Test - Part 2: Quantitative Criteria

    a. The test measurements shall not be scheduled for a period when the forecast is for a difference of more than 35°F between the ambient temperature readings at the times of the initial and final level measurements of the water surface. The test shall also not be scheduled when the weather forecast indicates the water surface would be frozen before the test is completed.

    b. The vertical distance to the water surface shall be measured to within 1/16 in. from a fixed point on the structure above the water surface. Measurements shall be recorded at 24-hour intervals. Measurements taken at the same time of day will reduce the probability of temperature difference.

    c. Measurements shall be taken at two locations, 180° apart, which will minimize the effect of differential settlement. Measurements shall be taken at the same locations to reduce the probability of measurement differences.

d. The test period shall be at least the theoretical time required to lower the water surface 3/8 in. assuming a loss of water at 0.050% of the water volume per 24-hour period. The test period shall not be longer than five days.

e. The water temperature shall be recorded at a depth of 18 in. below the water surface at the start and end of the test.

f. A floating, restrained, partially filled, calibrated, open container for evaporation and precipitation measurement should be positioned in open structures and the water level in the container recorded at 24-hour intervals. Determination of evaporation by a shallow pan-type measuring device is not acceptable due to possible heating of the bottom of the shallow pan resulting in accelerated evaporation.

C. EVALUATION

1. The containment structure shall continue to be observed in both the early mornings and late afternoons to verify compliance with Part 1 of the test during Part 2.

2. At the end of the test period, the water surface shall be recorded to within 1/16-in at the location of original measurements. The water temperature and the evaporation and precipitation measurements shall be recorded.

3. The allowable loss of water for tightness tests shall not exceed 0.050% of the test water volume in 24 hours.

4. The change in water volume in the structure shall be calculated and corrected, if necessary, for evaporation, precipitation, and temperature based on the change recorded in the water level from the open container. If the loss exceeds the allowable loss, the structure shall be considered to have failed the test.

5. During Part 2 of the test, observed flow or seepage of water from the exterior surface, including that from cracks and joints, should be considered as a failed test. The structure shall also be considered to have failed the test if moisture can be transferred from the exterior surface to a dry hand. Dampness or wetness on top of a footing shall not be considered as a failure test.

D. RETESTING

1. A restart of the test shall be required when test measurements become unreliable due to unusual precipitation or other external factors.

2. The Contractor shall be permitted to immediately retest when no visible leakage is exhibited. If the structure fails the second test or if the Contractor does not exercise the option of immediately retesting after the first test failure, the interior of

the structure shall be inspected by a diver or by other means to determine probable areas of leakage. The structure shall only be retested after the most probable areas of leakage are repaired.

3. If the leakage exceeds the allowable limit, the work shall be corrected by methods approved by the Engineer.

4. Upon completion of the necessary remedial work, the leakage test shall be repeated until it is successfully passed.

E. NOTIFICATION BY ENGINEER

1. If any leaks, in excess of the specified amount, are not remedied by the Contractor within four (4) weeks of notification by the Engineer, regardless of whether the cause of these leaks is or is not determined, the Engineer shall have the authority to have these leaks repaired by others. The cost of repairs, by others, shall be deducted from monies due or to become due to the General Contractor.

3.10 CARE AND REPAIR OF CONCRETE

A. The Contractor shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the Owner. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Care shall be exercised to avoid jarring forms or placing any strain on the ends of projecting reinforcing bars. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at no additional cost to the Owner.

B. Areas of honeycomb shall be chipped back to sound concrete and repaired as directed by the Engineer.

C. Concrete formwork blowouts or unacceptable deviations in tolerances for formed surfaces due to improperly constructed or misaligned formwork shall be repaired as directed by the Engineer. Bulging or protruding areas, which result from slipping or deflecting forms shall be ground flush or chipped out and redressed as directed by the Engineer.

D. Areas of concrete in which cracking, spalling, or other signs of deterioration develop prior to final acceptance shall be removed and replaced, or repaired as directed by the Engineer. This stipulation includes concrete that has experienced cracking due to drying or thermal shrinkage of the concrete. Structural cracks shall be repaired using an epoxy injection system approved by the Engineer. Non-structural cracks shall be repaired using a hydrophilic resin pressure injected grout system approved by the Engineer, unless other means of repair are deemed necessary and approved by the Engineer.

Extensive repair or replacement will be considered for concrete placed having compressive strengths greater than maximum strength specified. All repair work shall be performed at no additional cost to the Owner.

E. Concrete which fails to meet the strength requirements as outlined in Article 3.10, paragraph F, will be analyzed by the Engineer as to its adequacy based upon loading conditions, resultant stresses and exposure conditions for the particular area of concrete in question. If the concrete in question is found unacceptable based upon this analysis, that portion of the structure shall be strengthened or replaced by the Contractor at no additional cost to the Owner. The method of strengthening or extent of replacement shall be directed by the Engineer.

END OF SECTION

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SECTION 03350
CONCRETE FINISHES

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish all materials, labor, and equipment required to provide finishes of all concrete surfaces specified herein and shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03100 - Concrete Formwork

B. Section 03300 - Cast-in-Place Concrete

C. Section 03600 - Grout

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. ACI 301 - Specifications for Structural Concrete for Buildings

2. ACI 318 - Building Code Requirements for Structural Concrete

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300 - Submittals.

1. Manufacturer's literature on all products specified herein.

PART 2 – PRODUCTS

2.01 CONCRETE FLOOR SEALER

A. Floor sealer shall be Diamond Clear VOX or Super Diamond Clear VOX by the Euclid Chemical Company, Sonneborn Kure N Seal 30 by BASF Construction Chemicals.

2.02 CONCRETE LIQUID/SEALER DENSIFIER

A. Concrete liquid sealer/densifier shall be a high performance, deeply penetrating concrete densifier. Product shall be odorless, colorless, VOC-compliant, non-yellowing siliconate

based solution designed to harden, dustproof and protect concrete floors subjected to heavy vehicular traffic and to resist black rubber tire marks on concrete surfaces. The product must contain a minimum solids content of 20% of which 50% is siliconate. Acceptable products are Diamond Hard by the Euclid Chemical Company and Seal Hard by L&M Construction Chemicals. Liquid sealer/densifier shall be applied in strict accordance with directions of manufacturer and specifications.

B. Aggregate floor hardener shall be non-metallic. Hardener shall be Harcol by Sonneborn, Maximent by BASF, or Surflex by Euclid Chemical.

2.03 NON-METALLIC FLOOR HARDENER

A. The specified non-metallic mineral aggregate hardener shall be formulated, processed, and packaged under stringent quality control at the manufacturer's owned and controlled factory. The hardener shall be a factory-blended mixture of specifically processed graded mineral aggregate, selected Portland cement, and necessary plasticizing agents. Acceptable products shall be "Surflex" by the Euclid Chemical Company, "Harcol" by Sonneborn, "Maximent" by BASF, and "Mastercon" by BASF.

2.04 NON-OXIDIZING HEAVY DUTY METALLIC FLOOR HARDENER

A. Non-oxidizing heavy duty metallic floor hardener shall be formulated, processed, and packaged under stringent quality control at the manufacturer's owned and controlled factory. The hardener shall be a mixture of specifically processed non-rusting aggregate, selected Portland cement, and necessary plasticizing agents. Product shall be "Diamond-Plate" by the Euclid Chemical Company, or Masterplate by BASF Construction Chemicals.

2.05 NON-SLIP AGGREGATE

A. A. Shake-on aggregate for non-slip floors shall be non-metallic. Shake-on aggregate shall be Frictex NS by BASF Construction Chemicals, A-H Acox by Anti-Hydro, or Non-Slip by the Euclid Chemical Company.

PART 3 – EXECUTION

3.01 FINISHES ON FORMED CONCRETE SURFACES

A. After removal of forms, the finishes described below shall be applied in accordance with Article 3.05 - Concrete Finish Schedule. Unless the finish schedule specifies otherwise, all surfaces shall receive at least a Type I finish. The Engineer shall be the sole judge of acceptability of all concrete finish work.

1. Type I - Rough: All fins, burrs, offsets, marks and all other projections left by the forms shall be removed. Projections, depressions, etc. below finished grade required to be removed will only be those greater than ¼-inch. All holes left by removal of ends of ties, and all other holes, depressions, bugholes, air/blow holes

or voids shall be filled solid with cement grout after first being thoroughly wetted and then struck off flush. The only holes below grade to be filled will be tie holes and any other holes larger than ¼-inch in any dimension. Honeycombs shall be chipped back to solid concrete and repaired as directed by the Engineer. All holes shall be filled with tools, such as sponge floats and trowels, that will permit packing the hole solidly with cement grout. Cement grout shall consist of one part cement to three parts sand, epoxy bonding agent (for tie holes only) and the amount of mixing water shall be as little as consistent with the requirements of handling and placing. Color of cement grout shall match the adjacent wall surface.

2. Type II - Grout Cleaned: Where this finish is required, it shall be applied after completion of Type I finish. After the concrete has been predampened, a slurry consisting of one part cement (including an appropriate quantity of white cement in order to produce a color matching the surrounding concrete) and 1-1/2 parts sand passing the No. 16 sieve, by damp loose volume, shall be spread over the surface with clean burlap pads or sponge rubber floats. Mix proportions shall be submitted to the Engineer after a sample of the work is established and accepted. Any surplus shall be removed by scraping and then rubbing with clean burlap.

3. Type III - Smooth Rubbed: Where this finish is required, it shall be applied after the completion of the Type I finish. No rubbing shall be done before the concrete is thoroughly hardened and the mortar used for patching is firmly set. A smooth, uniform surface shall be obtained by wetting the surface and rubbing it with a carborundum stone to eliminate irregularities. Unless the nature of the irregularities require it, the general surface of the concrete shall not be cut into. Corners and edges shall be slightly rounded by the use of the carborundum stone. Brush finishing or painting with grout or neat cement will not be permitted. A 100 square foot example shall be established at the beginning of the project to establish acceptability.

3.02 SLAB AND FLOOR FINISHES

A. The finishes described below shall be applied to floors, slabs, flow channels and top of walls in accordance with Article 3.05 - Concrete Finish Schedule. The Engineer shall be the sole judge of acceptability of all such finish work.

1. Type "A" - Screeded: This finish shall be obtained by placing screeds at frequent intervals and striking off to the surface elevation required. When a Type "F" finish is subsequently to be applied, the surface of the screeded concrete shall be roughened with a stiff brush or rake prior to final set.

2. Type "B" - Wood or Magnesium Floated: This finish shall be obtained after completion of a Type "A" finish by working a previously screeded surface with a wood or magnesium float or until the desired texture is reached. Floating shall begin when the water sheen has disappeared and when the concrete has sufficiently hardened so that a person's foot leaves only a slight imprint. If wet spots occur, water shall be removed with a squeegee. Care shall be taken to

prevent the formation of laitance and excess water on the finished surface. All edges shall be edged with an 1/8-inch tool as directed by the Engineer. The finished surface shall be true, even, and free from blemishes and any other irregularities.

3. Type "C" - Cork Floated: This finish shall be similar to Type "B" but slightly smoother than that obtained with a wood float. It shall be obtained by power or band floating with cork floats.

4. Type "D" - Steel Troweled: This finish shall be obtained after completion of a Type "B" finish. When the concrete has hardened sufficiently to prevent excess fine material from working to the surface, the surface shall be compacted and smoothed with not less than two thorough and complete steel troweling operations. In areas which are to receive a floor covering such as tile, resilient flooring, or carpeting, the applicable Specification Sections and Contract Drawings shall be reviewed for the required finishes and degree of flatness. In areas that are intermittently wet such as pump rooms, only one troweling operation is required to provide some trowel marks for slip resistance. All edges shall be edged with an 1/8-inch tool as directed by the Engineer. The finish shall be brought to a smooth, dense surface, free from defects and blemishes.

5. Type "E" - Broom or Belt: This finish shall provide the surface with a transverse scored texture by drawing a broom or burlap belt across the surface immediately after completion of a Type "B" finish. All edges shall be edged with an 1/8-inch tool as directed by the Engineer.

6. Type "F" - Swept in Grout Topping: This finish shall be applied after a completion of a Type "A" finish. The concrete surface shall be properly cleaned, washed, and coated with a mixture of water and Portland Cement. Cement grout in accordance with Section 03600 shall then be plowed and swept into neat conformance with the blades or arms of the apparatus by turning or rotating the previously positioned mechanical equipment. Special attention shall be paid to true grades, shapes and tolerances as specified by the manufacturer of the equipment. Before beginning this finish, the Contractor shall notify the Engineer and the equipment manufacturer of the details of the operation and obtain approval and recommendations.

7. Type “G” Hardened Finish: This finish shall be applied after completion of a Type “B” or Type “C” finish and prior to application of a Type “D” finish. Hardeners shall be applied in strict accordance with the manufacturer’s requirements. Hardeners shall be applied using a mechanical spreader. The hardener shall be applied in two shakes with the first shake comprising 2/3 of the total amount. Type “D” finish shall be applied following completion of application of the hardener.

    a. Non-metallic floor hardener shall be applied where specifically required on the Contract Drawings at the rate of 1.0 pounds/ft.^{2}.

b. Non-oxidizing heavy duty metallic floor hardener shall be applied at the loading docks and where specifically required on the Contract Drawings or specified herein at the rate of 1.5 pounds/ft.^{2}.

8. Type "H" - Non-Slip Finish: This finish shall be provided by applying a non-slip shake-on aggregate concurrently with the application of a Type "D" finish. Application procedure shall be in accordance with manufacturer's instructions.

9. Type "J" - Raked Finish: This finish shall be provided by raking the surface as soon as the condition of the concrete permits by making depressions of ±1/4 inch.

3.03 CONCRETE SEALERS

A. Concrete sealers shall be applied where specifically required on the Contract Drawings or specified herein.

B. Sealers shall be applied after installation of all equipment, piping, etc. and after completion of any other related construction activities. Application of sealers shall be in strict accordance with manufacturer's requirements.

C. Sealers shall be applied to all floor slabs not painted and not intended to be immersed.

D. Floor slabs subjected to vehicular traffic shall be sealed with the concrete liquid densifier and sealer.

E. All other floor slabs to receive sealer shall be sealed with concrete floor sealer.

3.04 FINISHES ON EQUIPMENT PADS

A. Formed surfaces of equipment pads shall receive a Type III finish.

B. Top surfaces of equipment pads, except those surfaces subsequently required to receive grout and support equipment bases, shall receive a Type "D" finish, unless otherwise noted. Surfaces which will later receive grout shall, before the concrete takes its final set, be made rough by removing the sand and cement that accumulates on the top to the extent that the aggregate will be exposed with irregular indentations in the surface up to 1/2 inch deep.

3.05 CONCRETE FINISH SCHEDULE

A. Concrete Finish Schedule

Item	Type of Finish
Concrete surfaces indicated to receive textured coating (as noted on Drawings and in Section 09800, Special Coatings)	I
Inner face of walls of tanks, flow channels, wet wells, perimeter walls, and miscellaneous concrete structures:	
From 1 feet below water surface to bottom of wall	I
From top of wall to 1 feet below water surface	I
Exterior concrete walls below grade	I
Exterior exposed concrete walls, ceilings, beams, manholes, hand holes, miscellaneous structures and columns (including top of wall) to one foot below grade. All other exposed concrete surfaces not specified elsewhere	I
All interior exposed concrete walls and vertical surfaces	I
Interior exposed ceiling, including beams	III
Floors of process equipment tanks or basins, wetwells, flow channels and slabs to receive roofing material or waterproof membranes	B
All interior finish floors of buildings and structures and walking surfaces which will be continuously or intermittently wet	D
All interior finish floors of buildings and structures which are not continuously or intermittently wet	D
Floors to receive tile, resilient flooring, or carpeting	D
Exterior concrete sidewalks, steps, ramps, decks, slabs on grade and landings exposed to weather	E
Floors of process equipment tanks indicated on Drawings to receive grout topping	F
Garage and storage area floors	G
Precast concrete form panels, hollow core planks, double tees	J

END OF SECTION

SECTION 03370
CONCRETE CURING

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Protect all freshly deposited concrete from premature drying and from the weather elements. The concrete shall be maintained with minimal moisture loss at a relatively constant temperature for a period of time necessary for the hydration of the cement and proper hardening of the concrete in accordance with the requirements specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03100 - Concrete Formwork

B. Section 03300 - Cast-In-Place Concrete

C. Section 03350 - Concrete Finishes

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. ACI 301 - Specifications for Structural Concrete for Buildings
2. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete
3. ACI 305 - Hot Weather Concreting
4. ACI 306 - Cold Weather Concreting
5. ACI 308 - Standard Practice for Curing Concrete
6. ASTM C171 - Standard Specifications for Sheet Materials for Curing Concrete
7. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
8. Federal Specification TT-C-800

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300, Submittals.

1. Proposed procedures for protection of concrete under wet weather placement conditions.

2. Proposed normal procedures for protection and curing of concrete.

3. Proposed special procedures for protection and curing of concrete under hot and cold weather conditions.

4. Proposed method of measuring concrete surface temperature changes.

5. Manufacturer's literature and material certification for proposed curing compounds.

PART 2 – PRODUCTS

2.01 LIQUID MEMBRANE-FORMING CURING COMPOUND

A. Clear curing and sealing compound shall be a clear styrene acrylate type complying with ASTM C 1315, Type 1, Class A with a minimum solids content of 25%. Moisture loss shall not be greater than 0.40 kg/m^2 when applied at 300 sq.ft./gal. Manufacturer's certification is required. Acceptable products are Super Diamond Clear VOX by the Euclid Chemical Company, Sonneborn Kure N Seal 30 by BASF Construction Chemicals, and Cure & Seal 30 Plus by Symons Corporation.

B. Where specifically approved by Engineer, on slabs to receive subsequent applied finishes, compound shall conform to ASTM C 309. Acceptable products are "Kurez DR VOX" or "Kurez W VOX" by the Euclid Chemical Company. Install in strict accordance with manufacturer's requirements.

2.02 EVAPORATION REDUCER

A. Evaporation reducer shall be BASF, "Confilm", or Euclid Chemical "Euco-Bar".

PART 3 – EXECUTION

3.01 PROTECTION AND CURING

A. All freshly placed concrete shall be protected from the elements, flowing water and from defacement of any nature during construction operations.

B. As soon as the concrete has been placed and horizontal top surfaces have received their required finish, provision shall be made for maintaining the concrete in a moist condition for at least a 5-day period thereafter except for high early strength concrete, for which the period shall be at least the first three days after placement. Horizontal surfaces shall be kept covered, and intermittent, localized drying will not be permitted.

C. Walls that will be exposed on one side with either fluid or earth backfill on the opposite side shall be continuously wet cured for a minimum of five days. Use of a curing compound will not be acceptable for applications of this type.

D. The Contractor shall use one of the following methods to insure that the concrete remains in a moist condition for the minimum period stated above.

1. Ponding or continuous fogging or sprinkling.

2. Application of mats or fabric kept continuously wet.

3. Continuous application of steam (under 150°F).

4. Application of sheet materials conforming to ASTM C171.

5. If approved by the Engineer, application of a curing compound in accordance with Article 3.04.

E. The Contractor shall keep absorbent wood forms wet until they are removed. After form removal, the concrete shall be cured by one of the methods in paragraph D.

F. Any of the curing procedures used in Paragraph 3.01-D may be replaced by one of the other curing procedures listed in Paragraph 3.01-D after the concrete is one-day old. However, the concrete surface shall not be permitted to become dry at any time.

3.02 CURING CONCRETE UNDER COLD WEATHER CONDITIONS

A. Suitable means shall be provided for a minimum of 72 hours after placing concrete to maintain it at or above the minimum as placed temperatures specified in Section 03300, Cast-In-Place Concrete, for concrete work in cold weather. During the 72-hour period, the concrete surface shall not be exposed to air more than 20°F above the minimum as placed temperatures.

B. Stripping time for forms and supports shall be increased as necessary to allow for retardation in concrete strength caused by colder temperatures. This retardation is magnified when using concrete made with blended cements or containing fly ash or ground granulated blast furnace slag. Therefore, curing times and stripping times shall be further increased as necessary when using these types of concrete.

C. The methods of protecting the concrete shall be approved by the Engineer and shall be such as will prevent local drying. Equipment and materials approved for this purpose shall be on the site in sufficient quantity before the work begins. The Contractor shall assist the Engineer by providing holes in the forms and the concrete in which thermometers can be placed to determine the adequacy of heating and protection. All such thermometers shall be furnished by the Contractor in quantity and type which the Engineer directs.

D. Curing procedures during cold weather conditions shall conform to the requirements of ACI 306.

3.03 CURING CONCRETE UNDER HOT WEATHER CONDITIONS

A. When air temperatures exceed 85°F, the Contractor shall take extra care in placing and finishing techniques to avoid formation of cold joints and plastic shrinkage cracking. If ordered by the Engineer, temporary sun shades and/or windbreakers shall be erected to guard against such developments, including generous use of wet burlap coverings and fog sprays to prevent drying out of the exposed concrete surfaces.

B. Immediately after screeding, horizontal surfaces shall receive an application of evaporation reducer. Apply in accordance with manufacturer's instructions. Final finish work shall begin as soon as the mix has stiffened sufficiently to support the workmen.

C. Curing and protection of the concrete shall begin immediately after completion of the finishing operation. Continuous moist-curing consisting of method 1 or 2 listed in paragraph 3.01D is mandatory for at least the first 24 hours. Method 2 may be used only if the finished surface is not marred or blemished during contact with the coverings.

D. At the end of the initial 24-hour period, curing and protection of the concrete shall continue for at least four (4) additional days using one of the methods listed in paragraph 3.01D.

E. Curing procedures during hot weather conditions shall conform to the requirements of ACI 305.

3.04 USE OF CURING COMPOUND

A. Curing compound shall be used only where specifically approved by the Engineer. Curing compound shall never be used for curing exposed walls with fluid or earth backfill on the opposite side. A continuous wet cure for a minimum of five days is required for these applications. Curing compound shall not be used on surfaces exposed to water in potable water storage tanks and treatment plants unless curing compound is certified in accordance with ANSI/NSF Standard 61.

B. When permitted, the curing compound shall maintain the concrete in a moist condition for the required time period, and the subsequent appearance of the concrete surface shall not be affected.

C. The compound shall be applied in accordance with the manufacturer's recommendations after water sheen has disappeared from the concrete surface and after finishing operations. Maximum coverage for the curing and sealing compound shall be 300 square feet per gallon for trowel finishes and 200 square feet per gallon for floated or broom surfaces. Maximum coverage for compounds placed where subsequent finishes will be applied shall be 200 square feet per gallon. For rough surfaces, apply in two directions at right angles to each other.

3.05 EARLY TERMINATION OF CURING

A. Moisture retention measures may be terminated earlier than the specified times only when at least one of the following conditions is met:

1. The strength of the concrete reaches 85 percent of the specified 28-day compressive strength in laboratory-cured cylinders representative of the concrete in place, and the temperature of the in-place concrete has been constantly maintained at 50 degrees Fahrenheit or higher.

2. The strength of concrete reaches the specified 28-day compressive strength as determined by accepted nondestructive methods or laboratory-cured cylinder test results.

END OF SECTION

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SECTION 03600
GROUT

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish all materials, labor, and equipment required to provide all grout used in concrete work in accordance with the Contract Documents.

1.02 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. CRD-C 621	Corps of Engineers Specification for Non-shrink Grout
2. ASTM C 109	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm cube Specimens)
3. ASTM C 531	Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts and Monolithic Surfacings
4. ASTM C 579	Test Method for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfacings
5. ASTM C 827	Standard Test Method for Early Volume Change of Cementitious Mixtures
6. ASTM C 144	Standard Specification for Aggregate for Masonry Mortar
7. ASTM C 1107	Standard Specification for Packaged Dry, Hydraulic Cement Grout (Nonshrink)

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01300 - Submittals.

1. Certified test results verifying the compressive strength and shrinkage and expansion requirements specified herein.

2. Manufacturer's literature containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of grout used in the work.

1.04 QUALITY ASSURANCE

A. Field Tests (required for pump station and storage tank projects)

1. Compression test specimens will be taken during construction from the first placement of each type of grout and at intervals thereafter as selected by the Engineer to insure continued compliance with these Specifications. The specimens will be made by the Contractor and observed by Engineer.

   a. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C 109 at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days, 28 days and any additional time period as appropriate.

   b. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C 579, Method B, at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days and any other time period as appropriate.

2. The cost of all laboratory tests on grout will be borne by the Owner, but the Contractor shall assist the Engineer in obtaining specimens for testing. The Contractor shall be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. The Contractor shall supply all materials necessary for fabricating the test specimens, at no additional cost to the Owner.

3. All grout, already placed, which fails to meet the requirements of these Specifications, is subject to removal and replacement at no additional cost to the Owner.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Non-Shrink Cement Grout (Applicable for projects with Gravity Sewers and Force Mains)

1. Non-shrink grout shall conform to CRD-C 621 and ASTM C 1107, Grade B or C when tested at a max. fluid consistency of 30 seconds per CDC 611/ASTM C939 at temperature extremes of 45°F and 90°F and an extended working time of 15 minutes. Grout shall be non-metallic, non-stain, and non-shrink and color similar to concrete. Grout shall have a min. 28-day strength of 7,000 psi. Non-shrink grout shall be, "Euco N-S" by the Euclid Chemical Company, "Sikagrout 212" by Sika Corporation, Conspec 100 Non-Shrink Non-Metallic Grout by Conspec, Masterflow 555 Grout by BASF Construction Chemicals.

B. Epoxy Grout (Applicable for projects with Structures)

1. Epoxy grout shall be "Sikadur 32 Hi-Mod" by Sika Corporation, "Duralcrete LV" by Tamms Industries, or "Euco #452 Series" by Euclid Chemical, Concresive 1090 by BASF Construction Chemicals.

2. Epoxy grout shall be modified as required for each particular application with aggregate per manufacturer's instructions.

C. Epoxy Base Plate Grout (Applicable for projects with Structures)

1. Epoxy base plate grout shall be Sikadur 42, Grout-Pak by Sika Corporation, or Masterflow MP by BASF Construction Chemicals.

PART 3 – EXECUTION

3.01 GENERAL

A. Concrete surfaces shall be cleaned of all dirt, grease and oil-like films. Additionally, concrete surfaces shall be free of debris, including chipping or roughening the surface if a laitance or poor concrete is evident. The finish of the grout surface shall match that of the adjacent concrete.

B. All mixing, surface preparation, handling, placing, consolidation, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.

C. The Contractor, through the manufacturer of a non-shrink grout and epoxy grout, shall provide on-site technical assistance upon request, at no additional cost to the Owner.

3.02 CONSISTENCY

A. The consistency of grouts shall such that it is able to completely fill the space to be grouted. Dry pack consistency is such that the grout is plastic and moldable but will not flow.

3.03 MEASUREMENT OF INGREDIENTS

A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurement shall not be allowed.

B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

3.04 GROUT INSTALLATION

A. Grout shall be placed quickly and continuously, shall completely fill the space to be grouted and be thoroughly compacted and free of air pockets. The grout may be poured in place, pressure grouted by gravity, or pumped. The use of pneumatic pressure or dry-

packed grouting requires approval of the Engineer. For grouting beneath base plates, grout shall be poured form one side only and thence flow across to the open side to avoid air-entrapment.

END OF SECTION

SECTION 04200
UNIT MASONRY

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Extent of each type of masonry work is indicated on drawings and in schedules.

B. Types of masonry work required include:

1. Reinforced concrete unit masonry.

2. Brick or architectural concrete masonry, if shown or indicated.

1.03 QUALITY ASSURANCE

A. Fire Performance Characteristics: Where indicated, provide materials and construction which are identical to those of assemblies whose fire endurance has been determined by testing in compliance with ASTM E 119 by a recognized testing and inspecting organization or by another means, as acceptable to authority having jurisdiction.

B. Single Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.

C. Single Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

D. Mockups: Build sample panels for each type of exposed unit masonry assembly to verify selections made under sample Submittals and to demonstrate aesthetic effects.

1. Build an L-shaped mockup 48 inches long by 48 inches high by full thickness with a 24 inch leg. Mockup may be used in construction only with Engineer's approval.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each type of masonry unit, accessory, and other manufactured products, including certifications that each type complies with specified requirements.

B. Provide samples of brick or architectural concrete masonry for Owner selection.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver masonry materials to project in undamaged condition.

B. Store and handle masonry units to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion or other causes.

C. Store materials off the ground, under cover and in dry location.

D. Store aggregates where grading and other required characteristics can be maintained.

E. Store masonry accessories including metal items to prevent deterioration by corrosion and accumulation of dirt.

1.06 PROJECT CONDITIONS

A. Protection of Work: During erection, cover top of walls with waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.

B. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

C. Do not apply uniform floor or roof loading for at least 12 hours after building masonry walls or columns.

D. Do not apply concentrated loads for at least 3 days after building masonry walls or columns.

E. Staining: Prevent grout or mortar or soil from staining the face of masonry to be left exposed or painted. Remove immediately grout or mortar in contact with such masonry.

F. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.

G. Protect sills, ledges and projections from droppings of mortar.

H. Cold-Weather Requirements: Do not use frozen materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.

I. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.

1.07 ALLOWANCE

A. Include the allowance amount shown in Section 01210, Allowances, per thousand for face brick as specified in paragraph 2.1 of this section. This cost shall include delivery, taxes, and unloading on the project site.

B. Coordinate materials and their installation with related materials and installation to ensure that the allowance item is completely integrated and interfaced with related construction activities.

PART 2 – PRODUCTS

2.01 BRICK MADE FROM CLAY OR SHALE

A. Size: Provide 2-1/4" x 3-3/4" x 8" facing bricks.

B. Provide special molded shapes where indicated and for application requiring brick of form, size and finish on exposed surfaces which cannot be produced from standard brick sizes by sawing.

C. For sills, caps and similar applications resulting in exposure of brick surfaces which otherwise would be concealed from view, provide uncored or unfrogged units with all exposed surfaces finished.

D. Facing Brick: ASTM C 216, Grade SW, type FBS with a compressive strength of 7500 psi, average, per ASTM C67. Color to uniform in color as selected from standard colors available.

2.02 CONCRETE MASONRY UNITS

A. General: Comply with referenced standards and other requirements indicated below applicable to each form of concrete masonry unit required. Provide special shapes where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions. Provide bullnose units for outside corners for interior partitions, unless otherwise indicated.

B. Integral Water Repellent for Architectural Concrete Masonry Units: Provide units made with liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength for exposed units and where indicated.

C. Coordinate subparagraph and list below with Part 2 "Manufacturers" Article. Retain "Available" for nonproprietary and delete for semiproprietary specifications.

Available Products:

1. Addiment Incorporated; Block Plus W-10.

2. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block.

3. Master Builders, Inc.; Rheopel.

D. Concrete Block: Provide units complying with characteristics indicated below.

1. Size: Manufacturer's standard units with nominal face dimensions of 16" long x 8" high (15-5/8" x 7-5/8" actual) x thickness indicated.

2. Hollow Loadbearing Block: ASTM C 90, normal weight.

a. Net area compressive strength of concrete masonry units shall be a minimum of 1,900 psi when tested in accordance with ASTM C140. Compressive strength of masonry (f'm) shall be a minimum of 1,500 psi in accordance with ACI 530.1 when these units are used with the mortar specified

3. Non-Loadbearing Block: ASTM C155, normal weight or use hollow loadbearing block.

4. Architectural Concrete Masonry Units: ASTM C90, normal weight, minimum net compressive strength of 1,900 psi. Provide units with integral water repellant. Color of units shall be manufacturer's standard color and texture. Type of units shall be as indicated on Drawings.

5. Special Shapes: Provide normal weight loadbearing, non-loadbearing block, and architectural concrete masonry units as required to perform work without exposing cut surfaces. Bullnose shape shall be provided on outside corners within the building and where indicated on Drawings.

6. Concrete Building Brick: Provide units complying with ASTM C 55 and characteristics indicated below for grade, type, size and weight classification.

a. Grade: Same as indicated for concrete block.

b. Type: Same as indicated for concrete block.

c. Size: Non-modular Standard 2-1/4"x3-3/4"x8".

d. Weight Classification: Normal weight.

2.03 MORTAR AND GROUT MATERIAL

A. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold weather construction. Provide natural color cement.

B. Hydrated Lime: ASTM C 207, Type S.

C. Aggregate for Mortar: ASTM C 144, except for joints less than 1/4" use aggregate graded with 100% passing the No. 16 sieve.

D. Water: Clean and potable.

E. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with architectural concrete masonry units, containing integral water repellent by same manufacturer.

Coordinate subparagraph and list below with Part 2 "Manufacturers" Article. Retain "Available" for nonproprietary and delete for semiproprietary specifications.

Available Products:

1. Addiment Incorporated; Mortar Tite.

2. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.

3. Master Builders, Inc.; Rheomix Rheopel.

2.04 JOINT REINFORCEMENT, TIES AND ANCHORING DEVICES

A. Materials: Comply with requirements indicated below for basic materials and with requirements indicated under each form of joint reinforcement, tie and anchor for size and other characteristics:

1. Zinc-Coated (galvanized) Steel Wire: ASTM A 82 for uncoated wire and with ASTM C 641 for Class 3 (9.80 oz. per sq. ft. of wire surface). Use for masonry not exposed to exterior.

2. Hot-Dip Galvanized Steel Wire: ASTM A 82 for uncoated wire and with ASTM A 153, Class B-2 (1.5 oz. per sq. ft. of wire surface) for zinc coating applied after prefabrication into units. Use for masonry exposed to exterior and in contact with earth.

3. Zinc-Coated (Galvanized) Steel Sheet: Carbon steel with zinc coating complying with ASTM A 525, Coating Designation G90. Use for dovetail slots and where indicated.

4. Hot-Dip Galvanized Carbon Steel Sheet: ASTM A 366, Class 2 or ASTM A 635; hot-dip galvanized after fabrication to comply with ASTM A 153, Class B. Use for anchors.

5. Joint Reinforcement: Provide welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10', with prefabricated corner and tee units, and complying with requirements indicated below:

a. Width: Fabricate joint reinforcement in units with widths of approximately 2" less than nominal width of walls and partitions as required to provide mortar coverage of not less than 5/8" on joint faces exposed to exterior and 1/2" elsewhere.

b. Wire Size for Side Rods: 0.1875" diameter.

c. Wire Size for Cross Rods: 0.1875" diameter.

d. For multi-wythe masonry provide adjustable eye-wire joint reinforcement. Ladder design with cross rods spaced not more than 16" o.c. and having one side rod for each face shell of concrete masonry back-up and adjustable wall tie with seismic clip and continuous 9 gauge wire for veneer.

6. Anchor Bolts: Provide steel bolts with hex nuts and flat washers complying with ASTM A 307, Grade A, hot-dip galvanized to comply with ASTM C 153, Class C, in sizes and configurations indicated.

7. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

a. AA Wire Products Co.

b. Dur-O-Wall, Inc.

c. Heckman Building Products, Inc.

d. Hohmann & Barnard, Inc.

e. Masonry Reinforcing Corp. of America.

f. National Wire Products Corp.

2.05 CONCEALED FLASHING MATERIALS

A. Laminated Flashing: Manufacturer's standard laminated flashing consisting of 7 oz. per sq. ft. copper sheet bonded with asphalt between 2 layers of glass fiber cloth.

B. Products: Subject to compliance with requirements, provide one of the following:

1. Copper Fabric Laminate Flashing:

a. Copper Fabric; Afco Products, Inc.

b. Copper Fabric Flashing; Sandell Mfg. Co., Inc.

c. Copper Fabric Flashing; York Mfg., Inc.

2.06 MISCELLANEOUS MASONRY ACCESSORIES

A. Reinforcing Bars: Deformed steel, ASTM A 615, Grade 60 for bars No. 3 to No. 18.

B. Non-Metallic Expansion Joint Strips: Premolded, flexible cellular neoprene rubber filler strips complying with ASTM D 1056, Grade RE41E1, capable of compression up to 35%, of width and thickness indicated.

C. Premolded Control Joint Strips: Styrene-butadiene rubber compound complying with ASTM D 2000, Designation 2AA-805, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

D. Bond Breaker Strips: Asphalt-saturated organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

E. Weep Holes: Provide round Plastic tubing, medium-density polyethylene, 3/8" outside diameter by CMU or brick width long. Space as indicated on drawings.

2.07 INSULATION

A. Extruded Polystyrene Board Insulation: Rigid cellular polystyrene thermal insulation with closed cells and integral high density skin, formed by the expansion of polystyrene base resin in an extrusion process to comply with ASTM C 578, Type IV; 5-year aged r-value of 5 Btu/(hr x sf x degrees F) at 75 degrees F (24 degrees C); in manufacturer's standard lengths and widths; thickness as indicated. Subject to compliance with requirements, provide one of the following:

1. Dow Chemical USA: Styrofoam SM/SB.

2. UC Industries: Foamular 250.

3. 3Minnesota Diversified Products, Inc.: Certifoam.

B. Adhesive: Type recommended by insulation board manufacturer for application indicated.

2.08 MASONRY CLEANER

A. Job-Mixed Detergent Solution: Solution of trisodium phosphate (1/2 cup dry measure) and laundry detergent (1/2 cup dry measure) dissolved in one gallon of water. Modify mixture as required to meet requirements of the architectural concrete masonry unit and face brick manufacturer.

2.09 MORTAR AND GROUT MIXES

A. General: Do not add admixtures including coloring pigments, air-entraining agents, accelerators, retarders, anti-freeze compounds or other admixtures, unless otherwise indicated. Do not use calcium chloride in mortar or grout. Water repellant admixture

shall be used for masonry mortar used with architectural concrete masonry units with an integral water repellant admixture.

B. Mixing: Combine and thoroughly mix cementitious, water and aggregates in a mechanical batch mixer; comply with referenced ASTM standards for mixing time and water content.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, for type of mortar required, unless otherwise indicated. Limit cementitious materials in mortar to portland cement-lime. Type N mortar for exterior, above-grade loadbearing and non-loadbearing walls; for interior loadbearing walls; and for other applications where another type is not indicated.

D. Grout for Unit Masonry: Comply with ASTM C 476 for grout for use in construction of reinforced and nonreinforced unit masonry. Use grout of consistency indicated or if not otherwise indicated, of consistency (fine or coarse) at time of placement which will completely fill all spaces intended to receive grout. Use fine grout in grout spaces less than 2" in horizontal direction, unless otherwise indicated. Grout shall have a minimum compressive strength of 3,000 psi after 28 days.

PART 3 – EXECUTION

3.01 INSTALLATION, GENERAL

A. Wetting Clay Brick: Wet brick made from clay or shale which have ASTM C 67 initial rates of absorption (suction) of more than 30 grams per 30 sq. in. per minute. Use wetting methods which ensure each clay masonry unit being nearly saturated but surface dry when laid.

B. Do not wet concrete masonry units.

C. Cleaning Reinforcing: Before placing, remove loose rust, ice and other coatings from reinforcing.

D. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness indicated.

E. Build chases and recesses as shown or required for the work of other trades. Provide not less than 8" of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses.

F. Leave openings for equipment to be installed before completion of masonry work. After installation of equipment, complete masonry work to match work immediately adjacent to the opening.

G. Cut masonry units using motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining work. Use full-size units without cutting where possible. Use dry cutting saws to cut concrete masonry units.

3.02 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces of columns, walls and arrises do not exceed 1/4" in 10', or 3/8" in a story height not to exceed 20', nor 1/2" in 40' or more. For external corners, expansion joints, control joints and other conspicuous lines, do not exceed 1/4" in any story or 20' maximum, nor 1/2" in 40' or more. For vertical alignment of head joints do not exceed plus or minimum 1/4" in 10', 1/2" maximum.

B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/4" in any bay or 20' maximum, nor 1/2" in 40' or more. For top surface of bearing walls do not exceed 1/8" between adjacent floor elements in 10' or 1/16" width of a single unit.

C. Variation of Linear Building Lines: For position shown in plan and related portion of columns, walls and partitions, do not exceed 1/2" in any bay or 20' maximum, nor 3/4" in 40' or more.

D. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions, shown, do not exceed minimum 1/4" nor plus 1/2".

E. Variation in Mortar Joint Thickness: Do not exceed bed joint thickness indicated by more than plus or minus 1/8", with a maximum thickness limited to 1/2". Do not exceed head joint thickness indicated by more than plus or minus 1/8".

3.03 LAYING MASONRY WALLS

A. Layout walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to accurately locate openings, movement-type joints, returns and offsets. Avoid the use of less-than-half-size units at corners, jambs and wherever possible at other locations.

B. Lay-up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other work.

C. Pattern Bond: Lay exposed masonry in the bond pattern shown or, if not shown, lay in running bond with vertical joint in each course centered on units in courses above and below. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2". Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4" horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Rack back 1/2-unit length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly (if required) and remove loose masonry units and mortar prior to laying fresh masonry.

E. Built-in Work: As the work progresses, build-in items specified under this and other sections of these specifications. Fill in solidly with masonry around built-in items. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core. Fill cores in hollow concrete masonry units with grout 3 courses (24") under bearing plates, beams, lintels, posts and similar items, unless otherwise indicated.

3.04 MORTAR BEDDING AND JOINTING

A. Lay solid brick size masonry units with completely filled bed and head joint; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints.

B. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting courses on footings and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.

C. Set pre-cast concrete coping units in full bed of mortar with all vertical joints, slushed full. Fill dowel, anchor and similar holes solid. Rake head joints 1/2" to 3/4" and install elastomeric sealant and lead joint covers.

D. Maintain joint widths shown, except for minor variations required to maintain bond alignment. If not shown, lay walls with 3/8" joints.

E. Cut joints flush for masonry walls which are to be concealed or to be covered by other materials, unless otherwise indicated.

F. Tool exposed joints slightly concave using a jointer larger than joint thickness, unless otherwise indicated.

G. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners or jambs to shift adjacent stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

3.05 STRUCTURAL BONDING OF MULTI-WYTHE MASONRY

A. Use continuous horizontal joint reinforcement installed in horizontal mortar joints for bond tie between wythes. Install at not more than 16" o.c. vertically.

B. Corners: Provide interlocking masonry unit bond in each course at corners, unless otherwise shown.

C. For horizontally reinforced masonry, provide continuity at corners with prefabricated "L" units, in addition to masonry bonding.

D. Intersecting and Abutting walls: Unless vertical expansion or control joints are shown at juncture, provide same type of bonding specified for structural bonding between wythes, provide continuity with horizontal joint reinforcement using prefabricated "T" units.

E. Non-bearing Interior Partitions: Build full height of story to underside of solid floor or roof structure above, unless otherwise shown. Wedge non-bearing partitions against structure above with small pieces of tile, slate or metal. Fill joint with mortar after dead load deflection of structure above approaches final position.

3.06 CAVITY WALLS

A. Keep cavity clean of mortar droppings and other materials during construction. Strike joints facing cavity flush.

B. Tie exterior wythe to back-up with continuous horizontal joint reinforcing, installed in mortar joints at not more than 16" o.c. vertically.

C. Provide weep holes in exterior wythe of cavity wall located immediately above ledges and flashing, spaced 2'-0" o.c., unless other wise indicated.

3.07 CAVITY WALL INSULATION

A. On units of plastic insulation, install small pads of adhesive spaced approximately 1'-0" o.c. both ways on inside face. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown. Fill all cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.08 HORIZONTAL JOINT REINFORCEMENT

A. General: Provide continuous horizontal joint reinforcement as indicated. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8" on exterior side of walls, 1/2" elsewhere. Lap reinforcing a minimum of 6". Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

B. Reinforce walls with continuous horizontal joint reinforcing unless specifically noted to be omitted.

C. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

D. Space continuous horizontal reinforcement for single wythe and multi-wythe walls at 16" o.c. vertically.

E. Reinforce masonry openings greater than 1'-0" wide, with horizontal joint reinforcement placed in 2 horizontal joints approximately 8" apart, immediately above the lintel and immediately below the sill. Extend reinforcement a minimum of 2'-0" beyond jambs of the opening except at control joints.

3.09 ANCHORING MASONRY WORK

A. General: Provide anchor devices of type indicated.

B. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following: Provide an open space not less than 1" in width between masonry and structural member, rigid materials. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure. Space anchors as indicated, but not more than 24" o.c. vertically and 36" o.c. horizontally.

3.10 CONTROL AND EXPANSION JOINTS

A. General: Provide vertical expansion, control and isolation joints in masonry every 20 feet or where shown. Build-in related items as the masonry work progresses. Build-in non-metallic joint fillers where indicated.

3.11 LINTELS

A. Install steel lintels where indicated. Provide masonry lintels where shown and wherever openings of more than 1'-0" for brick size units and 2'-0" for block size units are shown without structural steel or other supporting lintels. Provide precast or formed-in-place masonry lintels. Cure precast lintels before handling and installation. Temporarily support formed-in-place lintels. For hollow concrete masonry unit walls, use specially formed U-shaped lintel units with reinforcement bars placed as shown filled with coarse grout. Provide minimum bearing of 8" at each jamb, unless otherwise indicated.

3.12 FLASHING OF MASONRY WORK

A. General: Provide concealed flashing in masonry work at, or above, shelf angles, lintels, ledges and other obstructions to the downward flow of water in the wall so as to divert such water to the exterior. Prepare masonry surfaces smooth and free from projections which could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with mastic before covering with mortar. Extend flashings through exterior face of masonry and turn down to form drip.

B. Extend flashing the full length of lintels and shelf angles and minimum of 4" into masonry each end. Extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 8", and through the inner wythe to within 1/2" of the interior face of the wall in exposed work. Where interior surface of inner wythe is concealed by furring, carry flashing completely through the inner wythe and turn up approximately 2". At heads and sills turn up ends not less than 2" to form a pan.

C. Provide weep holes in the head joints of the first course of masonry immediately above concealed flashings. Space 24" o.c., unless otherwise indicated.

D. Install reglets and nailers for flashing and other related work where shown to be built into masonry work.

E. Damp cure parging for at least 24 hours and protect until cured.

3.13 REPAIR, POINTING AND CLEANING

A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints including corners, openings and adjacent work to provide a neat, uniform appearance, prepared for application of sealants.

C. Final Cleaning: After mortar is thoroughly set and cured, clean masonry as follows: Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels. Protect adjacent concrete and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film or waterproof masking tape. Saturate wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water. Use bucket and brush hand cleaning method described in BIA "Technical Note No. 20 Revised" to clean brick masonry made from clay or shale. Clean concrete unit masonry to comply with masonry manufacturer's directions and applicable NCMA "Tek" bulletins.

D. Protection: Provide final protection and maintain conditions in a manner acceptable to Installer, which ensures unit masonry work being without damage and deterioration at time of substantial completion.

E. Water Protection: Water-repellant for all exposed brick and architectural concrete masonry walls shall be as specified in Section 07175 - Water Repellants.

END OF SECTION

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SECTION 05010
METAL MATERIALS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Metal materials not otherwise specified shall conform to the requirements of this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Requirements for specific products made from the materials specified herein are included in other sections of the Specifications. See the section for the specific item in question.

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. ASTM A36 Standard Specification for Structural Steel

B. ASTM A47 Standard Specification for Malleable Iron Castings

C. ASTM A48 Standard Specification for Gray Iron Castings

D. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

E. ASTM A123 Standard Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strip

F. ASTM A153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

G. ASTM A167 Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

H. ASTM A276 Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes

I. ASTM A307 Standard Specification for Carbon Steel Externally Threaded Standard Fasteners

J. ASTM A446 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) quality

K. ASTM A500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

L. ASTM A501 Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

M. ASTM A529 Standard Specification for Structural Steel with 42 000 psi (290 Mpa) Minimum Yield Point (1/2 in. (12.7 mm) Maximum Thickness)

N. ASTM A536 Standard Specification for Ductile Iron Castings

O. ASTM A570 Standard Specification for Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality

P. ASTM A572 Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel

Q. ASTM A780 Standard Practice of Repair of Damaged Hot-Dip Galvanized Coatings

R. ASTM A924 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

S. ASTM A992 Standard Specification for Structural Steel Shapes

T. ASTM A666 Standard Specification for Austenitic Stainless Steel, Sheet, Strip, Plate, and Flat Bar for Structural Applications

U. ASTM B26 Standard Specification for Aluminum-Alloy Sand Castings

V. ASTM B85 Standard Specification for Aluminum-Alloy Die Castings

W. ASTM B108 Standard Specification for Aluminum-Alloy Permanent Mold Castings

X. ASTM B138 Standard Specification for Manganese Bronze Rod, Bar, and Shapes

Y. ASTM B209 Standard Specification for Aluminum-Alloy Sheet and Plate

Z. ASTM B221 Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

AA. ASTM B308 Standard Specification for Aluminum-Alloy Standard Structural Shapes, Rolled or Extruded

BB. ASTM B574 Standard Specification for Nickel-Molybdenum-Chromium Alloy Rod

CC. ASTM F468 Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use

DD. ASTM F593 Standard Specification for Stainless Steel Fasteners

1.04 SUBMITTALS

A. Material certifications shall be submitted along with any shop drawings for metal products and fabrications required by other sections of the Specifications.

1.05 QUALITY ASSURANCE

A. Owner may engage the services of a testing agency to test any metal materials for conformance with the material requirements herein. If the material is found to be in conformance with Specifications the cost of testing will be borne by the Owner. If the material does not conform to the Specifications, the cost of testing shall be paid by the Contractor and all materials not in conformance as determined by the Engineer shall be replaced by the Contractor at no additional cost to the Owner. In lieu of replacing materials the Contractor may request further testing to determine conformance, but any such testing shall be paid for by the Contractor regardless of outcome of such testing.

PART 2 – PRODUCTS

2.01 CARBON AND LOW ALLOY STEEL

A. Material types and ASTM designations shall be as listed below:

1.	Structural Fabrications	A992, A572 Grade 50, or A36
2.	Sheet Steel	A 570 Grade C
3.	Steel Angles and Plates	A36
4.	Bars and Rods	A 36 or A307 Grade A
5.	Pipe - Structural Use	A53 Type E or S, Grade B
6.	Tubes	A500 Grade B or A501
7.	Cold-Formed Structural Studs and Joists (18-22 gauge)	A 446 Grade C
	Cold-Formed Structural Studs and Joists (12-16 gauge)	A 446 Grade D

B. Steel shapes, plates and bars which are to be galvanized shall be galvanized in accordance with ASTM A123. Iron and steel sheet which are to be galvanized shall be galvanized in accordance with ASTM A924. All connections for galvanized members shall use fasteners galvanized in accordance with ASTM A153 unless noted otherwise.

2.02 STAINLESS STEEL

A. All stainless steel fabrications exposed to underwater service shall be Type 316. All other stainless steel fabrications shall be Type 304, unless noted otherwise. All

connections for stainless steel fabrications shall use Type 304 or 316 stainless steel fasteners. Fasteners shall be of the same alloy type as the structural members.

B. Material types and ASTM designations are listed below:

1.	Plates and Sheets	ASTM A167 or A666 Grade A
2.	Structural Shapes	ASTM A276
3.	Fasteners (Bolts, etc.)	ASTM F593

2.03 ALUMINUM

A. All aluminum shall be alloy 6061-T6, unless otherwise noted or specified herein.

B. Material types and ASTM designations are listed below:

1.	Structural Shapes	ASTM B308
2.	Castings	ASTM B26, B85, or B108
3.	Extruded Bars	ASTM B221 - Alloy 6061
4.	Extruded Rods, Shapes and Tubes	ASTM B221 - Alloy 6063
5.	Plates	ASTM B209 - Alloy 6061
6.	Sheets	ASTM B221 - Alloy 3003

C. All aluminum shall be provided with mill finish unless otherwise noted.

D. Where bolted connections are indicated, aluminum shall be fastened with Type 304 stainless steel bolts unless noted otherwise.

E. Aluminum in contact with dissimilar materials shall be insulated with an approved dielectric.

2.04 CAST IRON

A. Material types and ASTM designations are listed below:

1.	Gray	ASTM A48 Class 30B
2.	Malleable	ASTM A47
3.	Ductile	ASTM A536 Grade 60-40-18

2.05 BRONZE

A. Material types and ASTM designations are listed below:

1. Rods, Bars and Sheets ASTM B138 - Alloy B Soft

2.06 HASTELLOY

A. All Hastelloy shall be Alloy C-276.

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 05120
STRUCTURAL STEEL

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services for furnishing and installing the structural steel as shown on the Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Cast-In-Place Concrete - Section 03300

B. Metal Materials - Section 05010

1.03 SUBMITTALS

A. Complete shop and erection drawings shall be submitted for review. Shop drawings shall be submitted in accordance with Section 01300. All welds shall be indicated by standard welding symbols of the AWS.

B. Templates shall be furnished, together with instructions for the setting of anchors, anchor bolts, and bearing plates. The Contractor shall ascertain that the items are properly set during the progress of the work.

1.04 APPLICABLE PUBLICATIONS

The current issue of the following publications form a part of this specification to the extent indicated by the reference thereto:

A. American Institute of Steel Construction publications: (AISC):

1. Code of Standard Practice for Steel Buildings and Bridges.

2. Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings.

3. Steel Construction Manual - Latest Edition.

B. American Welding Society Publication (AWS): Structural Welding Code, D1.1-82.

C. Research Council on Riveted and Bolted Structural Joints (RCRBSJ) of the Engineering Foundation Publication: Specifications for Structural Joints Using ASTM A 325 or a 490 Bolts.

1.05 GENERAL REQUIREMENTS

A. Except as otherwise specified hereinafter, the AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings shall govern the Work. Welding shall be in accordance with AWS Code D1.1. High-strength bolting shall be in accordance with RCRBSJ Specifications for structural joints using ASTM A 325 or A 490 Bolts.

B. Design of members and connections for any portion of the structures not indicated on the Contract Drawings shall be completed by the fabricator and indicated on the shop drawings.

C. Substitution of sections or modification of details, or both, and the reasons therefor shall be submitted with the shop drawings for review. Approved substitutions, modifications, and necessary changes in related portions of the work shall be coordinated by the Contractor and shall be accomplished at no additional cost to the Owner.

D. Responsibility for Errors: The Contractor shall be responsible for all errors of detailing, fabrication, and for the correct fitting of the structural member.

E. Storage of Materials: Materials shall be stored out of contact with the ground in such a manner and location which will minimize contamination and deterioration.

PART 2 – PRODUCTS

2.01 MATERIAL

A. Material shall conform to the following:

1.	Wide Flange Shapes	ASTM A992
2.	Steel Plates, Channels, S-shapes, and HP-shapes	ASTM A36
3.	Rectangular and Round Hollow Structural Sections	ASTM A500, Grade B
4.	Steel Pipes	ASTM A53
5.	Crane Rails	ASTM A759
6.	Bolts	ASTM A325
7.	Anchor Bolts	ASTM F1554
8.	Rolled Steel Floor Plates	ASTM A786
9.	Steel Castings	ASTM A27,Grade 65-35

10.	Tension-control Twist-off type Bolt Assemblies	ASTM F1852
11.	Hardened Steel Washers	ASTM F436

B. Welding electrodes shall conform to requirements shown in Table 4.1.1 of AWS D1.1 and shall be E70XX or F7XEXXX.

PART 3 – EXECUTION

3.01 FABRICATION

A. Structural material shall be fabricated and assembled in the shop to the greatest extent possible. Shearing, flame cuttings, and chipping shall be done carefully and accurately. Sheared and flame cut edges shall be finished smooth by grinding, chipping, or planing. The radii of re-entrant flame cut fillets shall be not less than one inch and as much larger as practicable. Sole plates of beams and girders shall have full contact with the flanges. Where shown or required, stiffeners shall be fitted neatly between the flanges of beams and girders and, where tight fits are required to transmit bearing, the ends of stiffeners shall be milled or ground to secure an even bearing against the flanges or shall be grooved and fully buttwelded to the flanges. The corners of stiffener plates shall be cut to clear fillets of beams. The clearance between the ends of spliced web plates shall not exceed 1/4 inch. Assembled pieces shall be taken apart, if necessary, for the removal of burrs and shavings produced by the reaming operation. Structural steelwork shall be prepared for painting in accordance with the AISC specification and primed with paint materials hereinafter specified.

B. Connections shall be as shown or, if connection details are not shown on the Drawings, the connections shall be designed for the reactions shown on the Drawings. Where connection details or reactions are not shown on the Drawings, the connections shall be designed for a shear equal to one-half of the allowable uniform load for simple beams, laterally supported, for the spans indicated, as tabulated in the AISC manual of steel construction, plus 5000 pounds. Connections shall be designed in accordance with the recommendations given in the AISC manual of steel construction, Eighth Edition. One-sided or other types of eccentric connections will be permitted only where shown on the Contract Drawings or accepted by the Engineer.

C. Steel work to be encased in concrete, including surfaces of top flanges of members supporting concrete slabs shall, after fabrication, be cleaned of all oil or grease by solvent cleaners and, after erection, be cleaned of dirt and foreign material by thoroughly sweeping with a stiff fiber brush or other approved method.

3.02 ERECTION

A. The erection of structural steel shall be in accordance with the applicable provisions of the AISC specification.

B. Anchor bolts and anchors shall be properly located and built into connecting work. Bolts and anchors shall be preset by the use of templates or such other methods as may be required to locate the anchors and anchor bolts accurately.

C. Column base and bearing plates shall be provided under all columns, and other members resting on walls or footings. Base and bearing plates may be attached or loose as noted on the shop drawings. Base plates and bearing plates shall be supported and aligned on steel wedges or shims. After the supported members have been plumbed and properly positioned and the anchor nuts tightened, the entire bearing area under the plate shall be filled solid with nonshrinking grout. Wedges and shims shall be cut off flush with edges of column base and bearing plates, and shall be left in place.

D. Holes, except for turned and ribbed bolts, shall not be enlarged more than 1/16 inch greater than the specified hole size without the approval of the Engineer.

E. Lockwashers shall be provided under all A 307 nuts. Threading shall be excluded form the shear planes for all a 307 and a 325 bearing-type bolted connections.

F. Driftpins may be used only to bring together the several parts and shall not be used in such manner as to distort or damage the metal.

G. Gas Cutting: The use of a gas-cutting torch in the field for correcting fabrication errors will not be permitted on any major member in the structural framing. The use of gas-cutting torch will be permitted only on minor members, when the member is not under stress, and then only after the approval of the Engineer has been obtained.

3.03 PAINTING

A. All steel work shall be painted with one shop coat in accordance with Section 09961, High Performance Paints and Coatings-Wastewater, with the exception of the following:

1. Steel work encased in concrete and contact surfaces of welded and/or bolted connections not conforming to Paragraph 3 (C) of RCRBSJ Specifications for Structural Joints Using ASTM A 325 or A 490 Bolts shall not be painted.

B. After erection, a prime coat shall be applied to all bolts, connections, damaged spots and areas which have been omitted in shop painting. Field painting shall be in accordance with Section 09900 "Painting."

3.04 QUALITY CONTROL

A. Engage an independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports.

B. Testing agency shall conduct and interpret tests, state in each report whether test specimens comply with requirements, and specifically sate any deviation therefrom.

C. Provide access for testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.

D. Testing agency may inspect structural steel at plant before shipment.

E. Correct deficiencies in structural steel work that inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as necessary to reconfirm any noncompliance or original work and to show compliance of corrected work.

F. Bolted Connections: Inspect or test in accordance with AISC specifications.

G. Welding: Inspect and test during fabrication of structural steel assemblies, as follows:

1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.

2. Perform tests of welds (Ultrasonic Inspection: ASTM E 164).

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SECTION 06600

FIBERGLASS REINFORCED PLASTIC PRODUCTS AND FABRICATIONS

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals necessary to install the fiberglass reinforced plastic (FRP) grating, stair treads, handrail, ladders and structurals as shown on the drawings and as specified herein.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this section.

1.03 QUALITY ASSURANCE

A. The material covered by these specifications shall be furnished by a reputable and qualified manufacturer of proven ability who has regularly engaged in the manufacture and installation of FRP systems.

B. Substitution of any component or modification of system shall be made only when approved by the Engineer.

C. Fabricator Qualifications: Firm experienced in successfully producing FRP fabrications similar to that indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.

D. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.04 DESIGN CRITERIA

A. The design of FRP products including connections shall be in accordance with governing building codes and standards as applicable.

B. Design of FRP live loads on grating shall not be less than 100 pounds per sq. ft. Grating deflection at the center of a simple span not to exceed 0.25 inch. Deflection in any direction shall not be more than L/180 of span for structural members. Connections shall be designed to transfer the above loads.

1.05 SYSTEM PERFORMANCE REQUIREMENTS

A. STRUCTURAL PERFORMANCE

1. Design, engineer, fabricate, and install the following FRP fabrications to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each respective component of each FRP fabrication.

B. STAIR TREAD PERFORMANCE

1. Capable of withstanding a uniform load of 100 lbs per sq. ft. or a concentrated load of 300 lbs on an area of 4 sq. inches located in the center of the tread, whichever produces the greater stress.

C. PLATFORMING AND STAIR PLATFORM PERFORMANCE

1. Capable of withstanding a uniform load of 100 lbs per sq. ft.

D. HANDRAILS SYSTEMS PERFORMANCE

1. Capable of withstanding a concentrated load of 200 lbs applied at any point non-currently, vertically downward, or horizontally.

1.06 SUBMITTALS

A. Shop drawings of all FRP structural members, handrails, gratings, plate, ladders and appurtenances shall be submitted to the Engineer for approval in accordance with the requirements of Section 01300.

B. Manufacturer's catalog data showing:

1. Dimensions, spacings, and construction of grating

2. Design tables showing limits for span length and deflection under various uniform and concentrated loads.

3. Materials of construction

C. Detail shop drawings showing:

1. Dimensions of grating, ladders, handrail, and structural members

2. Sectional assembly

3. Location and identification mark

4. Size and type of supporting frames required

5. Anchorage and accessory items.

D. Samples of each type of grating proposed shall be submitted for approval prior to placement of purchase orders.

1.07 SHIPPING AND STORAGE INSTRUCTIONS

A. All systems, sub-systems and structures shall be shop fabricated and assembled into the largest practical size suitable for transporting.

B. All materials and equipment necessary for the fabrication and installation of the grating, plate, handrails, stair treads, and structural shapes shall be stored before, during, and after shipment in a manner to prevent cracking, twisting, bending, breaking, chipping or damage of any kind to the materials or equipment, including damage due to over exposure to the sun. Any material which, in the opinion of the Engineer, has become damaged as to be unfit for use, shall be promptly removed from the site of work, and the Contractor shall receive no compensation for the damaged material or its removal.

C. Identify and match-mark all materials, items, and fabrications for installation and field assembly.

PART 2 – PRODUCTS

2.01 GENERAL

A. Materials used in the manufacture of the FRP products shall be new stock of the best quality and shall be free from all defects and imperfections that might affect the performance of the finished product.

B. All materials shall be of the kind and quality specified, and where the quality is not specified, it shall be the best of the respective kinds and suitable for the purpose intended.

C. All FRP products noted in 1.01 shall be manufactured using a pultruded process utilizing either an isophthalic polyester or a vinyl ester resin with flame retardant and ultra-violet (UV) inhibitor additives. A synthetic surface veil shall be the outermost layer covering the exterior surface. The FRP shapes shall achieve a flame spread of 25 or less in accordance with ASTM test method E84. (Isophthalic polyester resin is available without flame retardant and UV inhibitor additives.)

D. After fabrication, all cut ends, holes and abrasions of FRP shapes shall be sealed with a compatible resin coating to prevent intrusion of moisture.

E. FRP products exposed to weather shall contain an ultraviolet inhibitor and shall additionally receive one mil thick 1J.V. coating to shield from ultra-violet light if specified or requested.

F. All exposed surfaces shall be smooth and true to form.

G. Manufacturers:

1. Morrision Molded Fiber Glass Company (MMFG)

2. Fibergrate

3. Approved equal

2.02 GRATINGS AND TREADS

A. General

1. Grating shall be shipped from the manufacturer, palletized and banded with exposed edges protected by cardboard to prevent damage in shipment.

2. Each piece shall be clearly marked showing manufacturer's applicable drawing number.

B. Design

1. The panels shall be 1-1/2" deep and sustain a deflection of no more than 0.25 inches under a uniform distributed load of 100 psf for the span lengths shown on the plans.

2. The bearing bars shall be joined into panels by passing continuous length fiberglass pultruded cross rods through the web of each bearing bars. The pultruded cross rod assembly shall consist of two cross rod spacers that have notches cut into them at 1-1/2" inches on center to fit the distance between the web of each bearing bar. A continuous fiberglass pultruded bar shaped section shall be wedged between the two cross rod spacers mechanically locking the notches in the cross rod spacers to the web of the bearing bars. Chemical bonding shall be achieved between the cross rod spacers and the bearing web and between the bar shaped wedge and the two cross rod spacers locking the entire panel together to give a panel that resists twist and prevents internal movement of the bearing bars.

3. The top surface of all panels shall have a nonskid grit affixed to the surface by a baked epoxy resin followed by a top coat of baked epoxy resin.

4. Panels shall be fabricated to the sizes shown on the drawings.

5. Hold down clamps shall be type 316L stainless steel. A minimum of 4 each per panel.

6. Color shall be gray (OSHA safety gray)

7. All bearing bars that are to be exposed to UV shall be coated (optional) with polyurethane coating of a minimum thickness of I mil if desired.

C. FABRICATION

1. The FRP grating and stair treads shall be fabricated from bearing bars and cross rod manufactured by the pultrusion process. The glass fiber reinforcement for the bearing bars shall be a core of continuous glass strand rovings wrapped with continuous strand glass mat. A synthetic surface veil shall be the outermost layer covering the exterior surfaces.

2. Fiberglass Grating and Stair Treads

   a. Fiberglass grating and stair treads shall be made from a premium grade chemical resistant, fire retardant isophthalic polyester or fire retardant vinyl ester resin system with antimony trioxide added to meet the flame rating of 25 or less in accordance with ASTM E-84 testing and meet the self-extinguishing requirements of ASTM D-635. U. V. inhibitors are added to the resin.

3. Grating with Plate

   a. Grating shall be the same as described above in this section.

   b. Plate shall be manufactured using a premium grade polyester or vinyl ester resin with fire retardant additive to meet Class I flame rating of 25 or less as tested by ASTM E-84 and meet the self-extinguishing requirements of ASTM D-635. All plate shall contain a U. V. inhibitor.

   c. Plate will be epoxy bonded to the grating, and a non-skid grit will be affixed to the top surface of the assembly by a baked epoxy resin, followed by a top coat of baked epoxy resin.

4. All cut and machined edges, holes and abrasions shall be sealed with a resin compatible with the resin matrix used in the bearing bars and cross rods.

5. All panels shall be fabricated to the sizes shown on the approved shop drawing.

2.03 STRUCTURAL SHAPES

A. Structural shapes shall be made from a premium grade polyester or vinyl ester resin with fire retardant additives to meet Class 1 flame rating of ASTM E-84 and meet the self-extinguishing requirements of ASTM D-635. All structural shapes shall contain a U.V. inhibitor.

B. Manufactured by the pultrusion process.

1. Structural FRP members composition shall consist of a glass fiber reinforced polyester or vinyl ester resin matrix, approximately 50% resin to glass ratio. A synthetic surface veil shall be the outermost layer covering the exterior surfaces.

Continuous glass strand rovings shall be used internally for longitudinal strength. Continuous strand glass mats shall be used internally for transverse strength.

C. The following minimum mechanical properties shall apply:

Table 1 – Fiberglass Pultruded Material Properties
Minimum Ultimate Coupon Properties (UN)

Material Properties	ASTM Test Method	PSI (Mpa)
Pultruded Fiberglass Structural Shapes		
Ultimate tensile stress in longitudinal direction	D638	30,000 (207)
Ultimate compressive stress in longitudinal direction	D695	30,000 (207)
Ultimate flexural stress in longitudinal direction	D790	30,000 (207)
Ultimate short beam shear in longitudinal direction	D2344	4,500 (31)
Ultimate tensile stress in transverse direction	D638	7,000 (48)
Ultimate compressive stress in transverse direction	D695	15,000 (103)
Ultimate flexural stress in transverse direction	D790	10,000 (69)
Density (lb/in.^{3} (kg/mm^3)	D792	.060-.070 (0.00166-00194)
Water absorption (24-h immersion)	D570	0.60 Max, % by Weight
Barcol Hardness	D2583	45
Coefficient of thermal 10^{-6} in/in/°C	D696	8
Expansion,LW10^{-6} in/in/°F	_____	4.4
Thermal conductivity BTU-in/FT^2/hr/°F	C177	4
Flame Retardant Properties		
Flame resistance	FTMS 406-2023	55/30 Ign.burn.sec.
Flammability test	D 635	Self Extinguishing
Surface burning characteristics	E 84	25 maximum
Flammability class	UL 94	VO
Temperature index	UL94	130°C

2.04 HANDRAILS

A. Design:

1. The FRP handrail system shall be designed to meet the configuration and loading requirements of OSHA 1910.23, with a minimum factor of safety on loading of 2.0.

B. Material:

1. The rails and posts shall be 2"'x2"x.156" square tube manufactured by the pultrusion process. The kickplate shall be 4"xl/2" (corrugated) x .125" thick pultruded fiberglass shape. The parts may be coated with an industrial grade polyurethane paint for additional U.V. protection and wear resistance. The pultruded parts shall be made with a fire retardant resin which meets the ASTM E-84 test for a flame spread of 25 or less. The resin matrix shall be {polyester} or {vinyl ester} and shall contain a UV inhibitor. The color shall be {OSHA safety yellow} or {gray}.

2. The pultruded parts shall meeting the following minimum mechanical properties:

Properties	Test Method	Values
Tensile Stress	ASTM D638	30,000 psi
Tensile Modulus	ASTM D638	2.5×10^6 psi
Compressive Stress	ASTM D695	30,000 psi
Compressive Modulus	ASTM D695	2.5×10^6 psi
Flexural Stress	ASTM D790	30,000 psi
Flexural Modulus	ASTM D790	1.6×10^6 psi
Shear Stress	ASTM D2344	4,500 psi
Density	ASTM D792	.060 - .070 lbs/in^3
24 Hr. Water Absorption	ASTM D570	0.6% max
Coef. of Thermal Expansion	ASTM D696	4.4×10^{-6} in/in°F
Flexural Stress	Full Section	36,000 psi
Flexural Modulus	Full Section	3.7×10^6 psi

C. Fabrication Handrail System:

1. The fiberglass handrail system shall be fabricated into finished sections by fabricating and joining together the pultruded square tube using molded or pultruded components; epoxy bonded and connected as shown in the fabrication details. Where required by OSHA, fiberglass kickplate shall be attached to the

handrail posts with nylon rivets. Handrail sections shall be fabricated to the size shown on the approved fabrication drawings and shall be piece marked with a waterproof tag.

D. For Side Mount:

1. Post shall be constructed with a square pultruded bottom plug. Length shall be sufficient to extend a minimum of one inch beyond the uppermost bolt hole to prevent cursing of post tubing. Bolt holes shall provide clearance of 1/16 inch for 1/2 inch diameter bolts/studs. Holes shall be on longitudinal center line of post, 1 inch from bottom of post (minimum) and not less than 3 inches apart on center. Posts shall be fastened with stainless steel anchor bolts or studs, 1/2 inch diameter extending no less than 2-1/4 inches into the concrete, or into a minimum thickness of 1/4 inch structural steel or pultruded fiberglass.

2. Post locations shall be no greater than 24 inches, nor less than 9 inches from horizontal or vertical change in handrail direction. Post centers shall be no greater than 72 inches apart on any straight run of rail or 48 inches apart on any inclined rail section.

E. Other Attachment Methods:

1. Base mount, embedded, and removable are also types of mounting procedures for handrail. Contact approved fabricator for detailed information on these connection types.

F. Installation of Handrail Sections:

1. The fabricated handrail sections shall be supplied complete with fittings by the FRP manufacturer. The components used to joint fabricated sections together may be shipped loose, to be exposed and riveted together in the filed by the Contractor, per the manufacturer's recommendations.

2. The fabricated handrail sections shall be installed as shown on the approved shop drawings. The handrail sections shall be accurately located, erected plumb and level. The sections shall be fastened to the structure as shown on the approved shop drawing.

G. Approved Fabricators:

1. Morrison Molded Fiber Glass Company (MMFG)

a. AFC Division (Chatfield, MN)

b. Bristol Division (Bristol, VA)

2. Approved equal

2.05 LADDERS AND CAGES

A. Ladders and cages shall be made from (select either Isophthalic-Polyester or Vinylester) resin.

B. All ladder and cage components shall be flame retardant per ASTM E-84 Class 1.

C. Ladder rails shall be 2 x 2 x 1/4 square tube. Ladder rungs shall be 1 inch diameter solid round.

D. Ladders and cages are to be safety yellow.

E. Ladder rungs are to penetrate inside wall of ladder rail tube and be countersunk into outside wall of ladder rail tube, providing support for the ladder rung in 4 places. This connection is to be fully bonded and with epoxy adhesives and pinned to prevent rung rotation.

F. Ladder rungs to have slip-resistant quartz epoxy grit surface.

G. Ladder stand-off brackets are to be FRP and are to be installedd at a maximum of 6'-0 on center. Ladder base mount brackets are to be FRP. All bolts are to be 316 stainless steel.

H. Ladder cages, if required per OSHA, shall be fabricated from FRP Hoops and Straps. FRP Hoops are to be 3 x 1/4 preformed FRP. Hoop spacing shall be a max. of 4'-0 on center. FRP Straps are to be 2 x 1/4 FRP and are to be spaced at 9" on center. Hoops and Straps are to be bonded with epoxy adhesives and riveted with 316 stainless steel rivets.

I. Approved Fabricators:

1. Ladder and cages shall be manufactured by Seasafe Inc., Lafayette LA, or approved equal

2.06 FALL PREVENTION DEVICES

A. All ladders shall be equipped with Saf-T-Climb fall prevention device, Manufactured by Air Space Devices, Inc., Paramount, California, or equal.

B. All ladders and safety devices shall meet OSHA regulations

PART 3 – EXECUTION

3.01 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor

bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

B. Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from water and concrete entry.

3.02 INSTALLATION, GENERAL

A. Fastening to in-place construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous FRP fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, and other connectors as required.

B. Cutting, fitting, and placement: Perform cutting, drilling, and fitting required for installation of miscellaneous FRP fabrications. Set FRP fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

3.03 ALL FRP INSTALLATION

A. All field cut and drilled edges, holes and abrasions shall be sealed with a catalyzed resin compatible with the original resin as recommended by the manufacturer. The sealing of the edges shall prevent premature fraying at the field cut edges.

B. Install items specified as indicated and in accordance with manufacturer's instructions.

3.04 INSPECTION AND TESTING

A. The Engineer shall have the right to inspect and test all materials to be furnished under these specifications prior to their shipment from the point of manufacture.

B. All labor, power, materials, equipment, and appurtenances required for testing shall be furnished by the Contractor at no cost to the Owner.

END OF SECTION

SECTION 07900
JOINT SEALERS

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services for furnishing and installing the joint sealers in accordance with the Drawings and as specified herein.

B. The extent of each form and type of joint sealer is indicated on the drawings and includes but is not limited to, the following general locations:

1. Exterior wall joints.

2. Paving and sidewalk joints.

3. Joints at penetrations of walls, decks, and floors by piping and other services and equipment.

4. Joints between items of equipment and other construction.

5. Joints at windows, doors and louvers.

1.02 RELATED DOCUMENTS SPECIFIED ELSEWHERE

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.03 SUBMITTALS

A. Comply with the requirements of Section 01300 as well as the requirements specified herein.

1. Product Data: Submit manufacturer's technical data for each joint sealer product required, including instruction for joint preparation and joint sealer application.

2. Samples for Initial Selection Purposes: Submit manufacturer's standard bead samples consisting of strips of actual products showing full range of colors available, for each product exposed to view.

3. Certificates: Submit certificates from manufacturers of joint sealers attesting that their products comply with specification requirements and are suitable for the use indicated.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Engage an Installer who has successfully completed within the last 3 years at least 3 joint sealer applications similar in type and size to that of this project and who will assign mechanics from these earlier applications to this project of which one will serve as lead mechanic.

B. Single Source Responsibility for Joint Sealer Materials: Obtain joint sealer materials from a single manufacturer for each different product required.

C. System Performance: Provide joint sealers that have been produced and installed to establish and maintain watertight and airtight continuous seals.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multi component materials.

B. Store and handle materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.06 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealers under the following conditions:

1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturer or below 40 degrees F. (4.4 degrees C).

2. When joint substrates are wet due to rain, frost, condensation or other causes.

B. Joint Width Conditions: Do not proceed with installation of joint sealers when joint widths are less than allowed by joint sealer manufacturer for application indicated.

PART 2 – PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide joint sealers, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by testing and field experience.

B. Colors: Provide color of exposed joint sealers indicated or, if not otherwise indicated, as selected by Owner from manufacturer's standard colors.

2.02 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C 920 requirements, including those for Type, Grade, Class, and Uses.

B. Two-Part Pourable Urethane Sealant: Type M; Grade NS; Class 25; Uses T, M, A, and as applicable to joint substrates indicated, O.

C. One-Part Nonsag Urethane Sealant: Type S; Grade NS; Class 25; Uses NT, M, A, and as applicable to joint substrates indicated, O.

D. Products: Subject to compliance with requirements, provide one of the following:

1. Two Part, Pourable, Urethane Sealant:

   "Chem-Calk 550"; Bostik Construction Product Division

   "Pourthane"; W.R. Meadows, Inc.

   "Sonolastic Paving Joint Sealant"; Sonneborn Building Products Division, Rexnord Chemical Products, Inc.

2. One-Part Nonsag Urethane Sealant:

   "Chem-Calk 900"; Bostik Construction Products Division

   "Vulkem 116"; Mameco International, Inc.

   "Sonolastic NP 1"; Sonneborn Building Products Division, Rexnord Chemical Products, Inc.

2.03 LATEX JOINT SEALANTS

A. Acrylic-Emulsion Sealant: Manufacturer's standard, one part, nonsag, acrylic, mildew-resistant, acrylic-emulsion sealant complying with ASTM C 384, formulated to be paintable and recommended for exposed applications on interior and on protected exterior exposures involving joint movement of not more than + or - 7.5%.

B. Products: Subject to compliance with requirements, provide one of the following:

"Chem-Calk 600"; Bostik Construction Products Division

"AC-20"; Pecora Corp.

"Sonolac"; Sonneborn Building Products Division; Rexnord Chemical Products, Inc.

"Tremco Acrylic Latex Caulk"; Tremco, Inc.

2.04 JOINT SEALANT BACKING

A. General: Provide sealant backings of material and type which are non-staining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Plastic Foam Joint-Fillers: Preformed, compressible, resilient, non-waxing, non-extruding strips of plastic foam of material and size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance. Provide either flexible, open cell polyurethane foam or non-gasing, closed-cell polyethylene foam, unless otherwise indicated, subject to approval of sealant manufacturer.

2.05 MISCELLANEOUS MATERIALS

A. Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealer-substrate and field tests.

B. Cleaners for Nonporous Surfaces: Provide non-staining, chemical cleaner of type acceptable to manufacturer of sealant and sealant backing materials which are not harmful to substrates and adjacent nonporous materials.

C. Masking Tape: Provide non-staining, non-absorbent type compatible with joint sealants and to surfaces adjacent to joints.

PART 3 – EXECUTION

3.01 INSPECTION

A. Require Installer to inspect joints indicated to receive joint sealers for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealer performance.

B. Obtain Installer's written report listing any conditions detrimental to performance of joint sealer work.

C. Do not allow joint sealer work to proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:

1. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust; paints, except for permanent protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; oil; grease; waterproofing; water repellants; water; surface dirt and frost.

2. Clean concrete, masonry and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, acid washing or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

3. Remove latence and form release agents from concrete.

4. Clean metal and other non-porous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers.

B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealer manufacturer based on preconstruction joint sealer-substrate tests or prior experience. Apply primer to comply with joint sealer manufacturer's recommendations. Confine primers to areas of joint sealer bond, do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALERS

A. General: Comply with joint sealer manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Elastomeric Sealant Installation Standard: Comply with recommendations of ASTM C 962 for use of joint sealants as applicable to materials, applications and conditions indicated.

C. Latex Sealant Installation Standard: Comply with requirements of ASTM C 790 for use of latex sealants.

D. Installation of Sealant Backings: Install sealant backings to support sealants during application and at position required to produce optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.

2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Install joint-fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths which allow optimum sealant movement capability. Do not leave gaps between ends of joint-fillers. Do not stretch, twist, puncture or tear joint-fillers. Remove absorbent joint-fillers which have become wet prior to sealant application and replace with dry material.

F. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.

G. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning of curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer. Provide concave joint configuration per Figure 6A in ASTM C 962, unless otherwise indicated.

3.04 PROTECTION AND CLEANING

A. Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of substantial completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealers immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work.

B. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.

END OF SECTION

SECTION 09961

HIGH PERFORMANCE PAINTS AND COATINGS - WASTEWATER

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment and services for furnishing and installing the finishes as indicated on drawings and schedules, and as herein specified.

B. Work includes painting and finishing of interior and exterior exposed items and surfaces throughout project, except as otherwise indicated. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of work.

C. Work includes field painting of exposed bare and covered pipes and ducts (including color coding), and of hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under mechanical and electrical work, except as otherwise indicated. In addition, the Contractor shall provide for the use of deep tone colors to be applied in selected areas as wall graphics, stripes and visual accents. The areas and colors shall be selected by the Architect-Engineer and shall not exceed 15% of the total wall surface area to be painted.

D. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

E. Surfaces to be Painted: Except where natural finish of material is specifically noted as a surface not to be painted, paint exposed surfaces whether or not colors are designated in "schedules". Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas. If color or finish is not designated, Architect-Engineer will select these from standard colors or finishes available.

F. Following categories of work are not included as part of field- applied finish work.

1. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing or installer-finishing is specified for such items as (but not limited to) toilet enclosures, prefinished partition systems, acoustic materials, architectural woodwork and casework, and finish mechanical and electrical equipment, including light fixtures, switchgear, and distribution cabinets.

2. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, furred areas, pipe spaces, and duct shafts.

3. Finished Metal Surfaces: Unless otherwise indicated, metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting.

4. Operating Parts: Unless otherwise indicated, moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting.

G. Following categories of work are included under other sections of these specifications.

1. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, metal fabrications, hollow metal work and similar items.

2. Unless otherwise specified, shop priming of fabricated components such as architectural woodwork, wood casework and shop-fabricated or factory-built mechanical and electrical equipment or accessories is included under other sections of these Specifications.

H. Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

I. PVC plastic process piping shall not be painted, but shall be stenciled and labeled or tagged for identification surfaces. Each type of process piping using PVC pipe shall be installed using the same color pipe.

J. Repainting of existing structures, tanks, piping, and all other existing items shall not be part of this Contract unless otherwise noted or altered by this work. Areas that have been directly altered or damaged by construction shall be repainted to match existing conditions using the appropriate painting system. Repainting shall include the entire length of a system including piping, equipment, and accessories. Walls and structural items altered shall be painted for their entire length and height.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to Work of this Section.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical information including paint label analysis and application instructions for each material proposed for use. Provide MSDS sheets for each item submitted.

B. Samples: Prior to beginning work, submit color chips for surfaces to be painted. Use representative colors when preparing samples for review. Submit samples for Architect-

Engineer's review of color and texture only. Provide a listing of material and application for each coat of each finish sample.

1.04 QUALITY ASSURANCE

A. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

B. Coordination of Work: Review other sections of these Specifications in which prime paints are to be provided to ensure compatibility of total coatings systems for various substrates. Upon request from other trades, furnish information or characteristics of finish materials provided for use, to ensure compatible prime coats are used.

1.05 DELIVERY AND STORAGE

A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:

1. Name or title of material.
2. Fed. Spec. number, if applicable.
3. Manufacturer's stock number, batch number, and date of manufacturer.
4. Manufacturer's name.
5. Contents by volume, for major pigment and vehicle constituents.
6. Thinning instructions.
7. Application instructions.
8. Color name and number.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage of paint in a clean condition, free of foreign materials and residue. Protect from freezing where necessary. Keep storage area neat and orderly. Remove oily rags and waste daily. Take all precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of paints.

1.06 JOB CONDITIONS

A. Apply water-base paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees F (10 degrees C) and 90 degrees F (32 degrees C), unless otherwise permitted or restricted by paint manufacturer's printed instructions.

B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F (7 degrees C) and 95 degrees F (35 degrees C), unless otherwise permitted or restricted by paint manufacturer's printed instructions.

C. Do not apply paint in snow, rain, fog or mist, or when relative humidity exceeds 85%, or to damp or wet surfaces, unless otherwise permitted or restricted by paint manufacturer's printed instructions. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.

D. Paint only when the surface temperature is at least 5 degrees F above the dew point, unless otherwise permitted by paint manufacturer's printed instructions.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Tnemec Company, Inc. (Tnemec)
2. The Sherwin-Williams Company
3. Carboline

2.02 MATERIALS

A. Material Quality: Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable.

B. Proprietary names used to designate colors or materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products of other manufacturers.

C. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.

1. Lead content in pigment, if any, is limited to contain not more than 0.06% lead, as lead metal based on the total non-volatile (dry-film) of paint by weight.

PART 3 – EXECUTION

3.01 INSPECTION

A. Applicator must examine areas and conditions under which painting work is to be applied and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Applicator and coating manufacturer.

B. Starting of painting work will be construed as acceptance of surfaces and conditions within any particular area.

C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

3.02 SURFACE PREPARATION

A. General: Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.

1. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify Architect-Architect-Engineer in writing of any anticipated problems in using the specified coating systems with substrates primed by others.

2. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.

3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning per SSPC SP-1. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.

4. Abrasives for blasting shall be sharp, washed, salt free, angular, and free from feldspar or other constituents that tend to breakdown and remain on the surface.

5. Concrete floors shall be dry as indicated by testing in accordance with ASTM D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

B. Cementitious Materials: Per ASTM D4261, Standard Practice for Surface Cleaning Concrete Unit Masonry for Coating, prepare cementitious surfaces of concrete block to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze. Per ASTM D4262, Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces, determine alkalinity of surfaces to be painted by

performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Test the surface for moisture and do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions. Concrete surfaces shall be prepared in accordance with SSPC-13 – Concrete Surface Preparation. Prepare concrete to remove contaminants, open bugholes, surface voids, air pockets, and other subsurface irregularities. Do not expose underlying aggregate. Use dry, oil-free air for blasting operations. Surface texture after blasting shall be similar to that of medium grit sandpaper. Remove residual abrasives, dust, and loose particles by vacuuming or blowing with high pressure air.

C. Wood: Clean wood surfaces to be painted of dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.

   1. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, paneling.

   2. When transparent finish is required, use spar varnish for backpriming.

D. Ferrous Metals: Clean ferrous surfaces, which are not galvanized or shop-coated, of oil, grease, dirt, and other foreign substances by solvent cleaning per SSPC SP-1. Mechanical cleaning shall be in accordance with SSPC-SP6 Commercial Blast Cleaning specifications for non-immersion surfaces and SSPC-SP10 Near White Metal Blast Cleaning for immersion in potable or non-potable water.

E. Galvanized Surfaces: Clean free of oil and surface contaminants with non-petroleum based solvent cleaners such as Clean 'N' Etch or equivalent.

F. Shop Primed Surfaces: Prepare shop-applied prime coats wherever damaged or bare as required by other sections of these Specifications. Clean and touch-up with same type shop primer.

3.03 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer's directions.

B. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.

C. Stir materials before application to produce a mixture of uniform density, and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3.04 APPLICATION

A. General: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Painting requirements, surface treatments, and finishes, are indicated in "schedules" of the contract documents and as noted in Paragraph 3.11 hereinafter.

2. Provide finish coats which are compatible with prime paints used.

3. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to insure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

4. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently- fixed equipment or furniture with prime coat only before final installation of equipment.

5. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.

6. Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.

7. Finish exterior doors on tops, bottoms and side edges same as exterior faces, unless otherwise indicated.

8. Sand lightly between each succeeding enamel or varnish coat.

9. Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise indicated.

B. Scheduling Painting: Apply first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness (DFT) as indicated or, if not indicated, as recommended by coating manufacturer. Coatings to be in immersion or a severe environment shall be tested for dry film thickness. Testing shall be accomplished by methods recommended by coating manufacturer. Record DFT for each 100 square feet of surface area using the average of three readings within each 100

square feet. Additional coats of paint shall be applied where minimum DFT is not achieved.

D. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to those items exposed in mechanical equipment rooms and in occupied spaces.

1. Mechanical items to be painted include, but are not limited to, the following:

a. Piping, pipe hangers, supplementary steel and supports except galvanized surfaces.

b. Heat exchangers.

c. Tanks.

d. Ductwork, insulation.

e. Motor, mechanical equipment, and supports.

f. Accessory items.

2. Electrical items to be painted include, but are not limited to, the following:

a. Conduits and fittings except galvanized surfaces.

b. Switchgear.

c. Hanger and support except galvanized surfaces.

E. Prime Coats: Apply prime coat of material which is required to be painted or finished, and which has not been prime coated by others. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn- through or other defects due to insufficient sealing.

F. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable. Holiday test coated steel in immersion areas in accordance with NACE International SP 0188-90.

G. Transparent (Clear) Finishes: Use multiple coats to produce glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections. Provide satin finish for final coats, unless otherwise indicated.

H. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

3.05 FIELD QUALITY CONTROL

A. The right is reserved by Owner to invoke the following material testing procedure at any time, and any number of times during period of field painting:

1. The Owner's Resident Project Representative shall check paint film thickness with an approved paint mil thickness tester.

2. Engage services of an independent testing laboratory to sample paint being used. Samples of materials delivered to project site will be taken, identified and sealed, and certified in presence of Contractor.

3. Testing laboratory will perform appropriate tests for any or all of following characteristics: Abrasion resistance, apparent reflectivity, flexibility, washability, absorption, accelerated weathering, dry opacity, accelerated yellowness, recoating, skinning, color retention, alkali resistance and quantitative materials analysis.

B. If test results show that material being used does not comply with specified requirements, Contractor may be directed to stop painting work, and remove non-complying paint; pay for testing; repaint surfaces coated with rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are non-compatible.

3.06 CLEAN-UP AND PROTECTION

A. Clean-Up: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day.

B. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

C. Protection: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect-Architect-Engineer. Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations. At completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

3.07 PAINTING SYSTEMS

Product names and numbers are based on Tnemec products.

A. Ferrous Metals - Structural, Tanks, Pipes and Equipment

1. Exterior, Non-Immersion

		Dry Mils
Sur. Prep.:	SSPC-SP6 Commercial Blast Cleaning	
1st Coat:	1 Series 1 Omnithane	2.5 - 3.5
2nd Coat:	N 69 High-Build Epoxoline II	2.0 - 3.0
3rd Coat:	1074- Endura-Shield	2.0 - 3.0
1st Coat:	Corothane I Galvapac	2.5 - 3.5
2nd Coat:	Macropoxy 646 FC	2.0 - 3.0
3rd Coat:	HS Polyurethane	2.0 - 3.0

2. Interior, Non-Immersion

Sur. Prep.: SSPC-SP6 Commercial Blast Cleaning	
1st Coat: 1 Series 1 Omnithane	2.5 - 3.5
2nd Coat: N 69 High-Build Epoxoline II	4.0 - 6.0
Finish Coat: N 69 High-Build Epoxoline II	2.0 - 3.0
1st Coat: Corothane I Galvapac	2.5 - 3.5
2nd Coat: Macropoxy 646 FC	4.0 - 6.0
3rd Coat: Macropoxy 646 FC	2.0 - 3.0

3. Immersion, Non-Potable Water

Sur. Prep.: SSPC-SP10 Near-White Blast Cleaning	
1st Coat: 1 Series 1 Omnithane	2.5 - 3.5
2nd Coat: N 69 High-Build Epoxoline II	4.0 - 6.0
3rd Coat: N 69 High-Build Epoxoline II	4.0 - 6.0
1st Coat: Corothane I Galvapac	2.5 - 3.5
2nd Coat: Macropoxy 646 FC / SherGlass FF	4.0 - 6.0
3rd Coat: Macropoxy 646 FC / SherGlass FF	4.0 - 6.0

4. Factory Primed Interior (Refer to Piping Specifications)

Sur. Prep.: Surface shall be clean and dry	
Int. Coat: N 69 High-Build Epoxoline II	2.0 - 3.0
Finish Coat: N 69 High-Build Epoxoline II	2.0 - 3.0
2nd Coat: Macropoxy 646 FC	2.0 - 3.0
3rd Coat: Macropoxy 646 FC	2.0 - 3.0

5. Factory Primed, Exterior (Refer to Piping Specifications)

Sur. Prep.: Surface shall be clean and dry	
1st Coat: N69 Epoxoline II	4.0 – 6.0
2nd Coat: 1074- Endura-Shield	2.0 - 3.0
1st Coat: Macropoxy 646 FC	4.0 - 6.0
2nd Coat: HS Polyurethane	2.0 - 3.0

6. Primed Steel (Doors, Frames, etc.)

Touch up: 1 Series 1 Omnithane	
1st Coat: N 69 High-Build Epoxoline II	2.0 - 3.0
2nd Coat: N 69 High-Build Epoxoline II	2.0 - 3.0
Touch up: Corothane I Galvapac	
1st Coat: Macropoxy 646 FC	2.0 - 3.0
2nd Coat: Macropoxy 646 FC	2.0 - 3.0

7. Hydrogen Sulfide Exposed

Sur. Prep: SSPC-SP5	
1st Coat: 435 Perma-Glaze	15.0 - 20.0
2nd Coat: 435 Perma-Glaze	15.0 - 20.0
1st Coat: Dura-Plate 5900	15.0 - 20.0
2nd Coat: Dura-Plate 5900	15.0 - 20.0

B. Galvanized Steel - Pipe and Miscellaneous Fabrications

1. Exterior, Non-Immersion

Sur. Prep.: SSPC-SP1 Solvent Cleaning and Etch

1st Coat: N69 Epoxoline II	2.0 - 3.0
2nd Coat: 1074-Color Endura-Shield	2.0 - 3.0
1st Coat: Macropoxy 646 FC	2.0 - 3.0
2nd Coat: HS Polyurethane	2.0 - 3.0

2. Interior, Non-Immersion (Doors, Frames, etc.)

Sur. Prep.: SSPC-SP1 Solvent Cleaning and Etch

One Coat: N69 Epoxoline II	2.0 - 3.0
2nd Coat: N 69 High-Build Epoxoline II	2.0 - 3.0
1st Coat: Macropoxy 646 FC	2.0 - 3.0
2nd Coat: Macropoxy 646 FC	2.0 - 3.0

3. Immersion, Non-Potable Water

Sur. Prep.: SSPC-SP1 Solvent Cleaning followed by abrasive blast (SSPC-SP 16)

1st Coat: N69 Epoxoline II	3.0 - 5.0
2nd Coat: N69 Epoxoline II	4.0 - 6.0
1st Coat: Macropoxy 646 FC / SherGlass FF	3.0 - 5.0
2nd Coat: Macropoxy 646 FC / SherGlass FF	4.0 - 6.0

C. Porous Masonry - Concrete Masonry Units

1. Interior

Sur. Prep.: Surface shall be clean and dry

1st Coat: 130 Envirofill	80 - 100 sf/gal.
(Spray & Back Roll to Fill Porosity)	
2nd Coat: 84 Ceramlon ENV	4.0 - 6.0

3rd Coat: 84 Ceramlon ENV	4.0 - 6.0

1st Coat: Cement Plex 875	80 - 100 sf/gal.
(Spray & Back Roll to Fill Porosity)	
2nd Coat: ProIndustrial HD Epoxy	4.0 - 6.0
3rd Coat: ProIndustrial HD Epoxy	4.0 - 6.0

D. Cast-In-Place and Precast Concrete

1. Concrete Walls & Precast Concrete Ceilings (Interior)

Sur. Prep.: Abrasive Blast (SSPC-SP13) Fill bugholes and voids with coating manufacturer's epoxy filler.

1st Coat: N69 Epoxoline II	4.0 - 6.0
2nd Coat: N69 Epoxoline II	4.0 - 6.0

1st Coat: Macropoxy 646 FC	4.0 - 6.0
2nd Coat: Macropoxy 646 FC	4.0 - 6.0

2. Concrete Walls, Tanks and Basins (Exterior, Exposed) – Engineer to decide

3. Concrete Floors (Interior, Heavy Traffic and Chemical Exposure)

Sur. Prep.: SSPC-SP 13/NACE 6 – Degrease and chemical etch with muriatic acid

1st Coat: H&C Colortop Water Based Concrete Stain

2nd Coat: H&C Colortop Water Based Concrete Stain

Primer: SW GP 3561	1/8 inch
1st Coat: SW GP 3746	6.0 – 8.0
2nd Coat: SW GP 4638	2.0 – 3.0

4. Concrete Tanks & Basins (Immersion and Exposed, Interior) – Engineer to decide

5. Chemical Containment Areas

Sur. Prep.: Abrasive Blast (SSPC-SP13, Severe Service) Fill bugholes and voids with recommended coating manufacturer's epoxy filler.

1st Coat: 201 Epoxoprime	6.0 - 8.0
2nd Coat: 275 Stranlock	25.0 – 40.0
Finish Coat: 282 Tneme-Glaze	8.0 – 12.0

1st Coat: Corobond 100 Primer	6.0 - 8.0
2nd Coat: CorCote HCR FF	15.0 – 20.0
Finish Coat: CorCote HCR	8.0 – 12.0

6. Concrete Tanks and Basins (Below Grade) – Engineer to decide

E. Wood

Interior or Exterior

Sur. Prep.: Surface shall be clean and dry

1st Coat: 151-1051 Elasto-Grip FC	1.0 - 1.5
2nd Coat: 29 Tufcryl	2.0 - 3.0 - 3.5
3rd Coat: 29 Tufcryl	2.0 - 3.0

1st Coat: Premium Wall & Wood Primer	1.0 - 1.5
2nd Coat: ProClassic WB	2.0 - 3.0 - 3.5
3rd Coat: ProClassic WB	2.0 - 3.0

F. Insulated Pipe

Sur. Prep.: Surface shall be clean and dry

1st Coat: 6-Color Tneme-Cryl	2.0 - 3.0
2nd Coat: 6-Color Tneme-Cryl	2.0 - 3.0

1st Coat: DTM Primer / Finish	2.0 - 3.0
2nd Coat: DTM Primer / Finish	2.0 - 3.0

G. Gypsum Board

1. Interior Drywall - Architectural

Sur. Prep.: Surface shall be clean and dry

1st Coat: 151-1051 Elasto-Grip FC	1.0 - 1.5
2nd Coat: 6-Color Tneme-Cryl	2.0 - 3.0
1st Coat: ProMar 200 0 VOC Primer	1.0 - 1.5
2nd Coat: DTM Primer / Finish	2.0 - 3.0

2. Interior Drywall - Severe Exposure

Sur. Prep.: Surface shall be clean and dry	
Prime Coat: 151-1051 Elasto-Grip FC	1.0 - 1.5
1st Coat: 113 H.B. Tneme-Tufcoat	2.0 - 3.0
2nd Coat: 113 H.B. Tneme-Tufcoat	2.0 - 3.0
Prime Coat: ProMar 200 0 VOC Primer	1.0 - 1.5
1st Coat: ProIndustrial WB Epoxy, B73 Series	2.0 - 3.0
2nd Coat: ProIndustrial WB Epoxy, B73 Series	2.0 - 3.0

H. PVC Piping – Engineer to decide

I. Aluminum Windows, Doors, Handrails & Grating – Engineer to decide

J. Fiberglass Reinforced Plastic Doors & Windows – Engineer to decide

3.08 PIPING COLOR CODE

To facilitate identification of piping in plants and pumping stations it is recommended that the following color scheme be utilized:

WATER LINES	
Raw Water	Olive Green
Settled Water	Light Blue
Filtered or Finished Water	Dark Blue

CHEMICAL LINES	
Acid	Red
Ammonia	White
Caustic	Yellow w/ green band

Chlorine	Yellow
Coagulant	Orange
Fluoride	Light Blue w/ red band
Polymer	Orange w/ green band

WASTE LINES	
Overflow (Backwash waste)	Light Brown
Sewer (Sanitary or Other)	Dark Gray

OTHER	
Compressed Air	Dark Green
Other Lines	Light Gray

3.09 STENCILING

A. The Contractor shall supply all materials and labor necessary for stenciling of legends on pipes. The legend shall show the name of the contents. Review by the Architect-Engineer of legends will be required. Names shall be "plainly visible". Arrows showing direction of flow shall also be stenciled on pipes. The legends shall be located not more than 10 feet apart and, in general, at each valve and piece of equipment. The size and location of the legend shall be in general accordance with ANSI A13.1-1981 "Scheme for the Identification of Piping Systems". All visible piping 6" in diameter and larger shall be color-coded and stenciled. "Stick-on" labels are not acceptable.

3.10 PLASTIC IDENTIFICATION MARKERS

A. All visible piping 3/4" and greater and less than 6" which is accessible for maintenance operations shall be color-coded and identified with semi-rigid plastic identification markers equal to SETMARK Pipe Markers as manufactured by Seton Name Plate Corporation, New Haven, Conn.; T & B/Westline, Los Angeles, California; or equal. Direction of flow arrows are to be included on each marker, unless otherwise specified.

B. Each marker background is to be appropriately color coded with a clearly printed legend to identify the contents of the pipe in conformance with the "Scheme for the Identification of Piping Systems" (ANSI A 13.1 - 1981).

C. For pipes under 3/4" O.D. (too small for color bands and legends), brass identification tags 1-1/2" in diameter with depressed 1/4" high black-filled letters above 1/3" blackfilled numbers shall be fastened securely at specified locations.

D. All electrical conduits, which are accessible for maintenance operations, shall be identified with semi-rigid identification markers similar to those specified above.

E. Each marker background is to be color-coded with a clearly printed legend to identify the conductor. Size of markers and sizes of lettering to generally conform with the "Scheme for Identification of Piping Systems" (ANSI A 13.1 - 1981)

F. Locations for pipe and electrical markers to be as follows:

1. Adjacent to each valve and fitting (except on plumbing fixtures and equipment).
2. Each branch and riser take-off.
3. Each pipe passage through wall, floor and ceiling construction.
4. Each pipe passage to underground.
5. All horizontal pipe runs-marked every 25 feet.

END OF SECTION

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SECTION 11290
INTERIOR PROCESS PIPING

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to furnish and install all plant process piping as shown on the Drawings and specified herein.

B. This specification applies to all interior process piping and above ground piping installed as part of the odor control system. Any above ground piping included as part of the odor control system shall be rated for service outside.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Interior Process Valves: Section 11295

B. Valves: Section 02515

C. Piping furnished with equipment is included in the specific equipment item.

1.03 SUBMITTALS

A. The Contractor shall comply with the requirements of Section 01300 of these specifications.

B. A notarized certification shall be furnished for all pipe and fittings which verifies compliance with all applicable specifications.

PART 2 – PRODUCTS

2.01 DUCTILE IRON PIPE/DUCTILE IRON FITTINGS

A. Flanged ductile iron pipe shall conform to the latest revisions of ANSI/AWWA C115/A 21.15. Bolt pattern of flange shall be in accordance with ANSI/AWWA C115/A 21.15 (which is equivalent to ASME/ANSI B16.1, Class 125 flange bolt pattern). Pipe shall have pressure class 250 rating. Gaskets shall be synthetic rubber ring gaskets with a thickness of 1/8 inch. Nuts and bolts shall be in accordance with ASME/ANSI B18.2.1, ASME/ANSI B18.2.2, ASME/ANSI B1.1, and ASTM A307

Flanged fittings shall conform to the latest revisions of ANSI/AWWA C110/A 21.10 or ANSI/AWWA C153/A 21.53 (compact fittings). Gaskets shall be in accordance with ANSI/AWWA C111/A 21.11. Fittings shall have pressure class rating of 250 psi. Bolt pattern of flange shall be in accordance with ANSI/AWWA C115/A 21.15 (which is equivalent to ASME/ANSI B16.1, class 125 flange bolt pattern).

B. All exposed iron pipe to be field painted shall be furnished with an external coating of rust inhibitive primer, such as Tnemec Series 1 OmniThane, Sherwin-Williams Corothane I GalvaPac, or equal. Pipe manufacturer shall be responsible for compatibility of shop applied coatings with the field paint systems and products specified in Division 9, Section 09961. Do not apply asphalt or bituminous coatings on pipe to be painted.

C. Protecto 401 Ceramic Epoxy Interior Lining

1. Condition of ductile iron prior to surface preparation

All ductile pipe and fittings shall be delivered to the application facility without asphalt, cement lining, or any other lining on the interior surface. Because removal of old linings may not be possible, the intent of this specification is that the entire interior of the ductile iron pipe and fittings shall not have been lined with any substance prior to the application of the specified lining material and no coating shall have been applied to the first six inches of the exterior of the spigot ends.

2. Lining Material

The standard of quality is Protecto 401™ Ceramic Epoxy. The material shall be an amine cured novolac epoxy containing at least 20% by volume of ceramic quartz pigment. Any request for substitution must be accompanied by a successful history of lining pipe and fittings for sewer service, a test report verifying the following properties, and a certification of the test results.

a. A permeability rating of 0.00 when tested according to Method A of ASTM E-96-66, Procedure A with a test duration of 30 days.

b. The following test must be run on coupons from factory lined ductile iron pipe:

1) ASTM B-117 Salt Spray (scribed panel) - Results to equal 0.0 undercutting after two years.

2) ASTM G-95 Cathodic Disbondment 1.5 volts @ 77°F. Results to equal no more than 0.5 mm undercutting after 30 days.

3) Immersion testing rated using ASTM D-714-87.

a) 20% Sulfuric acid—No effect after two years.

b) 140°F 25% Sodium Hydroxide—No effect after two years.

c) 160°F Distilled Water—No effect after two years.

d) 120°F Tap Water (scribed panel)—0.0 undercutting after two years with no effect.

4) ASTM G-22 90 Standard practice for determining resistance of Synthetic Polymeric materials to bacteria. The test should determine the resistance to growth of Acidithiobacillus Bacteria and should be conducted at 30 degrees centigrade for a period of 7 days on a minimum of 4 panels. The growth must be limited only to trace amounts of bacteria.

c. An abrasion resistance of no more than 3 mils (.075 mm) loss after one million cycles using European Standard EN 598: 1994 Section 7.8 Abrasion Resistance.

3. Application

a. Applicator

The lining shall be applied by a certified firm with a successful history of applying linings to the interior of ductile iron pipe and fittings.

b. Surface Preparation

Prior to abrasive blasting, the entire area to receive the protective any substance that can be removed by solvent, shall be solvent cleaned to remove those substances. After the surface has been made free of grease, oil or other substances, all areas to receive the protective compounds shall be abrasive blasted using sand or grit abrasive media. The entire surface to be lined shall be struck with the blast media so that all rust, loose oxides, etc., are removed from the surface. Only slight stains and tightly adhering oxide may be left on the surface. Any area where rust reappears before lining must be re-blasted.

c. Lining

After surface preparation and within 12 hours of surface preparation, the interior of the pipe shall receive 40 mils nominal dry film thickness. No lining shall take place when the substrate or ambient temperature is below 40°F. The surface also must be dry and dust free. If flange pipe or fittings are included in the project, the lining shall not be used on the face of the flange.

d. Coating of Bell Sockets and Spigot Ends

Due to the tolerances involved, the gasket area and spigot end up to 6 inches back from the end of the spigot end must be coated with 6 mils nominal, 10 mils maximum using Protecto 401™ Joint Compound. The Joint Compound shall be applied by brush to ensure coverage. Care should be taken that the Joint Compound is smooth without excess buildup in the gasket seat or on the spigot ends. Coating of the gasket seat and spigot ends shall be done after the application of the lining.

e. Number of Coats

The number of coats of lining material applied shall be as recommended by the lining manufacturer. However, in no case shall this material be applied above the dry thickness per coat recommended by the lining manufacturer in printed literature. The maximum or minimum time between coats shall be that time recommended by the lining material manufacturer. To prevent delamination between coats, no material shall be used for lining which is not indefinitely recoatable with itself without roughening of the surface.

f. Touch-Up and Repair

Protecto 401™ Joint Compound shall be used for touch-up or repair in accordance with manufacturer's recommendations.

4. Inspection and Certification

a. Inspection

All ductile iron pipe and fitting linings shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC PA-2 Film Thickness Rating.

The interior lining of all pipe barrels and fittings shall be tested for pinholes with a non-destructive 2,500 volt test. Any defects found shall be repaired prior to shipment.

Each pipe joint and fitting shall be marked with the date of application of the lining system along with its numerical sequence of application on that date and records maintained by the applicator of his work.

b. Certification

The pipe or fitting manufacturer must supply a certificate attesting to the fact that the applicator met the requirements of this specification, and that the material used was as specified.

5. Handling

Lined pipe and fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. shall be placed inside the pipe and fittings for lifting, positioning, or laying. The pipe shall not be dropped or unloaded by rolling.

Care should be taken not to let the pipe strike sharp objects while swinging or being off loaded. Ductile iron pipe should never be placed on grade by use of hydraulic pressure from an excavator bucket or by banging with heavy hammers.

D. Ductile iron fittings shall conform to AWWA C 110 with flanges faced and drilled 125-pound. Fittings shall have interior lining and exterior coating same as the pipe.

2.02 POLYVINYL CHLORIDE (PVC) PLASTIC PRESSURE PIPE

A. PVC Pressure Pipe, 3" and Smaller: Polyvinyl chloride plastic pipe shall be ASTM D 1785 Schedule 80 or F441 CPVC, Schedule 80 with solvent weld joints. Fittings shall be ASTM D 2467 Schedule 80 socket type. All socket type connections shall be made with PVC solvent cement complying with ASTM D 2564 PVC solvent cement shall be furnished from the same supplier as the PVC pipe. Provide socket-threaded adapters for connection to threaded appurtenances where required.

2.03 WALL PIPE AND SLEEVES

A. All wall pipe shall be furnished with cast or welded collar water stops in the positions shown on the Drawings. Welding of water stop collars on pipe shall be accomplished by the wall pipe manufacturer in their shop. All centrifugally cast wall pipe shall be ductile iron meeting the requirements of AWWA C151 for the pipe barrel, conforming to the pressure rating of the pipeline in which installed, and in no case be lighter than Class 53.

B. All statically cast wall pipe shall be ductile iron meeting the requirements of AWWA C110 for fittings. Mechanical joint end and cast-on flange end wall pipe shall conform to AWWA C110 and welded flange wall pipe shall conform to AWWA C115. Where flanged or mechanical joint bell ends are flush with the wall, they shall be drilled and tapped for stud bolts which are to be of 300 Series stainless steel.

C. The length of all wall pipe shall be not less than the thickness of the wall in which installed. Wall pipe shall have the same pressure rating as connecting pipe. All wall pipe shall be AWWA C401 lined. The outside of wall pipes shall be left uncoated and shall be field primed for painting on the portion exposed, uncoated where embedded and field coated with standard bituminous coated where buried.

D. Contractor may have the option to install wall pipe flush face-to-face of wall in lieu of the dimensioned length wall pipe shown on the Drawings, in order to eliminate form penetrations. This option will be subject to Engineer`s review at each wall pipe location and covers both flanged and mechanical-joint bell-end wall pipe. Embedded flanged and MJ bell-end bolt holes shall be tapped for stud bolts; tapped bolt holes in embedded flanges shall be plugged for protection during concrete pouring.

E. All pipe wall sleeves shall be plain end galvanized steel pipe of diameter noted on Drawings and length to fit flush face-to-face of wall.

2.04 INTERLOCKING LINK PIPE SEALS

A. In all locations indicated on the Drawings, interlocking link pipe seals shall be used. Seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall sleeve. Links

shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide an absolutely water-tight seal between the pipe and wall sleeve. Seals shall be "Link-Seal" as manufactured by Thunderline Corporation, Wayne, Michigan, or approved equal.

B. The Contractor shall determine the required diameter of each individual wall opening according to the manufacturer's recommendations before ordering and installing the seal. Pipe shall be accurately centered in the sleeve and the link seals shall be sized, installed and tightened in accordance with the manufacturer's instructions.

2.05 COUPLINGS AND ADAPTERS

A. Flexible couplings shall be of the sleeve type with a middle ring, two round-wedge shaped rubber gaskets at each end, two following rings together and compress the gasket against the pipe. Flexible couplings shall be steel with minimum wall thickness of the middle ring or sleeve installed on pipe being 5/16-inch for pipe smaller than 10 inches, 3/8-inch for pipe 10 inches or larger. The minimum length of the middle ring shall be 5-inches for pipe sizes up to 10 inches and 7 inches for pipe 10 inches to 30 inches. The pipe stop shall be removed. Gaskets shall be suitable for 250 psi pressure rating or at rated working pressure of the connecting pipe. Couplings shall be harnessed and be designed for 250 psi.

B. Flanged adapters shall have one end suitable for bolting to a pipe flange and the other end of flexible coupling similar to that described hereinbefore. All pressure piping with couplings or adapters shall be harnessed with full threaded rods spanning across the couplings or adapters. The adapters shall be furnished with bolts of an approved corrosion resistant steel alloy, extending to the adjacent pipe flanges. Flanges on flanged adapter (unless otherwise indicated or required) shall be faced and drilled ANSI B16.1 Class 125.

C. Flexible couplings and flanged adapters shall be as manufactured by Dresser, Rockwell, or equal, per the following, unless otherwise specified and/or noted on the Drawings:

1. Steel couplings for joining same size, plain-end, steel, cast iron, and PVC plastic pipe -

Dresser	Smith-Blair
Style 253 (2"-15")	4ll
Style 38/138 (18" & above)	

2.

3. Transition couplings for joining pipe of different outside diameters-

Dresser	Smith-Blair
Style 162 (4"-12")	413 steel (2"-24")
Style 62 (2"-24")	415 steel (6"-48")
	433 cast (2"-16")
	435 cast (2"-12")

4. Flanged adapters for joining plain-end pipe to flanged pipe, fittings, valves and equipment.

Dresser	Smith-Blair
Style 227 cast (3"-12")	912 cast (3"-12")
Style 128 steel (3"-48" D.I. Pipe)	913 steel (3"-24" D.I. Pipe)
Style 128 steel (2"-96" steel pipe)	

2.06 FLANGED JOINTS

A. Flange bolts and nuts shall be ASTM A 307, Grade B and shall have hexagonal heads. All bolts, nuts and studs for flanged pipe in submerged locations shall be of 300 Series stainless steel. The flanges shall be drawn together until the joint is perfectly tight, with bolts of a length such that they will not project greater than 1/4-inch from the nut nor fall short of the end of the nut when drawn up. No washers shall be used. Gaskets shall be carefully fabricated prior to installation and must be suitable for pressure rating for the pipe for which it is used.

B. All flanges (unless otherwise indicated or required) shall be faced and drilled ANSI B16.1 125-pound for ductile iron and ANSI B16.5 150-pound for steel.

C. At the Contractor's option, and at no additional expense to the Owner, the following patented SBR flange gaskets or approved equal may be substituted for standard sheet packing ring gaskets in ductile iron flanged pipe:

1. TORUSEAL by American Cast Iron Pipe Company

2. FLANGE-TYTE by United States Pipe & Foundry Company

When using such gaskets, flange bolts shall be torqued to manufacturer's recommended torque values.

PART 3 – EXECUTION

3.01 INSTALLATION OF PIPING

A. Materials shall be new and of the best grade and quality; workmanship shall be first class in every respect.

B. Each piece of iron pipe and each fitting shall be plainly marked at the foundry with class number and weight.

C. Where indicated on the Drawings, plain-end pipe shall be joined by means of flanged adapters or flexible couplings which shall be Rockwell, Dresser, or equal.

D. All pipe couplings shall be designed to safely withstand the operating pressure of the lines in which they are installed. All couplings shall be shop primed with an approved rust inhibitive primer.

E. Taps and connections to piping shall be made as required to connect equipment, sample lines, etc., and where otherwise shown on the Drawings.

F. Piping shall be installed straight and true, parallel or perpendicular to walls, with approved offsets around obstructions. Standard pipe fittings shall be used for changing direction of piping. No mitered joints or field fabricated pipe bends are permitted unless accepted by the Engineer.

G. All piping, fittings, valves and other accessories shall be thoroughly cleaned of dirt, chips and foreign matter before joint connections are made.

H. All plastic pipe shall be adequately supported and braced. Support spacing shall not exceed the recommendations of the Plastics Pipe Institute.

I. Teflon tape shall be used on all plastic pipe threaded connections.

J. Field cut male threads on plastic pipe shall be made with plastic pipe threading dies.

K. The annular interior space of plain wall sleeves shall be grouted flush to wall face with non-staining nonshrink grout, Masterflow 713 by Master Builders, Sonogrout by Sonneborn-Contech, or equal.

L. All pipe sleeves passing through walls or floors of chlorine feed and storage areas shall be provided with gas tight seals.

M. All pipe threads shall conform to ANSI B2.1.

N. Piping shall be erected to provide for expansion and contraction.

O. Screwed or soldered unions shall be provided in all small piping as required to permit convenient removal of equipment, valves and piping accessories from the piping system.

P. Dielectric insulating couplings or brass adapters shall be used whenever the adjoining materials being connected are of dissimilar material such as connections between copper tubing and steel pipe.

Q. All inside piping shall be color coded, stenciled and label tagged for identification as specified in Division 9.

END OF SECTION

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SECTION 11295
INTERIOR PROCESS VALVES

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to furnish and install all new valves as shown on the Drawings and/or specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Interior Process Piping: Section 11290

B. Valves furnished with equipment are included with equipment specifications.

1.03 SUBMITTALS

A. Descriptive literature, catalog cuts, and dimensional prints clearly indicating all dimensions and materials of construction, shall be submitted on all items specified herein to the Engineer for review before ordering. Comply with provisions of Section 01300.

B. At the time of submission, the Contractor shall, in writing, call Engineer's attention to any deviations that the submittals may have from the requirements of the Engineer's Contract Drawings and Specifications.

PART 2 – PRODUCTS

2.01 PLUG VALVES

A. All plug valves shall be full port, eccentric plug valves unless otherwise specified.

B. Valves shall be of the non-lubricated eccentric type with flanged ends faced and drilled per ANSI B16.1 125 lb.

C. Valve bodies shall be flushing body type and made of ASTM A126 Class B cast iron. Valves shall be furnished with a 1/8" welded overlay seat of not less than 95% pure nickel. Seat area shall be raised, with raised surface completely covered with weld to ensure that the plug face contacts only nickel. Screwed-in seats shall not be acceptable.

D. Plugs shall be made of ductile iron and have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. Plug shall be resilient faced with neoprene or hycar, suitable for use with sewage.

E. Valves shall have replaceable sleeve type bearings and grit seals at the upper and lower journals.

F. Valve shaft seals shall be of the multiple V-ring type and shall be externally adjustable and repackable without removing the bonnet or actuator from the valve under pressure. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable.

G. Valve pressure ratings shall be 175 psi through 12" and 150 psi for 14" through 72". Each valve shall be given a hydrostatic and seat test with test results being certified when required by the specifications.

H. Manually operated valves 4-inch and larger shall have a worm gear actuator, stainless steel input shaft and handwheel operator. Manually operated valves 3-inch and smaller shall have a lever operator. All gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft shall be stainless steel and the quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque and to provide seat adjustment to compensate for change in pressure differential or flow direction change. All exposed nuts, bolts and washers shall be stainless steel.

I. Any cylinder actuators shall be equipped with 2-inch square operating nuts to allow manual valve operation in case of supply failure.

J. Valves shall provide drip tight shutoff up to the full pressure rating. Valves shall be provided with adjustable limit stops and rotate 90 degrees from fully opened to fully closed.

K. Valves located 6 feet or more above the floor shall be furnished with chain wheel operators.

L. Valves shall have rectangular port openings for throttling service, and shall open to 100% of the corresponding pipe diameter.

M. Plug valves shall be as manufactured by DeZurik, Val-Matic, Clow or approved equal.

2.02 CHECK VALVES

A. The valve is a counterweighted, rubber seated check valve with attached cushion chamber whose function is to permit flow in only one direction, close tightly when its discharge side pressure exceeds its inlet pressure, and to close without a slam or bang.

B. The swing check valve shall be constructed with heavy cast iron or cast steel body with a bronze or stainless steel seat ring, a non-corrosive shaft for attachment of weight and lever, and complete non-corrosive shockless chamber.

C. It shall absolutely prevent the return of water, oil or gas back through the valve when the inlet pressure decreases below the delivery pressure. The valve must be tight seating, and must be shockless in operation. The seat ring must be renewable.

D. The cushion chamber shall be attached to the side of the valve body externally and so constructed with a piston operating in a chamber that will effectively permit the valve to be operated without any hammering action. The shock absorption shall be by air, and the cushion chamber shall be so arranged that the closing speed will be adjustable to meet the service requirements.

E. The valve disc shall be of cast iron or cast steel and shall be suspended from a non-corrosive shaft which will pass through a stuffing box and be connected to the cushion chamber on the outside of the valve.

F. All material and workmanship shall be first class throughout and the purchaser reserves the right to inspect this valve before shipment.

G. The valves will be Golden-Anderson Industries, Val-Matic, Inc. Fig. No. 250-D, 125# or equal.

2.03 SEWAGE COMBINATION AIR VALVE

A. Sewage Combination Air Valves shall be installed at the high points of the force main and at various locations as shown on the Contract Drawings.

B. Air valves shall be automatic float operated valves designed to exhaust air during the filling of a piping system and close upon liquid entry. The valve shall open during draining or if a negative pressure occurs. The valve shall also release accumulated air from a piping system while the system is in operation and under pressure.

1. The valve seat shall provide complete shut off to the full valve pressure rating.

2. Valves shall incorporate a full port orifice, a seal plug assembly, and an upper and lower float to provide a rolling resilient seal.

3. The seal shall be a one-piece design and include a large orifice and a small orifice and each shall open or close as needed to allow release or intake of air as the demand on the system regulates.

4. Valve shall be designed to intake or discharge a minimum of 100 SCFM of air with a 3.5-psi differential pressure.

C. Materials

1. Valve cover, lower float, stem, washer, spring, nuts and bolts: 316 Stainless Steel.

2. Upper float: Foamed polypropylene.

3. O-rings: Buna-N.

4. Seal plug assembly and base and body: 316 Stainless Steel.

D. All Sewage Combination Air Valves on the force main shall be ARI model no. D-025 as manufactured by A.R.I. Flow Control Accessories, Kfar Charuv, Israel, or equal. Sizes shall be based on the pipeline diameter as noted herein:

Pipe Diameter	3" – 8"	10" – 16"	18" – 20"	24" – 48"
Air Valve Size	2"	3"	4"	6"

2.04 VALVE OPERATORS

A. Valve operators shall be as shown on the plans and specified herein and in Section 2.05.

B. Valves located six (6) feet or more from floor level shall be furnished with chain wheel operators or chain level operators. Chains shall extend to within four (4) feet off the floor. All NRS floor stands and geared operators shall be indicating type.

2.05 VALVE ACTUATORS

A. The actuator shall consist of an electric motor, worm gear reduction, absolute position encoder, electronic torque sensor, mechanically and electrically interlocked reversing motor contactor, electronic control, protection, and monitoring package, manual override hand wheel, valve interface bushing, 32-character graphical LCD (Liquid Crystal Display), and local control switches all contained in an enclosure that is sealed to NEMA 4, 4X, 6, IP68 to 15M for 96 hours, and (XP as required). Actuator design life shall be at least one million drive sleeve turns.

B. The power transmission shall be completely bearing-supported, and consist of a hardened alloy steel worm and bronze alloy worm gear; oil-bath lubricated using synthetic oil designed specifically for extreme pressure worm and worm gear transmission service.

C. The motor shall be three-phase/60-cycle with Class F insulation and a thermistor embedded within the motor windings to prevent damage due to overload. The motor shall be easily removed through the use of a plug-in connector and shaft coupling.

D. Valve position shall be sensed by an 18-bit, optical, absolute position encoder with redundant position sensing circuits designed for Built-In-Self-Test [BIST]. Each of the position sensing circuits shall be redundant permitting up to 50% fault tolerance before the position is incorrectly reported. The BIST feature shall discern which failures signal a warning only and which require a warning plus safe shutdown of the actuator. Open and closed positions shall be stored in permanent, nonvolatile memory. The encoder shall measure valve position at all times, including both motor and hand wheel operation, with or without power present, and without the use of a battery. The absolute encoder

will be capable of resolving ±7° of output shaft position over 10,000 output drive rotations.

E. An electronic torque sensor shall be included. The torque limit may be adjusted from 40-100% of rating in 1% increments. The motor shall be de-energized if the torque limit is exceeded. A boost function shall be included to prevent torque trip during initial valve unseating and during extreme arctic temperature operation (-50°C), and a "Jammed Valve" protection feature, with automatic retry sequence, shall be incorporated to de-energize the motor if no movement occurs.

F. The control module shall include power and logic circuit boards, control transformer, and at least two primary power protection fuses, all mounted to a steel plate and attached in the control compartment with captive screws. The use of O rings or other such devices to secure the control boards shall not be permitted. The module shall be easily removed through the use of plug-in connectors. The module shall also include a reversing contactor, local control switches, 32-character graphical LCD, and LED indicators. It shall also be Bluetooth ready. All internal wiring shall be flame-resistant, rated 105°C, and UL/CSA listed. Voltage shall be selectable via a jumper included on the power board.

G. The reversing contactor shall be mechanically and electrically interlocked to prevent simultaneous energizing of the open and close coils. The control module shall also include an auto reversal delay to inhibit high current surges caused by rapid motor reversals. The control transformer shall include vacuum-impregnated coils and dual primary fuses.

H. A Phase Correction circuit shall be included to correct motor rotation faults caused by incorrect site wiring. The phase correction circuit shall also detect the loss of a phase and disable operation to prevent motor damage. The monitor relay shall trip and an error message shall be displayed on the LCD screen when loss of phase occurs and indicate the fault for Remote operation.

I. Discrete remote control may be configured as 2, 3, or 4 wires for open-stop-close control. Remote control functions may be powered by external 24 VDC, 125 VAC, or the actuator's internal supply 24 VDC supply. The voltage values for signal threshold shall be 19.2V AC/DC and 5.0V AC/DC respectively. The maximum load for 24Vdc is 2mA. The internal supplies shall be protected against over current and short circuits faults and utilize optical isolation to minimize electro-magnetic interference. Discrete control shall have an isolated common.

J. ESD (Emergency Shut Down) provision shall be included in each actuator. The actuator shall permit up to three inputs for ESD and they shall be configurable. The ESD signal shall override any existing signal (except LOCAL, STOP, and INHIBIT) and send the valve to its configured emergency position. The ESD may also be configured to override LOCAL, STOP, and/or INHIBIT. Provision for an isolated common shall be provided.

K. Inhibit movement provision shall be included in each actuator. The actuator shall permit up to three inputs for Inhibits and they shall be configurable. Provision for an isolated common shall also be provided.

L. Terminals shall be included to connect the electronic controls package, including display, to a back-up 24 VDC power source. As a standard alternative the actuator shall have the ability to maintain the status and alarm contacts in order to update status to the control room and also provides status visibility on the LCD screen without main power applied. It should be configurable for at least one hour and, once main power is restored, be available for the next unforeseen power outage. The use of an integral battery is prohibited.

M. A dedicated circuit to prevent undesired valve operation in the event of an internal circuit fault or erratic command signal shall be included. A single point failure will not result in erratic actuator movement. An open or short-circuit in the internal circuit board logic shall not energize the motor contactor, nor shall a single fused control relay contact fail to deenergize the motor contactor. The command inputs shall be optically coupled and require a pulse width of at least 250 ms to 350 ms to turn on or off. In the event of an internal circuit fault, an alarm shall be signaled by tripping the Monitor Relay and through LCD indication.

N. Four latched status contacts rated 125VAC, 0.5A and 30VDC, 2 amps shall be provided for remote indication of valve position, configured as 1-N/O and 1-N/C for both the open and closed positions. Two contacts may be configured to represent any other actuator status; mid-travel position, switched to local, overtorque, motor over temperature, manual operation, switched to remote, switched to stop, valve moving, close torque switch, open torque switch, hardware failure, ESD active, inhibits active, valve jammed, analog IP (input) lost, lost phase, and network controlled.

O. A monitor relay shall be included and shall trip when the actuator is not available for remote operation. Both N/O and N/C contacts shall be included, rated 125VAC, 0.5A and 30VDC, 2 amps. The monitor relay shall be configurable for three additional fault indications; lost phase, valve jammed, and motor overtemp. The yellow LED shall blink when the monitor relay is active.

P. The ACP (Actuator Control Panel) cover & module shall use solid-state Hall-effect devices for local communication and configuration. The use of reed switches on the module is prohibited. A 32-character, graphical LCD shall be included to display valve position as a percent of open, 0-100%, and current actuator status. "STATUS OK" shall be displayed for an operable actuator. If the actuator is not operable, the appropriate alarm shall be displayed. The alarm shall be continuously displayed until the actuator is operable. Red, green, and yellow LEDs shall be included for open, close, stopped, and moving indication. The Red and Green LEDs shall be reversible. A padlockable LOCAL-STOP-REMOTE switch and an OPEN-CLOSE switch shall be included for local valve actuator control. The control switches shall not penetrate the controls cover and shall be designed to electrically isolate the actuator's internal components from the external

environment. The OPEN-CLOSE switch may be configured for maintained or push-to-run (inching) control.

Q. The device shall be non-intrusive - All calibration shall be possible without removing any covers and without the use of any special tools. All calibration shall be performed in clear text languages, no icons shall be used. The languages shall be English, Spanish, French, German, Portuguese, Italian, Mandarin, Russian, Malay, and Katakana. All calibration shall be performed by answering the "YES" and "NO" questions displayed on the LCD. "YES" is signaled by using the OPEN switch and "NO" by using the CLOSE switch, as indicated adjacent to the switches. A configurable password option shall be available to prevent unauthorized changes.

R. Double sealed terminal compartment & Terminal block - All customer connections shall be located in a terminal chamber that is separately sealed from all other actuator components. Site wiring shall not expose actuator components to the environment. The internal sealing within the terminal chamber is suitable for NEMA 4, 6, and IP68 to 15M for 96 hours. The chamber shall include screw-type terminals, three for power and 54 for control, for site connections. Three conduit entries, available as: (2) - 1.25" NPT (M32) and (1)-1.5" NPT (M40) shall be located in the terminal chamber.

S. Coatings - The actuator shall be coated with a polymer powder coat. The coating system shall be suitable for an ASTM B117 salt spray test of 1500 hours. External fasteners shall be stainless steel or high-strength carbon steel that has been chromate-hexavalent coated, and then top coated with a high-strength, high-endurance polymer. The fasteners shall be suitable for an ASTM B117 salt spray test of 500 hours.

T. A handwheel and declutch lever shall be provided for manual operation. The handwheel shall not rotate during electric operation nor can a seized motor prevent manual operation. Changing from motor to manual operation is accomplished by engaging the declutch lever. Energizing the motor shall return the actuator to motor operation. The lever to enable the declutch shall be padlockable to permit motor operation only.

U. The actuator shall include a removable torque or thrust bushing to mate with the valve shaft.

V. Diagnostic facilities shall be included to accumulate and report the performance of the motor, encoder, contactor, cycle time, handwheel operations, actuator ID, firmware revision, and output turns. In addition, a torque profile of the reference baseline valve stroke and the last valve stroke shall be included. A feature for reset shall be provided. All diagnostic information shall be displayed on the LCD. Diagnostics shall also include an FDA (Frequency Domain Analysis) feature. The Frequency Domain Analysis methodology shall capture torque, position or speed values at regular time intervals while the actuator is motoring, and calculate the resulting data set with a Fast Fourier Transform [FFT]. The resulting information shall be used to isolate any components in the mechanical drive train that may exhibit excessive wear or may effect normal actuator operation. FDA and resultant fault indications shall be displayed via the graphical LCD.

The actuator shall contain the ability for diagnostics information to be downloaded to a PC or PDA via both IRDA and Bluetooth ports.

W. Factory testing - Every actuator shall be factory tested to verify: rated output torque, output speed, handwheel operation, local control, control power supply, valve jammed function, all customer inputs and outputs, motor current, motor thermistor, LCD and LED operation, direction of rotation, microprocessor checks, and position-sensor checks. A report confirming successful completion of testing shall be included with the actuator.

2.06 ACTUATOR CERTIFICATIONS

A. Non-hazardous (Weatherproof/Submersion) Certifications

1. IEC 529 protection code IP68; 15 meters for 96 hours continuous

2. USA & CSA; NEMA 3, 4, NEMA 4X, NEMA 6

B. Standard Hazardous Global certifications:

1. FM – Class I, Groups B, C & D, DIV.1 and Class II, Groups E, F, & G, T4

   a. T4A temperature classification is acceptable w/ operational times < 15 min.

2. ATEX Eex d IIB T4 ATEX II 2 G, CENELEC Norm EN50014 and EN50018

3. ATEX Eex d IIC T4 ATEX II 2 G, CENELEC Norm EN50014 and EN50018

   a. T4A temperature classification is acceptable w/ operational times < 15 min.

4. CSA – Class I, Groups B, C & D, DIV.1 and Class II, Groups E, F, & G, T4

5. IEC Eexd IIB T4, IIB T4

6. IEC Eexd IIC T4, IIC T4

2.07 ACTUATOR OPTIONS

A. Lost power buffer

1. After the actuator has been powered by line power for one hour, it shall automatically withstand most power outages while maintaining the correct state of the S status contacts, even if the user repositions the actuator manually with the handwheel. To maximize its self-power time while the line power is lost, the actuator will place itself in its lowest possible power usage mode. The LCD will darken (sleep mode) until it is needed to be viewed. The LCD can be activated by moving the black knob to OPEN (YES) or by moving the actuator with the handwheel. After 10 seconds of inactivity, the LCD will return to sleep mode.

2. The use of batteries to perform this function shall be prohibited.

B. Analog Position Transmitter (APT)

1. A non-contacting, internally powered, electrically isolated position transmitter shall be included to provide a 4-20 mA signal that is proportional to valve position.

C. Modutronic Option

1. A controller that alters valve position in proportion to a 4-20 mA analog command signal shall be included. Positioning shall be accomplished by comparing the command signal to an internal position feedback. The internal feedback shall be of the non-contacting type. An automatic pulsing feature to prevent overshoot at the setpoint shall be included. Proportional bands, deadband, signal polarity, motion inhibits time, and fail position shall be adjustable through the LCD. Deadband shall be adjustable to 0.5% full span.

D. Relays for Status and Alarms

1. Up to eight additional latching output contacts rated 250 VAC/30 VDC, 5 amps and configurable to represent any actuator status in either N/O or N/C state shall be available: mid-travel position, switched to local, overtorque, motor over temperature, manual operation, switched to remote, switched to stop, valve moving, close torque switch, open torque switch, hardware failure, ESD active, inhibits active, valve jammed, analog IP (input) lost, lost phase, and network controlled.

E. DDC (Distributed Digital Control)

1. A digital communication control system that provides the ability to control and monitor up to 250 actuators over a single twisted-pair cable shall be included. The communication network shall employ Modbus (Bitbus) protocol on an RS-485 network, and shall be redundant such that any single break or short in the communication cable shall not disable any actuators. Each actuator shall include an addressable field unit that communicates over the twisted pair network and executes open, close, stop, ESD, and GO TO position commands. The field unit shall also communicate all actuator status and alarm diagnostic messages over the same communication network.

PART 3 – EXECUTION

3.01 INSTALLATION

A. All valves shall be installed in accordance with the manufacturer's recommendations.

END OF SECTION

SECTION 11310 (ADD #3)

SOLIDS HANDLING SUBMERSIBLE SEWAGE PUMPS

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment, delivering, installing, testing, and placing into service all pumping equipment and with all appurtenances associated with the Lift Stations complete as shown on the Drawings and more fully described hereinafter. The equipment to be furnished and installed shall be as shown on the Drawings and shall include pumps, motors, VFDs, guide rails, access hatches, control panels and control systems, and appurtenances, all tested and ready for operation.

B. Unless otherwise specified the pump manufacturer shall furnish each pumping unit complete with drive motor and all other components and shall be entirely responsible for the compatibility in all respects of all components furnished.

C. Several pump manufacturers are listed within this specification and for certain pump features there is more than one option that is acceptable. For these items, more than one option is specified in this specification and a pump manufacturer must meet one of the options.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 01300

B. Operating & Maintenance Manuals: Section 01780

1.03 MANUFACTURER

A. The pumping units shall be provided by a single manufacturer with a minimum of five (5) years' experience in designing and manufacturing pumping equipment of similar type, size and capacity. The pumps shall be manufactured by the Xylem Corporation Flygt Division, KSB, Grundfos, or approved equal.

1. To assure unity of responsibility, the pumps, motors, guide rails and other auxiliary equipment, and materials specified in this Section shall be furnished and coordinated by the pump manufacturer (Manufacturer) who shall assume responsibility for the satisfactory operation of the entire pumping system including pumps, motors, and accessories. The pump manufacturer shall coordinate closely with the existing VFD to ensure compatibility between the pump and VFD. See existing VFD shop drawing in Appendix 1 of these specifications.

B. Replacement Parts Capability: The manufacturer shall have the ability to promptly furnish any and all interchangeable replacement parts as may be needed at any time

within the expected life of the pumps. Upon request, the Contractor shall submit evidence of the proposed manufacturer's ability to promptly fill replacement orders.

C. Quality Assurance: All pumping units shall be of approved design and make products of manufacturers who have built equipment of similar type, size and capacity.

D. Additional Submittals: The Contractor shall submit, upon request, any additional information that the Engineer may deem necessary to determine the ability of the proposed manufacturer to produce the specified equipment.

E. Manufacturer Information: All manufacturer information required by the specifications shall be submitted by the Contractor within thirty (30) calendar days of the date of receipt of the Notice to Proceed.

1. Any additional information or data, specifically requested by the Engineer, concerning manufacturer's capabilities (especially relating to requirements described hereinbefore), shall be submitted by the Contractor within fourteen (14) calendar days of the receipt of the written request thereof, unless otherwise specified.

2. Approval of manufacturers or suppliers will not be given until all information required by the specifications or requested by the Engineer has been submitted and acceptable.

F. Prior to manufacture, a certified statement from the pump manufacturer shall be forwarded to the Engineer indicating that a torsional vibration analyses has been completed for the specified pump and that Hydraulic Institute (HI) limitations will be met.

G. Disqualification of Manufacturer:

1. Poor performance of similar pumping equipment now in operation under the specified conditions of service and pump rating constitute grounds for disqualification of the pump manufacturer, supplier, or both, unless such poor performance has been corrected.

2. Failure to successfully comply with the provisions of subparagraphs A through H, inclusive, will constitute grounds for disqualification of pump manufacturer.

1.04 SUBMITTALS (SHOP DRAWINGS)

A. General: The Contractor shall comply with the provisions of the specifications regarding submittals, unless otherwise specified herein.

B. At the time of submission, the Contractor shall, in writing, call the Engineer's attention to any deviations that the submittals may have from the requirements of the Engineer's Contract Drawings and Specifications.

C. The Contractor shall provide a notarized certification indicating that all pumping products meet the required Specifications.

D. Descriptive literature, catalog cuts, and dimensional prints clearly indicating all dimensions and materials of construction shall be submitted on all items specified herein to the Engineer for review and approval before ordering.

E. Content of Submittals: The following shall be included in submittals as a minimum. However, any additional information or data shall be added if and whenever requested by the Owner or the Engineer. Where applicable, submit separate data for each pump.

1. Descriptive Literature:

    1. Dimensions

    2. Materials of Construction (including required coating).

    3. Performance Data.

        a. Pump Impeller Size

        b. GPM

        c. TDH

        d. BHP

        e. RPM

        f. Performance curves showing pump operation including shutoff head, operating point, and run-out.

        g. Performance curves showing overall pump efficiencies.

        h. Weight of pump

        i. Horsepower rating of pump motor

2. Installation Information: Submit installation drawings and information for pump connections, connecting piping and valves, electrical connections, and auxiliary equipment.

    1. The Contractor shall submit all other drawings, material lists and other information specified, requested and/or necessary to show complete compliance with all details of the contract documents.

3. Operation and Maintenance Manual: Manual shall contain all information necessary for proper operation and maintenance of pumping units, as well as the location of the nearest permanent service headquarters.

F. A certificate from each equipment manufacturer shall be submitted stating that the installation of his/her equipment is satisfactory, that the equipment is ready for operation and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit.

1.05 TESTS

A. Shop Tests:

1. All pumps shall receive a non-witness certified factory performance test.

2. The Manufacturer shall factory test all pumps prior to shipment in accordance with the Hydraulic Institute standards, latest version. Flow rate, total head and Input KW shall be tested and recorded for at least five points on the pump performance curve. Test shall be performed to demonstrate that the pumps meet ANSI/HI 11.6 acceptance grade 1U for all specified points. The five points shall include the points specified in pump performance table in Paragraph 2.02.

3. The Manufacturer shall perform hydrostatic test on the pressure-containing parts in accordance with ANSI/HI 11.6. Test shall be conducted on each pump prior to shipment.

4. The Manufacturer shall perform the following test on each pump prior to shipment from factory:

    1. Megger motor and pump for insulation breaks or moisture.

    2. Prior to submergence, the pump shall be run dry and checked for correct rotation.

    3. Pump shall be run for a minimum of 30 minutes in a submerged condition.

    4. The pump shall be removed from test tank, meggered immediately for moisture and upper and lower seal unit shall be checked for water intrusion.

    5. A written certification test report regarding the above tests shall be submitted for approval prior to shipment.

5. Five (5) certified copies of the results of these tests are to be sent to the Engineer. Also included with the test curves shall be a certified bill of material list depicting quality of construction.

B. Field Tests:

1. The pumping units will be accepted upon the basis of the certified copies of the shop test and be subject to a four-hour field test of each unit. This test will be for the purpose of determining if each pumping unit will operate under installed conditions within a reasonable degree of correlation with the shop tests.

2. The Contractor shall give at least two (2) week notice to the Owner when the field tests are to be accomplished so that the Owner may have a representative present at the said tests.

3. The field tests shall be made by the Contractor in the presence of and as directed by the Engineer.

4. Field tests shall be made on each pumping unit. During the test, each pump shall be run at maximum rated speed for at least three (3) rates of flow corresponding to minimum rate, design rate, and maximum rate of flows specified as evidenced by the corresponding total head shown by the pump gages; simultaneous ammeter readings shall be taken. Variation of the rate of flow shall be made by throttling the discharge valve (where applicable). The rated motor nameplate current and power shall not be exceeded at any rate of flow within the specified range.

    1. Drawdowns shall be completed for all pump scenarios shall note methodology used to complete field tests including flow rates for each pump, feet of head achieved at said rate, and pump amperages. All results shall be certified by the Engineer and provided to the Owner for future maintenance purposes. Owner will provide drawdown test form prior to testing.

5. Before any pump is rotated, the Contractor shall make certain that no debris is present in suction well, pumps or pipelines. Any internal damage done to equipment while starting up shall be assumed to be caused by debris and shall be replaced at the Contractor's expense. No pump shall be rotated under power unless submerged with liquid.

6. When water can be pumped, the Contractor shall commence pumping and shall have representatives from the pump manufacturer to start the pumps. When flow conditions are favorable, the Contractor or pump manufacturer shall in the presence of the Engineer, run a series of tests to establish the adequacy of the pumping units.

7. Field tests shall also conform to Part 3, Paragraph 3.03 as specified hereinafter.

C. Failure of Tests:

1. Any defects in the equipment or failure to meet the guarantees or requirements of the specifications shall be promptly corrected by the Contractor by replacements or otherwise. The decision of the Engineer as to whether or not the Contractor has fulfilled his obligations under the Contract shall be final and conclusive. If the Contractor fails or refuses to make these corrections or if the improved equipment,

when tested, shall fail again to meet the guarantees of specified requirements, the Owner notwithstanding its having made partial payment for work and materials which have entered into the manufacture of said equipment, may reject said equipment and order the Contractor to remove it from the premises at his own expense.

2. In case the Owner rejects said equipment, then the Contractor hereby agrees to repay to the Owner all sums of money paid to him for said rejected equipment on progress certificates or otherwise on account of the lump sum prices herein specified, and upon the receipt of said sum of money the Owner will execute and deliver to the Contractor a bill of sale of all its rights, title, and interest in and to said rejected equipment; provided, however, that said equipment shall not be removed from the premises of the Owner until the Owner obtains from other sources the equipment to take the place of the rejected. The Owner hereby agrees to obtain said other equipment within a reasonable time and the Contractor agrees that the Owner may use the equipment furnished by him without rental or other charge until said other new equipment is obtained.

D. Responsibility During Test: The Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when the Owner formally takes over the operation thereof.

E. Manufacturer's Representative: For all pumping units, the Contractor shall furnish the services of accredited representatives of the pump manufacturer who shall supervise the installation, adjustment, and field tests of each pumping unit and give instructions to the operating personnel. As one condition necessary to acceptance of any pumping unit, the Contractor shall submit a certificate from the manufacturer, stating that the installation of the pumping unit is satisfactory, that the unit is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication, and care of the unit.

1.06 GUARANTEE PERIOD

A. After successful completion of tests and trials under operating conditions on all equipment, the Contractor shall guarantee all equipment, materials and workmanship from undue wear and tear, from mechanical and electrical defects, and from any failure whatever, for a minimum of five (5) years. This five (5) year minimum shall not replace a standard manufacturer's guarantee which exceeds one (1) year.

1.07 PUMP WARRANTY

A. The Contractor guarantees and warrants that during the first three years of operation, the pumps will operate satisfactorily and continuously according to the pump schedule specified herein, and that after due notice has been given by the Owner, he or the pump manufacturer will proceed, within a reasonable time, to adjust, regulate, repair and renew at his own expense or perform such work as is necessary to maintain the

guaranteed capacities, efficiencies and performances. Overall pump warranty is five-years that includes 100% parts and labor for five years.

1.08 DYNAMIC ANALYSIS

A. ~~Instead of preparing level 1 analysis for wet pit submersible pumps, perform factory and field vibration testing at 50 rpm speed intervals across the full range of operations to validate that there is no vibration in excess of HI 9.6.4 and no apparent resonance condition.~~

Instead of preparing level 1 analysis for wet pit submersible pumps, perform factory and field vibration testing at 50 rpm speed intervals across the full range of operations to validate that there is no vibration in excess of HI 9.6.4 and no apparent resonance condition. (ADD #3)

PART 2 – PRODUCTS

2.01 SOLIDS HANDLING SUBMERSIBLE SEWAGE PUMPS

A. Pump Design:

1. The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two parallel guide bars extending from the top of the station to the wet well mounted discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal-to-metal, or a resilient seating system with O-ring or profile gasket connection making watertight contact. The entire weight of the pump/motor unit shall be borne by the pump discharge elbow. No portion of the pump/motor unit shall bear on the sump floor directly or on a sump floor mounted stand.

2. Power and pilot cable supports shall be provided and consist of a wire braid sleeve with attachment loops or tails to connection to the underside of the access frame.

B. Pump Construction:

1. Major pump components shall be of gray cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other casting irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel. All metal surfaces coming into contact with the pumped media, other than stainless steel, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with either a polyester resin or a high solids two-part epoxy paint finish on the exterior of the pump.

2. Sealing design shall incorporate metal-to-metal contact between machined surfaces or a resilient seating system with O-ring or profile gasket. Pump/Motor unit mating surfaces where watertight sealing is required shall be machined and

fitted with Nitrile or Viton rubber O-rings. Joint sealing will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific bolt torque limit. Rectangular cross-sectioned rubber, paper or synthetic gaskets that require specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

C. Cooling System:

1. Requirement:

1. Each pump, as specified herein or as recommended by the manufacturer, shall be provided with integral cooling capabilities.

2. The cooling feature(s) shall provide heat dissipation for the motor regardless of whether the motor unit is submerged in the pumped media or surrounded by air.

3. The cooling system shall provide for continuous submerged and completely non-submerged pump operation in liquid or in air having a temperature of up to 40°C (104°F), in accordance with NEMA standards. Restrictions limiting the ambient or liquid temperatures at levels less than 40°C are not acceptable.

2. Type: Product cooling jacket or Glycol jacket cooled or Ambient cooled integral, self-supplying cooling system capable of cooling the motor at the rated starts per hour without an external cooling source.

3. Configuration: The cooling feature(s) shall surround the stator housing.

D. Cable Entry Seal:

1. Option 1 - The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of dual cylindrical elastomer grommets, flanked by washers, all having a close tolerance fit against the cable outside diameter and the cable entry inside diameter. The grommets shall be compressed by the cable entry unit, thus providing a strain relief function. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be sealed from each other, which shall isolate the stator housing from foreign material gaining access through the pump top.

2. Option 2 - Cable seal shall include a compressed rubber grommet to seal the cable exterior and epoxy fill to seal the interior passages. A strain relief device, in direct contact with both the cable and the cast iron entry housing, shall be

provided. The cable entry shall be rated by Factory Mutual (or UL) for submerged operating depths to 85 feet.

3. Option 3 - The cable entry design shall not require a specific torque to insure a watertight seal. The cable entry shall consist of cylindrical elastomer grommets, flanked by stainless steel washers. A cable cap incorporating a strain relief and bend radius limiter shall mount to the cable entry boss, compressing the grommet ID to the cable while the grommet OD seals against the bore of the cable entry. The junction chamber shall be isolated and sealed from the motor by means of sealing glands. Electrical connections between the power cables and motor leads shall be made via a compression or post type terminal board, allowing for easy disconnection and maintenance. An access port shall be located in the center of the motor lid to allow easy access to the electrical connections without the need to remove the entire motor lid.

E. Motor:

1. Option 1 - The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 30 and 31. The stator shall be heat-shrunk fitted into the cast iron stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable.

    1. The motor shall be specifically designed for submersible pump usage and designed for continuous duty pumping media of up to 40°C (104°F) with an 80°C temperature rise and capable of at least 10 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches shall be embedded in the stator end coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable. The motor and the pump shall be produced by the same manufacturer.

    2. The motor service factor shall be a minimum of 1.10. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C. A performance chart shall be provided upon request showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.

2. Option 2 - The Premium Efficiency motor shall meet efficiency standards in accordance with IEC 60034-30:2008, level IE3 and NEMA Premium*. Motor rating tests shall be conducted in accordance with IEC 60034-2-1 requirements and shall be certified accurate and correct by a third party certifying agency. A certificate shall be available upon request.

    1. * IE3 and NEMA Premium efficiency levels are equivalent, however the NEMA Premium standard is intended to cover dry installed motors only, not integrated submersible motors.

    2. The motor shall be housed in a water-tight gray cast iron, EN-GJL-250 (ASTM A-48, Class 35B), enclosure, capable of continuous submerged operation underwater to a depth of 20 meters (65 feet) and shall have an IP68 protection rating. The motor shall be of the squirrel-cage induction design, NEMA type B. The copper stator windings shall be insulated with moisture resistant, Class H insulation material, rated for 180°C (356°F). The stator shall be press fitted into the stator housing. The use of bolts, pins, or other fastening devices requiring penetration of the stator housing is unacceptable. The rotor bars and short circuit rings shall be made of cast aluminum.

    3. The motor shall be designed for continuous duty. The maximum continuous temperature of the pumped liquid shall be 40°C (104°F), and intermittently up to 50°C (122°F). The motor shall be capable of handling up to 10 evenly spaced starts per hour without overheating. The service factor (as defined by the NEMA MG1 standard) shall be minimum 1.1. The motor shall have a voltage tolerance of +/- 10% from nominal, and a phase to phase voltage imbalance tolerance of 1%. The motor shall have a NEMA Class A temperature rise, providing cool operation under all operating conditions. The motor shall be FM approved for use in NEC Class I, Division I, Groups C & D hazardous locations. The surface temperature rating shall be T3C. The motor shall meet the requirements of NEMA MG1 Part 30 and 31 for operation on PWM type Variable Frequency Drives.

3. Both Options - The power cables shall be sized according to NEC and CSA standards and shall be of sufficient length to reach the junction box without requiring splices. The outer jacket of the cable shall be of chlorinated polyethylene (CPE) and be oil, water, and UV resistant, capable of continuous submerged operation underwater to a depth of 65 feet. The pump manufacturer shall provide pump cable supports to adequately support the size of the pump cables supplied with the pump. Pump support cables shall be constructed of 316 stainless steel. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

F. Pilot Cable:

1. The pilot cable shall be designed specifically for use with submersible pumps and shall be type SUBCAB (Submersible Cable). The cable shall be shielded, multi-conductor type with a chloroprene outer jacket and the tinned copper conductors insulated with ethylene-propylene rubber. The conductors shall be arranged in twisted pairs. The cable shall be rated for 600 Volts and 90°C (194°F) with a 40°C (104°F) ambient temperature and shall be approved by Factory Mutual (FM). The cable length shall be adequate to reach the junction box without the need for splices.

G. Bearings:

1. The pump shaft shall rotate on high quality permanently lubricated greased bearings. The upper bearing, provided for radial forces, shall be a single roller bearing. The upper bearing shall be a cylindrical roller bearing which is electrically isolated from the bearing housing to prevent bearing damage from circulating currents when the pump is operated on a variable frequency drive. The lower bearings shall consist of at least two heavy duty angular contact ball bearings (required) and one roller bearing (optional but must meet criteria below).

2. All lower bearings shall have identical outer race diameters to provide maximum bearing load capacity. Designs which utilize a roller bearing with a smaller outer diameter than the other bearings in the assembly do not provide maximum load capacity and shall not be considered equal. Bearings shall be of sufficient size and properly spaced to transfer all radial and axial loads to the pump housing and minimize shaft deflection. *L-10 bearing life shall be a minimum of 100,000 hours at all points along the usable portion of the pump curve at maximum pump speed.* ***(ADD #3)***

3. The bearings shall be manufactured by a major internationally known manufacturer of high quality bearings and shall be stamped with the manufacturer's name and size designation on the race. Generic or unbranded bearings from other than major bearing manufacturers shall not be considered acceptable.

4. The bearing housings shall include an independent thermal sensor to monitor the bearing temperature. If a high temperature occurs, the sensor shall activate an alarm and shut the pump down.

H. Mechanical Seal:

1. Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The lower seal shall be independent of the impeller hub. The seals shall operate in a lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide or silicone-carbide seal ring.

2. Install the upper seal in an oil-filled chamber with drain and inspection plug (with positive anti-leak seal) for easy access from external to the pump. Provide seals requiring neither routine maintenance nor adjustment, but capable of being easily inspected and replaced. Provide seals which are non-proprietary in design, with replacements available from a source other than the pump manufacturer or its distributors. Do not provide seals with the following characteristics: conventional double mechanical seals with single or multiple springs acting in opposed direction; cartridge-type mechanical seals; seals incorporating coolant circulating impellers, seals with face materials other than those specified.

3. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide or silicone-carbide seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment and shall be capable of operating in either clockwise or counter clockwise direction of rotation without damage or loss of seal. For special applications, other seal face materials shall be available.

4. Provide two totally independent mechanical shaft seals, installed in tandem, each with its own independent single spring system acting in a common direction.

5. Should both seals fail and allow fluid to enter the stator housing, a port shall be provided to direct that fluid immediately to the stator float switch to shut down the pump and activate an alarm. Any intrusion of fluid shall not come into contact with the lower bearings.

6. The following seal types shall not be considered acceptable nor equal to the dual independent seal specified: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. No system requiring a pressure differential to offset pressure and to effect sealing shall be used.

7. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate continuously while non-submerged without damage while pumping under load. Seal lubricant shall be FDA Approved, nontoxic.

I. Pump Shaft:

1. Pump and motor shaft shall be a solid continuous shaft. The pump shaft shall be the extension of the motor shaft. Couplings shall not be acceptable. The shaft shall be of sufficient size to transmit full driver output with a maximum deflection of 0.002 inches measured at the lower mechanical seal. The pump shaft shall be of

carbon steel ASTM A 572 Grade 50 or stainless steel, 1.4021 (AISI 420) and shall be completely isolated from the pumped liquid.

J. Impeller:

1. Impellers shall be constructed of ASTM A48 Class 30 or 35B minimum gray cast iron and solids handling type capable of passing solids (minimum of 18" diameter) either due to internal clearances or other features to facilitate solids handling such as a wear plate with groove.

2. The impeller shall be a rotodynamic semi-open or enclosed. The wear plate to impeller clearance shall be easily adjustable without the need for disassembly of the pump or the need to add or remove shims. In lieu of wear plate, dual stainless-steel wear rings, one for the impeller and one for the volute are allowed. The impeller may include pump out vanes on the upper shroud to reduce axial thrust and minimize clogging due to debris accumulation around the mechanical seal. The impeller shall be dynamically balanced to the ISO 1940 G6.3 or ISO 10816 standard to provide smooth, vibration free operation.

K. Volute:

1. Pump volute(s) shall be single-piece gray cast iron, ASTM A-48 Class 30 or 35B, non-concentric design with centerline discharge and smooth passages large enough to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The discharge size shall be the minimum size shown on the pump schedule. Proprietary or nonstandard flange dimensions shall not be considered acceptable.

L. Protection:

1. Option 1 - All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. Should high temperature occur, the thermal switches shall open, stop the motor and activate an alarm in the control panel.

    1. A lower bearing temperature sensor shall be provided. The sensor shall directly contact the outer race of the thrust bearing providing for accurate temperature monitoring.

    2. A leakage sensor shall be provided to detect water in the stator chamber. The Float Leakage Sensor (FLS), a small float switch, shall be used to detect the presence of water in the stator chamber. When activated, the FLS will stop the motor and activate an alarm. The use of voltage sensitive solid state sensors shall not be allowed.

    3. The thermal switches, FLS and the lower bearing temperature monitor shall be connected to a MAS (Monitoring and Status), PumpSafe or equal

monitoring unit. The unit shall be designed to be mounted in the motor control center.

2. Option 2 - An upper and lower bearing bi-metallic temperature switch shall be provided on pumps 100HP and larger providing for accurate temperature monitoring and warning signals

    1. A vibration sensor shall be included on pumps 100HP and larger and allow continuous measurement of the pump's vibration magnitude. The sensor shall be a direct current, single axis velocity transducer with a 4 – 20 mA output which is directly proportional to the vibration level. The vibration sensor shall be mounted inside the motor's connection chamber and positioned perpendicular to the motor shaft. A visual display and/or monitor, installed in the control panel, shall monitor the vibration level and energize a warning light, or optionally, cause the pump to shut down in the event of excessive vibration. Externally mounted vibrations sensors attached to outside of the pump or motor shall not be acceptable.

    2. The integrity of the mechanical seal system shall be continuously monitored using an electrical probe provided in a sensing chamber positioned above the mechanical seals for detecting the presence of water contamination within the chamber. The sensing chamber shall be oil-filled and shall have a drain / inspection plug with a positive anti-leak seal which is easily accessible from the outside of the pump.

    3. A solid-state relay mounted in the pump control panel or in a separate enclosure shall send a low voltage, low amperage signal to the probe, continuously monitoring the conductivity of the liquid in the sensing chamber. If sufficient water enters the sensing chamber, the probe shall sense the increase in conductivity and signal the solid state relay in the control panel. The relay shall then energize a warning light on the control panel, or optionally, cause the pump shut down.

    4. The thermal switches and seal leakage probe shall be connected to a CA462 pump monitoring relay or equal. For pumps 100HP and larger, a PC441 monitoring unit with temperature, moisture and vibration sensing modules and graphical interface display shall be provided per the electrical drawings.

3. Option 3 – Provide thermal/moisture control panel that monitors moisture entering the oil cavity and winding over-temperature. If winding over-temperature occurs, a red light will illuminate indicating high temperature. If moisture is detected between the probes, an amber light will illuminate indicating a seal leak. A test pushbutton will be provided that serves both over-temperature and moisture detection. Load contacts are provided for each fault condition to shut down the pump motor and operate a remote alarm (SCADA system). The started shall be wired to shutdown the motor if winding over-temperature occurs. Panel shall be UL listed and meet requirements of Division 17.

M. Pump Discharge Flange:

1. The pump discharge-mating flange shall be as shown on the drawings.

2.02 PUMPING REQUIREMENTS

A. Solids handling pumps shall be manufactured by Xylem Corporation Flygt Division, KSB, or Grundfos and shall comply with the following characteristics:

Submersible Pump Performance Criteria Schedule

Number of Units	*4 (ADD #3)*
Pump Identification Numbers	400, 401, 402, *403 (ADD #3)*
Pump Shutoff Head (Minimum) (ft)	185
Static Head (all operating points) (ft)	106.5
Rating Point (at Full Speed)	
Total Flow (gpm)	11,500
Flow per pump (2 pumps in operation) (gpm)	5,750
Total Head (ft)	132.0
Minimum Pump Efficiency (%)	76.1
NPSH Required shall not exceed (ft)	23.9
Rating Point shall be within the following range as % of BEP Flow	85% to 105%
Factory test acceptance grade	1U
Maximum Flow Operating Point (at Full Speed)	
Total Flow (gpm)	12,560 (min)
Flow per pump (3 pumps in operation) (gpm)	4,187 (min)
Total Head (ft)	133.9
NPSH Required shall not exceed (ft)	30
Operating Point shall be within (AOR/POR)	POR
Factory test acceptance grade	2B
Minimum Flow Operating Point (at Full Speed)	
Flow (gpm)	5,000
Total Head (ft)	114.3
Operating Point shall be within (AOR/POR)	AOR

Factory test acceptance grade	2B
Minimum Pumping Speed to Achieve Flow (rpm)	1,180
Minimum Brake Horsepower for all operating points	250
Maximum Brake Horsepower for all operating points	275
Maximum Pump Operating Speed (rpm)	1,200
Fluid Pumped	Wastewater
Fluid Temperature (degrees F)	Ambient
Discharge Configuration	Center
Drive configuration	Close Coupled
Direction of rotation when viewed from driver end (top)	Clockwise
Minimum ABMA L-10 Bearing life [along the full length of the published operating curve] (hours)	100,000
Rated Starts Per Hour, Minimum	10
Area Classification	Class 1, Div 1, Group D

*Pump selected to meet required 2 pump flow. 3 Pump flow must at least match minimum of 12,560 gpm, but can be greater.

B. Power supply shall be 480 volts, 3-Phase, 60 Hz, 4 wire service.

C. Motors shall be 460 volt, 3 phase, 60 Hz.

D. Each pump shall be operated by VFD – see Specifications Division 16

E. Minimum pump discharge diameter shall be 12 inches.

F. Maximum allowable NPSHr at Design Point Number 3 is 30 feet.

2.03 THE PUMPS SHALL OPERATE THROUGHOUT THE ENTIRE OPERATING RANGE WITH THE MAXIMUM VIBRATION VELOCITY IN INCHES PER SECOND RMS UNFILTERED, MEASURED IN THE FIELD, SHALL BE LESS THAN THE REQUIREMENTS OF ANSI/HI 9.6.4-LATEST EDITION.PUMP ACCESSORIES AND OTHER

A. All pumps and controls shall be completely wired at the factory for power and control and shall be color-coded. All wiring outside the control cabinet shall be rigid conduit. All accessory equipment shall be permanently wired with suitable disconnecting means and overload protection.

B. All pump motors shall be provided with stator temperature sensor switches and stator housing leak detector.

C. The pump/motor assembly shall be suitable for use in Class I, Division 1, Group D hazardous locations.

D. Contractor shall be responsible for supply of appropriate lengths of lifting chain, submersible power cable, and MG Hi conductor submersible cable.

E. Access hatches for wet well and valve pit shall be as specified in Section 08370 of these specifications. Dimensions as noted on the Drawings shall be confirmed by the Pump Manufacturer.

2.04 VARIABLE FREQUENCY DRIVES

A. The speed control for variable speed pumps shall be Variable Frequency Drives, as specified in Division 16 suitable for installation as shown on the Drawings.

B. The Variable Frequency Drives shall be the existing Square D VFDs currently installed at the pump station and shall be completely coordinated with the pumps and pump driving motors. See Appendix 1 for existing VFD shop drawings.

C. The motors provided by the Pump Manufacturer shall be compatible with the existing Variable Frequency Drives.

2.05 GUIDE RAILS

A. The pumping station shall be furnished with the necessary, stainless steel upper guide holder and level sensor cable holder.

B. Lower guide holders shall be integral with the discharge connection. Dual guide rails shall be of Schedule 40, welded two-inch minimum diameter, Type 316 stainless steel pipe of the length required by the Drawings. Single guide rails and guide cables are not acceptable.

C. Intermediate guide brackets shall be furnished and installed so that the maximum length of unsupported guide rails will be no longer than 20 feet, and shall be fabricated of Type 316 stainless steel.

D. Stainless steel cable holders including the cable hooks shall be fabricated from Type 316 stainless steel plate. Sharp corners and edges shall be ground smooth to prevent abrasion and cutting of electrical cable insulation. The cable holder shall be of sufficient length and strength to provide support for each separate cable, except that the pump power and lift cables may use the same hook position, provided the cables do not foul one another and the lift cable is easily accessed from the hatch opening.

PART 3 – EXECUTION

3.01 PREPARATION

A. Coordinate with other trades, equipment and systems to the fullest extent possible.

B. Take all necessary measurements in the field to determine the exact dimensions for all work and the required sizes of all equipment under this contract. All pertinent data and dimensions shall be verified by the Contractor.

3.02 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the Drawings. Anchor bolts shall be set in accordance with the manufacturer's recommendations and setting plans.

B. The Contractor shall also provide from the submersible pump supplier the service of a qualified start-up engineer (factory representative) who has had prior on-site start-up experience to assist in performing start-up, checkout and initial operation services of the pumping units. The start-up engineer shall also instruct the Owner's personnel on the operation and maintenance procedures for the station. Qualified supervisory services, including manufacturers' engineering representatives, shall be provided for a minimum of 4 man-days to ensure that the work is done in a manner fully approved by the respective equipment manufacturer. The pump manufacturer's representatives shall specifically supervise the installation of the pump and the alignment of the connection piping. If there are difficulties in the start-up or operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no cost to the Owner. Services of the manufacturer's representatives and training shall be provided when the first pump is started, with follow-up visits upon start-up of each subsequent pump.

3.03 FIELD TESTS

A. During the field tests, observations shall be recorded of head, capacity, and motor input. All defects or defective equipment revealed by or noted during the tests shall be corrected or replaced promptly at the expense of the Contractor, and if necessary, the tests shall be repeated until results acceptable to the Engineer are obtained. The Contractor shall furnish all labor, piping, equipment, and materials necessary for conducting the tests. A report of the field tests shall be submitted to the Engineer.

B. After installation of the pumping equipment, and after inspection, operation, testing and adjustment have been completed by the manufacturer's representative, each pump shall be given a running test in the presence of the Engineer, such tests as necessary to indicate that the pumps, motors, and drives generally conform to the efficiencies and operating conditions specified and its ability to operate without vibration or overheating. The pumps and motors shall operate at the specified capacities in the range of heads specified without undue noise or vibration. Any undue noise or vibration in the pumps or

motors, which is deemed objectionable by the Engineer, will be sufficient cause for rejection of the units.

C. A thirty-day operating period of the pumps will be required before acceptance. If a pump performance does not meet the Specifications, corrective measures shall be taken or the pump shall be removed and replaced with a pump which satisfies the conditions specified. All test procedures shall be in accordance with Hydraulic Institute Standards certified results of tests shall be submitted.

D. Provide, calibrate and install all temporary gauges and meters, shall make necessary tapped holes in the pipes, and install all temporary piping and wiring required for the field acceptance tests. Written test procedures shall be submitted to the Engineer for approval 30 days prior to testing.

E. Field Vibration Testing

1. *After installation and as soon as conditions permit full speed operation, and in the presence of the Engineer, have the vibration tests performed at 50 rpm speed intervals across the full range of operations in accordance with ANSI/HI 9.6.4 on each unit to (a) prove compliance with specified limitations, and (b) prove that there are no field installed resonant conditions due to misalignment, the foundation, or the connecting piping and its supports, when operating at any speed within the specified operating range.* ***(ADD #3)***

3.04 TRAINING

A. A factory representative shall provide a minimum of eight (8) person-hours of training to the Owner's operations staff concerning the recommended operation and maintenance of the equipment. Training shall be performed after substantial completion of the project with the use of operating equipment.

END OF SECTION

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SECTION 11435
OPEN-CHANNEL GRINDERS

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes Modular Open-channel Grinder with Solids Diverter, Support and Installation Frames and Controller.

1.02 REFERENCE STANDARDS

A. Equipment shall, as applicable, meet the requirements of the following industry standards.

B. ASTM International (ASTM):

1. ASTM A36 - Carbon Steel Plate.
2. ASTM A536 - Ductile Iron Castings.
3. ASTM A48 - Gray Iron Castings.
4. ASTM A564 Grade 630 condition H1150 (17-4) stainless steel.

C. American Iron and Steel Institute (AISI):

1. AISI Type 1020 Steel
2. AISI Type 1045 Steel.
3. AISI Type 4130 - Heat Treated Alloy Steel.
4. AISI Type 4140 Heat Treated Alloy Steel.
5. AISI Type 18-8 Stainless Steel.
6. AISI Type 303 Stainless Steel.
7. AISI Type 304 and 304L Stainless Steel.
8. AISI Type 316 and 316L Stainless Steel.

D. Society of Automotive Engineers (SAE):

1. SAE Type 660 Bearing Bronze.

E. National Electrical Manufacturer's Association (NEMA) Standards.

F. National Electrical Code (NEC).

G. Underwriters Laboratory (UL and cUL).

H. International Electrotechnical Commission (IEC).

1.03 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer is documented as being engaged in the sale of similar products for over forty-years.

2. Manufacturer is single supplier for equipment listed in this section.

3. Manufacturer's Service Center is located domestically for repairs and upgrades.

4. Manufacturer supports Renew Program, providing new factory-built replacements of selected products for install without requirement to return existing equipment.

5. Manufacturer supports Preventative Maintenance Program, providing inspection and service of equipment by Manufacturer's Factory Technicians.

6. Manufacturer stocks all non-custom spare Parts.

B. Regulatory Requirements:

1. Manufacturer is U.L. listed for the construction of controller.

C. Certifications:

1. Manufacturer's management system is ISO9001 certified.

1.04 SUBMITTALS

A. Submittal documentation is provided for approval in ".pdf" format.

B. Product Data:

1. Product description text.

2. Performance curves or capacity tables.

3. Catalog data.

C. Shop Drawings

1. General arrangement of installation.

2. Product Configuration.

3. Assembly.

D. Operation and Maintenance Manuals:

1. Submit one copy of a suitable operation and maintenance manual with shipment of product. An electronic version shall be supplied to create additional copies.

a. The manuals shall include but not be limited to the following: Equipment descriptions, operating instructions, drawings, troubleshooting techniques, recommended maintenance schedule, recommended lubricants, and recommended replacement parts list.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Packaging, Shipping, Handling, and Unloading

1. Packaged in containers or on skids suitable for normal shipping, handling, and storage.

2. Protected from rain, snow, impact, and abrasion while in the possession of the carrier.

B. Acceptance at Site

1. Contractor shall review the contents of the shipment at time of delivery and promptly notify the carrier and supplier of any discrepancies.

C. Storage and Protection

1. Equipment to remain in the packaging provided by the supplier until it is installed.

2. Equipment to be stored in a dry environment between 40 and 100 degrees F.

D. Waste Management and Disposal

1. Contractor shall be responsible for discarding all packaging materials in an environmentally friendly manner and in accordance with local regulations.

1.06 WARRANTY

A. Equipment and materials shall be guaranteed to be free of defects in workmanship, design, and/or materials for a period of one (1) year.

1.07 SERVICE

A. Supplier supports product with multiple programs options available.

1. Service Center located domestically for repairs and upgrades.

2. Renew Program: Provides new factory-built replacements of selected products for install without requirement to return existing products.

3. Preventative Maintenance Program: Inspection and service of equipment by Factory Technicians.

4. Spare Parts.

PART 2 – PRODUCT

2.01 MANUFACTURERS

A. JWC Environmental Inc, 2850 S. Red Hill Ave. Suite 125, Santa Ana, CA 92705; Tel: 800-331-2277; www.jwce.com, Or Equal.

1. Substitution requests will be considered in accordance with provisions in appropriate sections in Division 01 and the following conditions.

a. Manufacturers who deem their product comparable shall perform the following tasks at the sole expense of the manufacturer to be considered.

1) Submit certified documentation showing compliance with these specifications a within five days following the bid opening.

2) Alternative product must be listed in the Bid Form (Section 00410) with deductive alternative amount included.

2.02 OPEN-CHANNEL GRINDER WITH SOILDS DIVERTER

A. Open-channel Grinder with Solids Diverter comprised of individual Grinder and Solids Diverter, Support Frame and Channel Frame. Grinder using electric motor and speed reducer to provide low speed shaft rotation and high torque with individual cutters interleaved on two-counter rotating hexagonal shafts in a vertical configuration. Solids Diverter with rotating perforated screen using electric motor and speed reducer to rotate screen at a minimum 1/10th the RPM of the adjacent cutter shaft. Grinder and Solids Diverter connected by a support frame that allows the grinder, solids diverter, and frame to be lifted or moved as a single component. Support Frame with adjustable mechanism to optimize distance of Grinder cutters to surface of Solids Diverter perforated drum. Design allows Grinder and Solids Diverter to be removed and replaced individually for repair or replacement. Design allows Solids Diverter to be replaced with larger or smaller screen as needed with replacement of entire system.

B. Basis of Design:

1. Channel Monster Flex model# CMF6036 as manufactured and supplied by JWC Environmental Inc.

a. Maximum Design Flow Capacity: 28,080 GPM (40.44 MGD)

b. Cutter Stack and Perforated Drum Height: 60 inches

c. Perforated Drum Diameter: 36 inches

d. Cutter Stack Configuration: Multi Zone-Staggered and Helical

1) Zone 1 (Grit) Stack Height: Nominal 6-inches

2) Zone 2 (Working) Stack Height: Nominal 54-inches

2.03 GRINDER

A. Reduces solids conveyed in a wastewater stream to a size that is non-detrimental to downstream equipment. Grinder uses low speed and high torque drive with two counter-rotating shafts stacked with intermeshed individual cutters and spacers supported on both ends of each shaft with mechanical seal and bearing cartridges, driven by an electric motor and speed reducer.

B. Cutter Assembly

1. Stack Configuration: Multi-Zone-Staggered and Helical Stack

a. Cutters and spacers stacked with two defined zones, each with its own unique cutter and spacer type, thickness, stacking configuration, and material throughout zone. Zone 1 cutters for high abrasion resistance and Zone 2 cutter for shearing and particle size control.

b. Manufacturer shall provide any available feature for successfully cutting / shredding rags to a point they will not reform.

C. Zone 1-Grit Zone

1. Material Zone 1: Alloy Steel.

a. Cutters: Through hardened to 45-52 HRC.

b. Spacers: Through hardened to 34-52 HRC.

2. Cutters-Zone 1 (6-inch Grit Zone)-Staggered Stack

a. 7-tooth Cam style, 0.875-inch effective thickness, 4.710-inch diameter. Designed specifically for waste streams containing heavy volumes of solids.

b. Comprised of two precision ground individual cutter elements with a thickness tolerance of +.000/ -.001.

c. Keyed to shaft with hexagon opening.

3. Spacers-Zone 1(6-inch Grit Zone)

a. Smooth O.D. 0.892-inch thick, Alloy Steel.

b. Comprised of two precision ground individual spacer elements with a thickness tolerance of +.001/ -.000.

c. Keyed to shaft with hexagon opening.

4. Configuration-Zone 1 (Grit Zone)

a. Cutters and spacers form 6-inch nominal stack height.

b. Cutters stacked staggered with every other cutter's teeth aligned to minimize absorbed torque requirement and maximize cutter tooth force.

D. Zone 2-Working Zone

1. Material Zone 2: Alloy Steel.

a. Cutters: Through hardened to 45-52 HRC.

b. Spacers: Through hardened to 34-52 HRC.

2. Cutters-Zone 2 (Working Zone)-Helical Stack

a. 7-tooth Cam style, 0.438-inch thick, 4.710-inch diameter. Designed specifically for waste streams containing heavy volumes of solids.

b. Precision ground individual cutter elements with a thickness tolerance of +.000/ -.001.

c. Keyed to shaft with hexagon opening.

3. Spacers-Zone 2 (Working Zone)

a. Smooth O.D. 0.446-inch thick.

b. Precision ground individual spacer elements with a thickness tolerance of +.001/ -.000.

c. Keyed to shaft with hexagon opening.

E. Intermediate Shaft Collar with Vertical Support

1. Intermediate shaft collars, AISI 304 stainless steel housing, SAE 660 bearing bronze bushing and 17-4 PH rotating element.

2. Vertical Support with adjustable brackets for mounting of the shaft collars.

3. Vertical Support, AISI 304 stainless steel.

4. AISI 304 stainless steel grease fittings and grease lines attached to shaft collars and routed through Vertical Support.

5. Bushing and rotating element factory lubricated with high temperature marine grade grease.

F. Mechanical Seal and Bearing Cartridges-Severe Duty

1. Seals and bearing incorporated into a cartridge style design requiring no external seal flush or lubricants to operate wet or dry.

2. Rated for maximum operating depth: 346 feet (150 psi).

3. Secondary lip seal with grease barrier.

4. Dynamic and Static seal faces to be Tungsten carbide with 6% nickel binder.

5. Cartridge bushing and housing are AISI 304 stainless steel.

6. O-rings to be Viton (Fluorocarbon).

G. Shafts

1. 2-inch hexagon heat treated AISI 4140 alloy steel.

2. Minimum tensile strength of 170,000 psi.

3. Supported on either end by Mechanical Seal and Bearing Cartridges.

4. Cantilevered designs are not acceptable.

H. Compression Nut and Spring Disk

1. Compression Nut

   a. Stack nut sized to provide proper clamping force to secure cutting stack at manufacturer's recommended torque.

2. Spring Disk

   a. Spring element provides a preload of the cutter stack maintaining a clamping force securing the cutter from movement.

b. Disk or seat element prevents overloading of cutter stack by limiting distance spring element can be compressed.

I. End Housings, Side Rail, Screen Side Rail, Top Cover, Bottom Cover, and Gaskets

1. End Housings:

a. Cast integral bushing deflector directs solids away from Mechanical Seal and Bearing Cartridge bushings.

b. Directional flow arrows on side of housings indicate correct installation orientation for solids discharge.

c. Cast ASTM A48 Class 40 gray iron.

2. Side Rail

a. Evenly-spaced horizontal fingers and flow channels. Flows channel create additional open area through grinder increasing flow capacity. Horizontal fingers direct solids toward cutters by creating a pressure differential towards the cutters.

b. Shape of flow fingers creates a pressure gradient to force solids to cutters and minimize water head loss.

c. Fingers and flow channel are positioned on the upstream side of the grinder terminating even with the center of the cutter proving free discharge.

d. Side rails with flow channel running the entire length of the side rail are not allowed.

e. Cast ASTM A536-84 65-45-12 ductile iron.

3. Screen Side Rail

a. Opening allows Solids Diverter perforated drum to be positioned close to cutter's tooth tip.

b. Cast ASTM A536 65-45-12 ductile iron.

4. Top Cover:

a. Manufacturing identification plate mounting on surface.

b. Cast ASTM A48 Class 40 gray iron.

5. Bottom Cover:

a. ASTM A36 steel plate.

6. Gaskets:

    a. Cork and neoprene rubber.

J. Transfer Gears

1. Heat treated and hardened AISI 4140 alloy steel.

2. Number of teeth on gears creates ratio of cutter tip speed on low speed shaft to cutter tip speed of highspeed shaft greater than 0.90 and less than 1.00 to promote cleanout of processed material in cutting stack.

K. Couplings

1. Low Speed Coupling

    a. Two-piece 3-jaw interlocking design.

    b. Hardened AISI 4140 alloy steel.

2. High Speed Coupling

    a. Type L 3-jaw with elastomer.

    b. Buna-N spider.

L. Lifting Brackets

1. AISI 304 stainless steel.

M. Speed Reducer

1. Grease lubricated cycloidal design Cyclo Series 6000 with 29:1 reduction ratio.

2. Manufacturer: Sumitomo Machinery Corporation of America.

N. Motor

1. XPNV Immersible Explosion Proof Motor: Baldor Electric Company.

    a. Installed Horsepower: 10 HP.

    b. Motor Service Factor: 1.15.

    c. Minimum Motor Efficiency (at Full Load): 91.7 percent.

    d. Minimum Motor Power Factor (at Full Load): 87.

2. Performance:

a. Grinder Peak Torque with Reducer: 3,016 lb-ft.

b. Grinder Peak Force at Cutter Tip: 15,368 lbf.

c. UL rated NEMA 6P, Class I, Div. 1 Groups C&D, Class II Div. 2, Groups F&G, Class III Div. 1.

d. Manufacturer rating of 40 consecutive days of submergence at a maximum depth of 40 feet.

e. Capable of operating in air 100 percent of time with no external cooling required.

f. No fan cooling during operation.

g. Utilize ceramic shaft seal requiring no oil lubrication.

O. Identification:

1. Corrosion resistant nameplate affixed to top cover of Grinder.

2. Nameplate Information: Manufacturer's name and address, Model No., Serial No., Capacity, Max. psi, Weight, Manuf. Date.

P. Finishes:

1. Paint Coatings for Ferrous Materials: Prepared to SSPC-SP6 (Commercial Blast Cleaning) and coated with minimum 6 to 8 mils TDFT (total dry film thickness) of an aliphatic acrylic polyurethane paint in the color Hunter Green.

2. Paint Coatings for Previously Coated Components (Motors, Speed Reducers, etc.): Prepared to SSPC-SP1 (Solvent Cleaning) and SSPC-SP2 (Hand Tool Cleaning) and coated with minimum 6-8 mils TDFT (total dry film thickness) of an aliphatic acrylic polyurethane paint in the color Hunter Green.

2.04 SOLIDS DIVERTER

A. Cylindrically formed stainless steel perforated screen drum mounted vertically between two housings containing mechanical seals and bearing cartridges, driven by an electric motor and speed reducer. Solids captured on the surface of the rotating screen drum are conveyed to the cutters of the Grinder. Low RPM of screen drum allows cutters of Grinder multiple tooth passes to remove and reduce solid. Vertical brush sweeps perforations of screen drum keeping orifices free from buildup.

B. Perforated Screen Drum

1. Screen cylindrically formed using ½ inch diameter holes (Orifices) with a nominal 50% open area across the surface of the screen.

2. Maximum area of each orifice: 0.2 square-inches.

3. Screen deburred AISI 304 stainless steel.

4. Trunnions top and bottom of drum ASTM A564 Grade 630 condition H1150 (17-4) stainless steel.

C. Mechanical Seal and Bearing Cartridges-Severe Duty

1. Seals and bearing incorporated into a cartridge style design requiring no external seal flush or lubricants to operate wet or dry.

2. Rated for maximum operating depth: 346 feet (150 psi).

3. Secondary lip seal with grease barrier.

4. Dynamic and Static seal faces to be Tungsten carbide with 6% nickel binder.

5. Cartridge bushing and housing are AISI 304 stainless steel.

6. O-rings to be Viton (Fluorocarbon).

D. End Housings

1. Cast ASTM A48 Class 30 gray iron.

E. Shrouds and Covers

1. Shrouds

a. Glass bead blast and passivate AISI 304L stainless steel.

2. Cover

a. Manufacturing identification plate mounting on surface.

b. Glass bead blast and passivate AISI 304L stainless steel.

F. Drum Baffle/ Channel Seal and Brush

1. Drum Baffle

a. Glass bead blast and passivate AISI 304L stainless steel.

2. Channel Seal

a. Buna-N rubber 60A durometer.

3. Brush

a. Nylon bristles with PVC base.

G. Couplings

1. Low Speed Coupling

a. Two-piece 3-jaw interlocking design.

b. Hardened AISI 4140 alloy steel.

2. High Speed Coupling

a. Type L 3-jaw with elastomer.

b. Buna-N spider.

H. Lifting Brackets

1. AISI 304 stainless steel.

I. Speed Reducer

1. Grease lubricated cycloidal design Cyclo Series 6000 with 377:1 reduction ratio.

2. Manufacturer: Sumitomo Machinery Corporation of America.

J. Motor

1. XPNV Immersible Explosion Proof Motor: Baldor Electric Company.

a. Installed Horsepower: 1 HP.

b. Motor Service Factor: 1.15.

c. Minimum Motor Efficiency (at Full Load): 85.5 percent.

d. Minimum Motor Power Factor (at Full Load): 80.

e. UL rated NEMA 6P, Class I, Div. 1 Groups C&D, Class II Div. 2, Groups F&G, Class III Div. 1.

f. Manufacturer rating of 40 consecutive days of submergence at a maximum depth of 40 feet.

g. Capable of operating in air 100 percent of time with no external cooling required.

h. No fan cooling during operation.

i. Utilize ceramic shaft seal requiring no oil lubrication.

K. Identification:

1. Corrosion resistant nameplate affixed to top cover of Solids Diverter.

2. Nameplate Information: Manufacturer's name and address, Model No., Serial No., Capacity, Max. psi, Weight, Manuf. Date.

L. Finishes:

1. Paint Coatings for Ferrous Materials: Prepared to SSPC-SP6 (Commercial Blast Cleaning) and coated with minimum 6 to 8 mils TDFT (total dry film thickness) of an aliphatic acrylic polyurethane paint in the color Hunter Green.

2. Paint Coatings for Previously Coated Components (Motors, Speed Reducers, etc.): Prepared to SSPC-SP1 (Solvent Cleaning) and SSPC-SP2 (Hand Tool Cleaning) and coated with minimum 6-8 mils TDFT (total dry film thickness) of an aliphatic acrylic polyurethane paint in the color Hunter Green.

2.05 SUPPORT AND INSTALLATION FRAMES

A. Support Frame provides structure for mounting and mechanism for positioning of the Grinder and Solids Diverter combining the modules into one system for installation and removal. Design allows individual removal and replacement of the Grinder and Solids Diverter. Installation frame mounts into open channel and wet wells creating an interface for the support frame to insert. Design baffles solids to the system and provide structural support to hold the system in place.

B. Support Frame and Lifting eyes

1. Support Frame

a. Support Frame slides into Channel Frame guide slots positioning Grinder and Solids Diverter into channel without further fastening or assembly.

b. Mechanism for adjustment of the grinder to set the distance of the cutter teeth to the perforated drum of the Solids Diverter.

c. Designs that do not allow for adjustment of cutter teeth to screen are not acceptable.

d. AISI 304L stainless steel with a passivated bead blast finish.

2. Lifting Eyes

a. Galvanized steel.

b. Lifts system when motors not attached to Grinder and Solids Diverter.

c. Individual lifting of Grinder or Solids Diverter when motors and lifting brackets not attached.

C. Channel Frame

a. Mounts to channel walls with suitable anchors supplied by contractor for installation.

b. Fabricated of AISI 304L stainless steel with a passivated bead blast finish.

2.06 MOTOR CONTROLLER

A. NEMA enclosure with programmable logic controller (PLC), Operator Interface Terminal (OIT) for status information and operating parameter configuration, operation and fail indicators, and selector switches.

B. Basis of Design:

1. Model# PC2222 as manufactured and supplied by JWC Environmental, Inc.

a. Motor Controller Power Supply: 460 V/ 3 PH/ 60 Hz.

C. Enclosure, Selector Switches, Pushbuttons and Pilot Lights

1. Enclosure NEMA 4X

a. Fiberglass reinforced plastic (36 in. x 30 in. x 12 in.) with hinged door and mounting flanges.

b. Selector Switches:

1) Grinder

a) 22 mm, three-position, rated equal or better than the enclosure.

b) Indicate ON-OFF-REMOTE.

2) Screen

a) 22 mm, three-position, rated equal or better than the enclosure.

b) Indicate ON-OFF-AUTO.

c. Pushbuttons

1) EMERGENCY STOP

a) 22mm, maintained.

2) RESET

a) 22mm, momentary.

d. Pilot Lights:

1) 22 mm, LED (pilot lamp), rated equal or better than the enclosure.

2) Indicate POWER ON, GRINDER RUN, SCREEN RUN and FAIL.

D. Programmable Logic Controller

1. Basis of Design: Siemens S7-1200.

a. 100kB working memory.

b. (14) 24 Vdc inputs, (10) relay outputs.

c. (2) 0-10 Vdc analog inputs.

d. PROFINET interface.

E. Operator Interface Terminal

1. Basis of Design: Siemens KTP400

a. Key/ touch operation, 4 in. widescreen TFT (Thin Film Transistor) display.

b. 4 MB configuration memory.

c. PROFINET interface.

d. SD card slot.

e. NEMA 4X suitable for indirect sunlight.

F. Motor Starters, Overload Relays and Control Power Transformer:

1. Starters

a. IEC, full voltage, and reversing.

2. Overload Relays

a. Adjustable and sized to full load amperes (FLA) of the motor.

3. Control Power Transformer

a. Produce 120-volt AC power from the supply power. Sized and fused in accordance with code to accommodate the control power requirements.

G. Current Transducers

1. 0-10VDC analog output.

H. Operation:

1. Grinder Control: In accordance with ON-OFF-REMOTE selector switch setting.

a. OFF Position: Grinder will not run. Motor controller faults to be cleared with RESET pushbutton.

b. ON Position: Grinder will run forward.

c. REMOTE Position: Grinder operates as controlled by a remote start/stop dry contact.

2. Solids Diverter Control: In accordance with ON-OFF-AUTO selector switch setting.

a. OFF Position: Solids Diverter will not run. Motor controller faults to be cleared with RESET pushbutton.

b. ON Position: Solids Diverter will run forward.

c. AUTO Position: Solids Diverter operates as controlled by Grinder operation.

3. Emergency Stop: In accordance EMERGENCY STOP pushbutton depressed:

a. Control circuit de-energizes the PLC outputs to all motor starters, causing the coils of all motors starters to be de-energized.

b. Fail relay energizes. OIT will display message: [Emergency Stop Activated].

c. Emergency Stop condition only cleared locally by resolving the issue, resetting the EMERGENCY STOP switch and depressing the RESET pushbutton.

4. No current sensed at Grinder motor running condition: Controller will activate FAIL indicator and OIT will display message: [Grinder Fail to Run].

5. No current sensed at Solids Diverter motor running condition: Controller will activate FAIL indicator and OIT will display message: [Solids Diverter Fail to Run].

6. Grinder JAM Condition: Controller will stop the Grinder, reverse rotation of Grinder to clear the obstruction.

a. If obstruction is cleared, controller will return Grinder to normal operation.

b. If three reverses occur within a 30 second interval, controller will stop the Grinder and Solids Diverter motors, activate the FAIL indicator and relay. OIT will display message: [Grinder Jammed].

7. Solids Diverter JAM Condition: Controller will stop the Solids Diverter and reverse rotation to clear the obstruction.

   a. If obstruction is cleared, controller will return Solids Diverter to normal operation.

   b. If two reverses occur within a 30 second interval, controller will stop the Solids Diverter motor and activate the FAIL indicator and relay. OIT will display message: [Solids Diverter Jammed].

   c. Grinder will continue to operate.

8. Grinder MOTOR OVERLOAD Condition: Motors will be de-energized.

   a. The FAULT indicator lamp will be illuminated, and the FAIL contact will be closed. OIT will display message: [Grinder Motor Overload].

   b. Grinder and Solids Diverter will stop operation.

9. Grinder MOTOR OVERTEMP Condition: Motors will be de-energized.

   a. The FAULT indicator lamp will be illuminated, and the FAIL contact will be closed. OIT will display message: [Grinder Motor Overtemp.].

   b. Grinder and Solids Diverter will stop operation.

10. Solids Diverter MOTOR OVERLOAD Condition: Motor will be de-energized.

    a. The FAULT indicator lamp will be illuminated, and the FAIL contact will be closed. OIT will display message: [Solids Diverter Motor Overload].

    b. Solids Diverter will stop operation.

    c. Grinder will continue to operate.

11. Solids Diverter MOTOR OVERTEMP Condition: Motor will be de-energized.

    a. The FAULT indicator lamp will be illuminated, and the FAIL contact will be closed. OIT will display message: [Solids Diverter Motor Overtemp.].

    b. Solids Diverter will stop operation.

    c. Grinder will continue to operate.

12. Power Failure:

a. While System is Operating: System shall return to normal operation when power is restored.

b. While System is in a Fail Condition: System shall return to a fail state when power is restored. The fail state shall not be cleared until reset.

13. Reset of Grinder and Solids Diverter: Accomplished from the controller only.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Coordinate installation of the equipment in accordance with the manufacturer's installation instructions, approved submittals, and in accordance with OSHA, local, state, and federal codes and regulations.

3.02 FIELD QUALITY CONYROL

A. Inspection

1. The manufacturer is required to provide the services of a factory or manufacturer's representative for a minimum of one day to inspect the equipment for proper installation, apply power for the first time and check for proper motor rotation, oversee the initial introduction of material into the system and confirm the equipment operates as intended.

B. Training

1. Field training for operations, maintenance, and supervisory staff members is to be provided by a manufacturer or manufacturer's representative. Field instruction shall cover key components of the equipment, operating and maintenance requirements and troubleshooting techniques.

END OF SECTION

SECTION 14630

BRIDGE CRANES, OVERHEAD ELECTRIC, UNDER-RUNNING TROLLEY

PART 1 – GENERAL

1.01 SCOPE

A. The CONTRACTOR shall design, fabricate, and install a 3-ton capacity free-standing underhung single girder electric bridge crane system with under running trolley mounted hoist, conforming to MHI MH27.1 and CMMA 74 service class A, complete and operable, in accordance with the Contract Documents. The crane shall be designed for operation in an indoor environment, general purpose service meeting the requirements of ASME B30.16 and ASME B30.17. The crane must be pendant controlled and operate in the spaces and within the loading conditions indicted. Provide a crane, including hooks and hoisting rope or load chain, that can clear permanent obstructions in designated operating configurations. The pendant controller must be mounted on a separate festooned cable system from the trolley power supply. The crane shall operate on 460-volts AC, three phase power source. Maximum loading on the facility (without impact) due to dead loads, trolley loads, and lifted loads, with the trolley in any position, must not exceed maximum hanger loading for under running cranes.

1.02 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01300 - Contractor Submittals.

1. Shop Drawings

a. Submit drawings showing the general arrangement of all components in plan, elevation, and end views to demonstrate proper interface with the facility. Show all major features of the crane including hook approaches on all four sides, clearances and principal dimensions, hoist, trolley and bridge drives, motor nameplate data, overcurrent protective device ratings, and electrical schematic/wiring drawings. Include weights and centers of gravity of major components (e.g., bridge girder, trolley/hoist).

b. Submit shop drawings of all fabricated components. Shop drawing quality must be equivalent to the contract drawings accompanying this solicitation. Drawings must be reviewed, signed and sealed by a licensed professional engineer.

c. Provide Bill of Materials for crane components on each drawing. The schedule must provide a cross reference between manufacturer data and shop drawings. Components listed on the schedule of crane components must include total quantity, description, original manufacturer, and part number.

2. Test Reports

   a. Three copies of reports for field tests, describing the components tested; the type of test; procedures and instrumentation; and test results as required to demonstrate compliance.

3. Manufacturer's certification of proper Installation.

4. Manufacturer Qualifications: Submit documentation of number of installation and years of operational experience prior to submittal of the Shop Drawings.

1.03 QUALITY ASSURANCE

A. Manufacturer shall have at least 10 installations of similar complexity and equal or larger crane hook capacity with a minimum of 5 years operational experience.

B. Approved Vendors:

1) L.K. Goodwin Co., Inc.
20 Technology Way
West Greenwich, RI 02817

2) AFE Crane
1824 Lincoln Street
PO Box 487
Cedar Falls, IA 50613

3) Approved Equal

1.04 REFERENCE DRAWINGS

A. East Hickman Pump Station, dated March 2025, Sheets S001 through S010.

1.05 RESPONSIBILITIES

A. Vendor will furnish on this order:

1. All material necessary for the complete installation of the above-mentioned crane.

2. Complete controls.

3. Equipment operating instructions.

4. Drawings and parts lists as specified.

5. The complete system, including the installation, must conform to the applicable requirements of the latest edition of the following:

   a. Occupational Safety and Health Act (OSHA)

   b. State and Local Codes

   c. American Gear Manufacturers Standards (AGMA)

   d. American National Standards Institute (ANSI) B30.10 – Hooks

e. B30.11 – Underhung Single Girder Bridge Cranes B30.16 – Overhead Hoists (underhung)

f. HST-1M – Performance Standard for Electric Chain Hoists

g. HST-4M – Performance Standard for Overhead Electric Wire Rope Hoists

h. Crane Manufacturers Association of America (CMAA) – CMAA Specification #74, for electric underhung cranes

i. Hoist Manufacturers Institute (HMI)

j. HMI 100-74 Specifications for electric wire rope hoists

k. National Electric Manufacturing Association, Inc.

l. National Electric Code (NFPA 70)

m. Motors – NEMA MG-1

n. Control Enclosures – NEMA Rated

B. Site contractor will furnish the materials and labor for the following:

1. Complete installation of the crane and crane support system

2. Electric power service including local fused disconnect switch. Crane supplier shall provide all electrical connections and equipment located downstream of the local disconnect switch. Crane supplier shall determine the fuse size to be installed in the disconnect switch.

3. Painting as required

1.06 OPERATING CONDITIONS

A. The equipment will be operated in ambient temperatures ranging from 0 degrees F to 110 degrees F

B. The atmospheric conditions are classified as nonhazardous wet and humid.

C. Electrical classification: Area is non-hazardous, damp/wet, NEMA 4X

D. Electrical power characteristics: Power for operating the equipment will be supplied by a (460v (nominal), three-phase, 60hertz, 3 wire) connected circuit.

1.07 GENERAL SPECIFICATIONS

A. Hook Capacity - 3 Tons

B. Total Lift – 38 feet

C. Operating Speeds (Maximums)

1. Bridge: 120 feet per minute (VFD)

2. Trolley: 65 feet per minute (VFD)

3. Hoist: 16/2.6 feet per minute

4. Type of Control – ac control for pendant operation from the operating floor

   a. Bridge: Single

   b. Trolley: Single

   c. Hoist: Single

5. Type of Service

   a. Crane – CMAA Crane Service Class A

   b. Hoist – HMI 100-71 Hoist Service Class H3, H4

6. Heights

   a. Operating floor to hook in high position: 14'-3" (±)

   b. Operating floor to top of crane framing: 18'-7"

   c. Operating floor to underside of building ceiling: 20'-8"

      Operating floor to high point of crane bridge beam: 18'-5" (minimum 3" below low obstruction)

7. Length of runway: 36'-7"

8. Span between centerlines of runway beams: 6'-4"

9. Operating Acceleration (Maximum): Acceleration of any of the trolley or the bridge beam shall not exceed 3.0 feet per second squared.

1.08 CRANE RUNWAYS

Crane runway tracks shall be furnished by the steel contractor and shall be fabricated of w-beam sections. The lower section shall provide a smooth rolling surface. Runways shall be hung from the support steel on the column centerlines. Additional supporting steel will be provided where required, as specified by the steel design engineer. The crane vendor shall supply all accessories required for completing the

installation. Stops and bumpers shall be provided at the extreme of crane travel.

1.09 BRIDGE

A. The bridge shall consist of one precision rolled, patented track s-beam, w-beam section. Section shall be rigidly braced, and securely fastened to the end trucks to maintain proper alignment.

B. The end trucks shall consist of tube, structural sections bolted or welded to the bridge beam. A long wheelbase shall be provided for proper weight distribution. Each carrier shall be furnished with four hardened tread wheels equipped with antifriction bearings.

C. The bridge shall be motor-driven through gear reducer and shaft, using (2) gear reducers, known as A-4 drives. The drives shall be shock-free on starting and stopping. Safety lugs and bridge motor disk brakes shall be furnished on each carrier end truck.

1.10 TROLLEY

A. A monorail type carrier shall be furnished to support the hoisting equipment and operate on the bridge girder. Hardened tread wheels with antifriction bearings shall be provided.

B. The carrier shall be motor driven by a worm gear or spur gear drive unit. An electric brake shall be furnished on each drive. The drive shall be shock-free on starting and stopping. Safety lugs shall be furnished on the trolley.

C. The carrier shall be of welded steel construction. It shall be designed to transmit the imposed load to the bridge girder without undue deflection.

1.11 ELECTRIC WIRE ROPE HOIST

A. A hoisting machine of proper capacity shall be mounted on the trolley. It shall consist of a motor, gear reducer, hoist drum, sheaves, load block, hook and hoisting rope. An electric brake and mechanical load brake or high ratio worm drive shall be supplied on the hoist.

B. The motor shall be designed specifically for hoisting duty. The electric brake shall be of suitable size to promptly stop the motor rotation in either direction and hold the load.

C. The mechanical load brake shall be a Weston friction disc type or high ratio worm gear set w/ minimum ratio 60:1_ and be capable of holding and controlling the lowering speed of the load under all conditions.

D. Precision cut, full depth teeth, heat treated forged steel gears or centrifugally cast alloy bronze gear and heat-treated worm shall be used in the gear reducer. These gears shall be provided with oil bath lubrication and enclosed in a drip- proof case.

E. The hoist drum and sheaves shall be of large diameter to permit maximum rope life. The drum diameter shall be at least 20 times the rope diameter and shall be grooved to

provide for the entire lift without overlapping the rope. With the hook in its lowest position, at least two turns shall remain on the drum. The drum flanges shall be guarded so that the rope cannot wedge between the drum and the hoist frame.

F. A paddle or weight operated type upper final limit switch shall be provided to protect against hoisting beyond safe limits of travel. The switch system must be designed in such a manner that the switch operator mechanism cannot be over traveled and allow the switch to become inoperative.

G. A loading limit device shall be provided to prevent overstressing the system. This device shall reenergize the hoist motor and immobilize the up-circuit when an overcapacity lift is attempted. This switch must be set to overcome dynamic loading conditions but not exceed 125% rated capacity.

H. Geared upper and lower limit switches shall be furnished to restrict motion beyond the normal operating travel. These switch contacts shall be connected in the respective motor control circuits.

I. The hoisting rope shall be improved plow steel, of suitable diameter, with a factor of safety of at least five. Connection to the drum shall be made adequately and shall be easily detachable for replacement.

J. The load block shall be of the enclosed type and equipped with a swivel type safety latch hook.

1.12 MOTORS

A. All motors shall be rated for either hoist, trolley or bridge duty, totally enclosed, induction type, per NEMA MG-1. They shall be 460 volts, three-phase, and rated for 30-minute operation, Class "F" insulation under full load with a temperature rise not to exceed 80°C above an ambient temperature of 40°C. Service factor=1.0.

B. Motors shall be the standard type supplied by the hoist, trolley and crane component manufacturer.

1.13 CONTROL STATION

A. A pendant type pushbutton station shall be provided to control the motions of the bridge, trolley, projecting beam, and hoist. This station shall consist of buttons having the following marking:

1.	Bridge Forward	Marked North, East
2.	Bridge Reverse	Marked South, West
3.	Trolley Forward	Marked East, North
4.	Trolley Reverse	Marked West, South

5.	Hoist Up	Marked "Up"
6.	Hoist Down	Marked "Down"
7.	Start	Marked "Start"
8.	Stop*	Marked "Stop"

*Button to have red mushroom head

Where two speed control is specified, fast/slow buttons shall be incorporated into the above arrangement.

B. The pushbutton station shall be suspended on a bonded strain cable, from a festooned track mounted on the bridge, to a position 4"-0" above the operating floor level from the bottom of the station. It shall be possible to move the station along the bridge span independent of the trolley.

1. The pushbutton enclosure shall be of lightweight construction in accordance with Vendor's standard.

2. The pushbutton station shall consist of lightweight enclosure and a cover with button guards.

1.14 TRAVEL LIMIT SWITCHES

A. Limit switches shall be provided on the bridge, trolley, and wired into the respective control circuits to stop the driving motors at the extremes of travel. Triggers shall be provided by the crane manufacturer.

1.15 CURRENT CONDUCTORS

A. CONDUCTOR BAR

1. A four-bar, enclosed type conductor system, Duct-O-Bar, Conductix or approved equal, shall be provided along the full length of the runway. Three of these conductors will be used to supply electric power to the crane. The remaining conductor, colored green, will be used for equipment grounding.

1.16 CRANE CONTROL

A. Speed control shall be provided for all travel and hoisting motions as outlined in these specifications.

B. All single or two speed motions shall be controlled by across-the-line, reversing type motor starters, with an electronic trolley and bridge soft start.

1.17 ELECTRICAL WIRING

A. The complete electrical installation shall be made in accordance with the National Electric Code requirements and the conditions outlined in Paragraph 4.

B. All electrical equipment shall be mounted in NEMA Type 4. enclosures.

C. All wiring connections within the electrical control enclosures shall be made with 600-volt, 90 C machine tool wire. Wiring connections between control enclosures and other electrical devices shall be made with 600-volt conductors and run in rigid conduit. Liquid tight flexible metal conduit may be used to devices requiring position adjustment or run less than three feet. All wiring connections to electrical equipment in control enclosures shall be terminated on terminal strips with lugs or spades and properly identified. Open trays or unguarded wire conductors with zip tied wire bundles are not permitted.

D. Conduits shall be terminated at all enclosures and boxes in drilled holes or knockouts. Conduits one inch and smaller shall be fastened to the enclosure by the use of dished type lock nuts with trailing knife edge. Conduits, 1-1/4 inch and larger, shall be terminated in a threaded hub or an Appleton "HUB" fitting inserted in a drilled hole knockout. Insulated bushings shall be furnished on all conduit terminations. Threaded conduit fitting shall be used for all other connections.

E. Damp and Humid Atmospheres

1. Electric space heaters shall be supplied in all enclosures containing main control devices. A minimum of four watts per square foot of enclosure surface shall be provided. Heaters shall have a minimum rating of 240 volts and operate on 120-volt circuit. Heater power shall be derived from a fused control transformer in the crane controls. Separate source heater power will not be acceptable.

2. Drain/Breathers shall be supplied in motors and control enclosures.

1.18 EQUIPMENT DESIGN

A. All equipment furnished to vendor's standard design, which incorporates weldments, is to be welded in accordance with the appropriate codes and standards of the American Welding Society, D14.1.

1.19 PAINTING

A. All surfaces of the structural parts of the crane shall be finished in accordance with the environment and vendor's standard practice for that environment.

B. All surfaces of electrical and mechanical parts shall be finished in accordance with the vendor's standard practice.

1.20 INSPECTION AND TESTS

A. Inspection by an outside inspector during fabrication shall be permitted by the vendor. These inspections shall be performed to determine the general adherence to these specifications and to determine the quality of welding and painting provided.

B. Final acceptance will be made after the entire installation has been completed and a satisfactory trial has been made. All tests required to prove the ability of the crane shall be made by contractor. A vendor's representative is invited to attend.

1.21 WARRANTY

A. The vendor shall warranty that the materials and workmanship of the equipment installed under these specifications shall be first class in every respect and shall guarantee the equipment for a period of one year after installation against defective material and/or workmanship, ordinary wear and tear excepted.

1.22 GENERAL

A. Any other requirements not set forth in these specifications, but necessary for the safe and reliable operation of the equipment, shall be included.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 15010
GENERAL MECHANICAL PROVISIONS

PART 1 – GENERAL

1.01 SYSTEM DESCRIPTION

A. Consult Plans and Specifications in Division 15.

B. Drawings:

1. Drawings are schematic and show approximate locations of ducts, piping and equipment. Coordinate and field verify exact locations with other trades.

2. Obtain Engineer's approval for significant deviations from drawing locations and layout.

3. The Engineer reserves the right to make minor changes in the location of mechanical work or equipment prior to roughing-in without additional cost.

4. Examine the Contract Documents and immediately report any error, discrepancy or omission. The Engineer will determine which interpretation shall take precedence where two or more conflicting statements occur. Otherwise, the Contractor is responsible for the more stringent (or expensive) interpretation. In general, schedules, wherever they appear, supersede specifications, and specifications supersede plans.

5. Contractor shall make use of all data in all Contract Documents and shall verify this information at the building site. All Drawings of the Contract set are hereby made a part of these Specifications and shall be consulted by Contractor and his work adjusted to meet the conditions shown thereon.

1.02 QUALITY ASSURANCE

A. Materials, equipment and installation shall meet the requirements of the following as applicable:

1. American Gas Association (AGA)

2. American National Standards Institute (ANSI).

3. 3American Society for Testing and Materials (ASTM).

4. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).

5. American Society of Mechanical Engineers (ASME).

6. National Fire Protection Association (NFPA).

7. Sheet Metal and Air-Conditioning Contractor's National Association (SMACNA).

8. Underwriters Laboratories (UL).

B. All equipment shall bear the label of an approved independent testing laboratory (e.g. UL), where such standards exist.

C. All equipment shall be supplied with integral fusing as required for compliance with its listing.

D. Performance of work shall be in strict accordance with the best common practices of the trades involved, in a thorough, substantial, neat, and workman-like manner by competent, qualified workmen. No trainees or apprentice workmen shall be allowed at the job site unless under the direct, continuous supervision of a qualified journeyman. All work on HVAC, plumbing, fire protection or electrical systems shall be supervised and performed by individuals properly licensed, where required by state law, or as otherwise indicated in these Documents.

1.03 REGULATORY REQUIREMENTS

A. The work in this Division shall meet the requirements, as applicable, of the following Codes and regulatory bodies:

1. Kentucky Building Code (KBC).

2. Kentucky Department for Natural Resources and Environmental Protection.

3. Kentucky Department of Public Protection and Regulation, Department of Housing, Buildings, and Construction (State Fire Marshal, Plumbing Div., Building Code Enforcement).

4. Life Safety Code - NFPA 101.

5. Local Building Codes and Health Department.

6. Local Utility Regulations.

7. ANSI 17.1 Elevator Code as adopted by KBC.

8. Americans with Disabilities Act (ADA) - Where referenced, product design and installation shall meet minimum requirements of the Act.

B. Conformity with code requirements shall be maintained whether or not official inspections, fees or certificates are required due to project not falling under scope or jurisdiction of regulatory agencies.

1.04 REFERENCES

A. With regard to this Project and these Contract Documents, the following specific definitions shall apply:

1. "Furnish": To purchase and deliver products to the project site and prepare for installation.

2. "Install": To take furnished products, assemble, erect, secure, connect and place into operation.

3. "Provide": To furnish and install.

4. "Products": Includes materials, systems, equipment and accessories, as specified.

5. "Work": The providing of products for any or all of the entire Contract.

6. "Project": The sum total of all work by all parties, to be accomplished as directed in the Contract Documents.

7. "Documents", "Contract Documents": All Plans, Specifications, addenda, bid packages and any other enclosures, agreements or instruments specifically included in the Contract.

8. "Division(s)": Means the generally accepted subdivisions of the Specifications, usually according to the CSI scheme of organizing construction documents, such as Division 15 - Mechanical, Division 16 - Electrical, etc. Also refers to all work covered within the referenced Division(s) of the Specifications.

9. "Section(s)": Means the subdivisions of the "Division" of construction specifications, such as, under Division 15, Section 15010 - General Mechanical Provisions, etc. Also refers to all work covered within the referenced Section(s) of the Specifications.

10. "Engineer", "Architect", "E/A", "A/E": The engineering, architectural or architectural/engineering firm with design authority for the Project.

11. "Contractor": Means the General Contractor and also the Plumbing, Fire Protection, Controls, HVAC or any other Mechanical Contractor, individually or collectively.

12. "Concealed": Embedded in or installed behind walls, within partitions, above ceilings, in trenches, in tunnels and crawl spaces. Areas above lay-in ceilings, in crawl spaces or in service tunnels and trenches, other than stand-up utility tunnels, chases or vaults, may be considered concealed with reference to appearance or finish but not concealed with respect to accessibility. Check for specific exceptions.

13. "Exposed": Not installed underground or "concealed" as defined above. Generally, systems in all mechanical spaces, including mechanical or boiler rooms, stand-up or walk-thru chases and utility tunnels or vaults shall be considered to be exposed with respect to finish or accessibility requirements.

14. "Equivalent" or "Equal": In the opinion of the Engineer, acceptably comparable in concept, form, quality, performance and compatibility with the design.

15. "Mechanical": May refer to all mechanical trades, including HVAC, plumbing, fire protection, or may refer to HVAC work as opposed to say plumbing, the difference being necessarily taken from context.

16. "Plans", "Drawings": Mean all information presented in a drawing or graphical format, which have been included in the Contract, including but not limited to plans, sections, elevations, details, diagrams, schedules, notes, legends and addenda thereto.

17. "Specifications": Means all information pertaining to performing the Work, presented in text format and in the accepted organization of Divisions and Sections and in the addenda thereto.

18. "Addendum", "Addenda": Means information published after the original distribution of Documents (but before the Bid Opening), which may contain changes to Drawings, Specifications or the bidding process. Such information carries the same weight as if originally included in the Documents.

B. Abbreviations and Symbology:

1. Refer to the following references for any abbreviations, acronyms or symbols not defined in the Contract Documents:

   a. ASHRAE Fundamentals Handbook, current edition, chapter on Abbreviations and Symbols.

2. The following abbreviations may be used throughout the mechanical Documents. Refer also to legends or symbol lists on Drawings and to architectural abbreviations. Note that all abbreviations are not necessarily used.

A, AMP	Ampere	AFD	Adj. Freq. Drive
AV	Air Vent	AAE	Automatic Air Eliminator
AAV	Automatic Air Vent	ABV	Above
AC	Alternating Current, Air Conditioning	ACCU	Air Cooled Condensing Unit

AD	Access Door	ADDL	Additional
ADJ	Adjustable Adjacent	ARL	Above Roof Level
A/E	Architect/Engineer	AFF	Above Finished Floor
AHU	Air Handling Unit	ALT	Altitude, Alternate
AL	Aluminum	ANOD	Anodized, Anode
ALTN	Alternate	APPROX	Approximate
AP	Access Panel	ATM	Atmosphere
ARCH	Architect(ural)	AV	Acid Vent
AUTO	Automatic	AW	Acid Waste
AVG	Average	AWT	Average Water Temperature
AWG	American Wire Gauge		

BDD	Backdraft Damper	BHP	Brake Horsepower
BEL	Below	BOD	Bottom of Duct (Elevation)
BLDG	Building	BRK	Break, Breaker
BOP	Bottom of Pipe (Elevation)	BRZ	Bronze, Braze
BRKT	Bracket	BSMT	Basement
BS	Bird Screen	BTUH	BTU/HR
BTU	British Thermal Unit	BFP	Backflow Preventer
B	Board		

CAP	Capacity	CB	Catch Basin
CC	Center to Center	CD	Ceiling Diffuser
CEIL	Ceiling	CENT	Central
CFH	Cubic Feet/Hour	CFM	Cubic Feet/Minute
CHG	Charge, Change	CG	Ceiling Grille
CI	Cast Iron	CKT	Circuit
CLG	Cooling	CLO	Closet
CLR	Clear	CO	Carbon Monoxide

CO	Cleanout	CO2	Carbon Dioxide
COL	Column	COMP	Compound, Compressor (ed)
CONC	Concrete	CONFIG	Configuration
COND	Condensate, Condensation, Condenser	CONN	Connection
CONT	Control(s), Continuous	CONST	Construction
CPLG	Coupling	CONTR	Contractor
CT	Cooling Tower	COP	Coefficient of Performance, Copper
CTR	Center	CU	Copper, Condensing Unit, Cubic
CUH	Cabinet Unit Heater	CIRC	Circular
CW	Cold Water	CWR	Chilled Water Return
CWS	Chilled Water Supply	CR	Ceiling Register

D	Depth, Diameter, Differential	dB	Decibels
DB	Dry Bulb	DOUB	Double
DCW	Domestic Cold Water	DC	Direct Current
DET	Detail	DD	Direct Drive
DF	Drinking Fountain	DDC	Direct Digital Control
DHW	Domestic Hot Water	DG	Door Grille
DI	Double Inlet	DHWR	Domestic Hot Water Return
DIA	Diameter	DIFF	Diffuser
DIM	Dimension	DISC	Disconnect
DISC	Discharge	DL	Door Louver
DN	Down	DP	Double Pole
DS	Downspout	DT	Double Throw
DW	Double Width	DWG	Drawing
DWH	Domestic Water Heater	DWV	Drain, Waste and Vent
DR	Drain	DHBC	See HBC

E	East	EA	Each, Entering Air, Exhaust Air
EER	Energy Efficiency Ratio	EF	Exhaust Fan
EL	Elevation	EGW	Ethylene Glycol/ Water Mixture
ELEC	Electric	EMD	End of Main Drip
EMER	Emergency	ENTR	Entrance
ENT	Entering	EQUIP	Equipment

EQ	Equal, Equivalent	ET	Entering Temperature, Expansion Tank
EVAP	Evaporative	EWC	Electric Water Cooler
EW	Eye Wash	EXH	Exhaust
EWH	Electric Wall Heater	EXIST	Existing
EWT	Entering Water Temperature	EXT	Exterior, External, Extruded
EXP	Expansion, Exposed, Explosion	EAT	Entering Air Temperature
EDB	Entering Dry Bulb	ESP	Ext. Static Pres.
EWB	Entering Wet Bulb		

F	Fahrenheit Temperature	FEC	Fire Extinguisher Cabinet
FDN	Foundation	FH	Fire Hydrant
FE	Fire Extinguisher	FIG	Figure
FF	Fouling Factor	FL, FLR	Floor
FHC	Fire Hose Cabinet	FLEX	Flexible
FIN	Finish	FOR	Fuel Oil Return
FLA	Full Load Amps	FP	Fire Protection
FLUOR	Fluorescent	FPF	Fins Per Foot
FOS	Fuel Oil Supply Suction	FPM	Feet Per Minute
FPH	Frost-Proof Hydrant	FPS	Feet Per Second
FPT	Female Pipe Thread	FR	Frame

FTR	Finned Tube Radiation	FT	Feet
FCV	Flow Cont. Valve	FVC	Fire Valve Cabinet
FCU	Fan/Coil Unit	FSD	Fire/Smoke Damper
FD	Floor Drain, Fire Damper		
GA	Gauge	GAL	Gallon
GALV	Galvanized	GI	Grease Interceptor
GL	Glass	GND, GRD	Ground
GPD	Gallons Per Day	GPH	Gallons Per Hour
GPM	Gallons Per Minute	GR	Grade, Grille
H	Height, Horizontal	HBC	Ky. Dept. of Housing, Buildings, Const.
HT, HGT	Height	HB	Hose Bib
HIGH	Height	HD	Head
HEX	Hexagonal	HDWE	Hardware
HORIZ	Horizontal	HOA	Hand/Off/Automatic
HPR	High Pressure Steam Condensate Return	HP	High Pressure, Horsepower Heat Pump
HI	High	HPS	High Pressure Steam
HR	Hour	HS	Hair Strainer
HTG	Heating	HTR	Heater
HUH	Horizontal Unit Heater	HVAC	Heating, Ventilating and Air Conditioning
HVY	Heavy	HWR	Heating Hot Water Return
HW	Hot Water	HZ	Hertz = CPS = Cycles/Sec.
HWS	Heating Hot Water Supply		

ID	Inside Diameter, Inside Dimension	ID	Identification
IFB	Integral Face and Bypass Damper	IDENT	Identification

IN.Hg	Inches of Mercury	IN	Inches
INJ	Injection, Injector	INCAND	Incandescent
IND	Indirect Drain	INSUL	Insulation
IR	Infrared	IN.W.C., IN.W.G.	Inches of Water column
INV	Invert	IMC	International Mechanical Code

JT	Joint		
KIT	Kitchen	KV	Kilovolt
KVA	Kilovolt Amps	KW	Kilowatt
KWH	Kilowatthour	KBC	Ky. Bldg. Code

L	Long, Louver, Latent	LG	Length
LFS	Low Fire Start	LAV	Lavatory
LAT	Leaving Air Temperature, Latent	LIQ	Liquid
LP	Low Pressure, Liquified Petroleum (Gas)	LPR	Low Pressure Steam Condensate Return
LPS	Low Pressure Steam	LT	Light, Leaving Temperature
LTG	Lighting	LVG	Leaving
LWT	Leaving Water Temperature	LDB	Leaving Dry Bulb
LWB	Leaving Wet Bulb	LO	Low
LB, #	Pound		

MA	Milliampere	MATL	Material
MAN	Manual	MAX	Maximum
MAV	Manual Air Vent	MD	Manual Damper
MBH	Thousand BTU Per Hour	MECH	Mechanical
MET	Metal	MEZZ	Mezzanine

MFR	Manufacturer	MH	Manhole
MIN	Minimum, Minute	MISC	Miscellaneous
MK	Mark	MO	Motor-Operated, Month
MOD	Motorized Damper Modulating	MPH	Miles Per Hour
MPR	Medium Pressure Steam Condensate Return	MPS	Medium Pressure Steam
MS	Motor Starter	MPT	Male Pipe Thread
MTD	Mounted	MT	Mount
MV	Millivolt	MTG	Mounting
MCC	Motor Control Ctr.	MW	Megawatt
MACH	Machine		

N	North, Neutral	NPSH	Net Positive Suction Head
NEUT	Neutral	NC	Noise Criteria, Normally Closed
NIC	Not In Contract	NO	Normally Open, Number
NOM	Nominal	NTS	Not To Scale

O2	Oxygen	OA	Outside Air
OBD	Opposed Blade Damper	OD	Outside Diameter, Outside Dimension
OC	On Center (s)	OPN	Operation
OPP	Opposite	OPNG	Opening
OVHD	Overhead	OZ	Ounces

P	Pressure, Pump	PD	Pressure Drop
PERF	Perforated	PH	Phase
PIV	Post Indicator Valve	PL	Plate, Property Line
PLBG	Plumbing	PNEU	Pneumatic

PNL	Panel	PPM	Parts Per Million
PR	Pair	PRELIM	Preliminary
PRES	Pressure	PRI	Primary
PRV	Pressure Regulating Valve	PSC	Permanent Split Capacitor
PSF	Pounds Per Square Foot	PSI	Pounds Per Square Inch
PSIG	Pounds Per Square Inch, Gauge	PT	Plaster Trap, Point
PVC	Polyvinyl chloride	Ø	Phase
PCR	Pumped Condensate Return	POC	Point of Conn.

QT	Quart	QTY	Quantity
QUAL	Quality	QX	Heat Exchanger

R	Thermal or Electrical Resistance, Radius	RECT	Rectangular
RD	Roof Drain	RA	Return Air
RECIRC	Recirculating	RAD	Radius
RED	Reducing	RCP	Reinforced Concrete Pipe
REINF	Reinforced	RECOV	Recovery
REQD	Required	REG	Register Regulator
RH	Relative Humidity	REV	Revised, Revision
RND,Ø	Round	RM	Room
RPS	Revolutions Per Second	RPM	Revolutions Per Minute
RG, RAG	Return Air Grille	RWC, RWL	Rainwater Conductor
RF	Return Fan	RPZ	Reduced Pressure Zone (BFP)

S	South, Sensible	SW	Switch
SAN	Sanitary	SCHED	Schedule(d)

SCR	Silicon-Controlled Rectifier	SD	Smoke Detector, Storm Drain
SEC	Secondary	SECT	Section, Sector
SENS	Sensible	SERV	Service
SF	Square Feet, Supply Fan	SGL	Single
SH	Sheet	SG, SAG	Supply Air Grille
SING	Single	SHT	Sheet
SOL	Solenoid	SIM	Similar
SPEC(S)	Specification(s)	SP	Static Pressure, Space, Single Pole
SP.GR.	Specific Gravity	STRUCT	Structural
SQ	Square	ST	Sound Trap, Single Throw
SS	Stainless Steel, Sanitary Sewer or Storm Sewer (See Legend)	SWP	Steam Working Pressure
STD	Standard	STL	Steel
STM	Steam	STOR	Storage
STR	Straight	STRL	Structural
SUP	Support(ed)	SUSP	Suspend(ed)
SA	Supply Air	SYS, SYST	System
SCH	Schedule		

T	Temperature, Total	T&B	Top and Bottom, Testing & Balancing
TAB	Testing Adjusting & Balancing	TOT	Total
TD	Temperature Difference	TDH	Total Dynamic Head
TEFC	Totally Enclosed Fan Cooled	TEMP	Temperature, Temporary
TERM	Terminal	THK	Thick
THRU	Through	TYP	Typical

TG, TAG	Transfer Grille		

U	Overall Heat Transfer Coefficient	UGND	Underground
UH	Unit Heater	UR	Urinal
UTIL	Utility, Utilities	UV	Ultraviolet, Unit Ventilator
UC	Undercut		

V	Volts, Vent, Vertical, Velocity	VAC	Vacuum
VCP	Vitrified Clay Pipe	VEL	Velocity
VERT	Vertical	VENT	Ventilate (or), (ion), (e)
VOL	Volume	VSP	Vitrified Sewer Pipe
VTR	Vent Thru Roof	VSD, VFD	Variable Speed Drive
VUH	Vert. Unit Heater		
W	Waste, Water, Watt, West, Width	WB	Wet Bulb
WC	Water Column, Water Closet	WOG	Water, Oil or Gas
WG	Water Gauge	WH	Wall Hydrant
WL	Water Level	WO	Waste Oil
W/O	Without	WP	Working Pressure
WSHP	Water Source Heat Pump	WT	Weight
W/	With	WTR	Water

XFMR	Transformer	XBRA	Cross Bracing
XT	Expansion Tank	XFER	Transfer
XA	Transfer Air		

YD	Yard	YH	Yard Hydrant
YR	Year		

Z	Impedance		

C. Organizational Acronyms

AABC	Associated Air Balance Council
ACGIH	American Conference of Governmental Industrial Hygienists
ADC	Air Diffusion Council
AEE	Association of Energy Engineers
AFBMA	Antifriction Bearing Manufacturers Association
AGA	American Gas Association
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute
ARI	Air-Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
BOCA	Building Officials & Code Administrators International, Inc. (ICC)
CISPI	Cast Iron Soil Pipe Institute
CS	Commercial Standards (sometimes known as commodity standards') produced by the U.S. Department of Commerce
FM	Factory Mutual System
FS	Federal Specification
IBR	Hydronics Institute
ICC	International Code Council
IRI	Industrial Risk Insurers (Formerly FIA)
MIL	Military Specifications

MSS	Manufacturer's Standardization Society of the Valves and Fitting Industry
NBS	National Bureau of Standards
NEBB	National Environmental Balancing Bureau
NEC	National Electrical Code (NFPA)
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration or Occupational Safety and Health Act
PS	Product Standard, produced by U.S. Department of Commerce
SMACNA	Sheet Metal and Air Conditioning Contractor's National Association
SFPE	Society of Fire Protection Engineers
UL	Underwriters Laboratories, Inc.

D. Technique:

1. HVAC Metal Duct Standards - SMACNA
2. Industrial Duct Construction - SMACNA
3. Industrial Ventilation - ACGIH
4. Welding Pressure Piping - ASME

1.05 SUBMITTALS

A. Refer to Division 1 for submittal procedures and references.

B. Otherwise, submit 8 to 12 copies of information to the Engineer for approval. Check each Specification Section for all items to be included

C. Submit all required items within sixty (60) days of Contract date or Notice to Proceed, whichever is later, unless otherwise specifically instructed. Approval of the Engineer must be obtained to submit later on any item.

D. Submittals are required for all items of mechanical equipment and products provided by the Contractor which are called out in individual sections of the specifications. In general, do not submit product data on pipe, pipe fittings, sheet metal, sleeves, lubrication or packing unless specifically directed in these Contract Documents, but do submit schedules listing materials to be used.

E. All drawings or other material submitted on sheets larger than 8 1/2" X 11" (or 11" X 17" foldout) shall be submitted as one set of paper sepia or mylar sepia reproducibles and

one set of blueline prints. Corrections and approvals will be indicated on the sepias and returned to the Contractor for copying and distribution.

F. Submittals shall be referenced correctly to the appropriate Sections of the Specifications.

G. Manufacturer's catalog cuts, instead of complete shop drawings, may be submitted for all standard cataloged equipment, provided that the item required to meet the project specifications is not modified in any way from the standard catalog version of said item. Cuts shall be clearly marked to indicate the version of said item, including the exact size, type, rating, capacity, accessories, etc., of the item to be furnished. Do not use the term "furnished by others" or similar designations, as this may imply that the item is not being provided in the Contract.

H. No faxed (Facsimile Transmitted) material will be accepted for submittals and all drawings and text shall be clear original printed material or low-generation copies with no blurred, blotched or unreadable areas.

I. Bind shop drawings/catalog cuts in folders with a title sheet and identification on front of the folder. Allow space for Contractor, Architect and Engineer review stamps.

J. All submittals must bear the dated, handwritten signature of the Contractor and his stamp of approval before being considered for review.

K. See additional requirements in individual Sections of these Specifications.

1.06 SAMPLES AND MOCK-UPS

A. Samples of any product called for by individual sections of the specifications shall be delivered to the Engineer at the time of submittal on that item. Submittals, in those cases, will not be approved until the samples have been examined.

B. Where called for in the specifications, the Contractor shall construct a sectional mock-up of equipment installations using actual equipment or equipment cabinets of the type to be used for purposes of checking appearance, fit of piping, ductwork, controls or structural elements. Mock-ups shall be inspected and approved by the Engineer prior to release for shipment of the material in question.

1.07 CERTIFICATES, LICENSES AND FEES

A. The Contractor shall pay all fees, stand all required inspections, obtain all necessary licenses, and obtain all required certificates for the work at his own expense.

B. Certificates requiring display shall be suitably framed and mounted in the mechanical room or other appropriate location. Copies of the certificate shall be included in each copy of the maintenance and operating manuals.

C. Certificates not requiring display shall be delivered to the Engineer for transmittal to the Owner, and copies of the certificate shall be included in each copy of the maintenance and operating manuals.

1.08 PROJECT RECORD DOCUMENTS

A. Record Drawings

1. Comply with Division 1 for record document procedures and requirements.

2. Maintain and protect one complete set of drawing prints on job site to record any deviations from Contract drawings.

3. Neatly and correctly enter with multicolored pencils any deviations on drawings and keep drawings available for inspection.

   a. Record locations of concealed ducts, piping and valves.

   b. Record Addendum and Change Order items.

4. Record deviations made necessary to incorporate equipment different from base equipment specified.

5. Drawings shall be available at the site at all times for inspection by the Engineer during normal project working hours.

6. At completion of Project and before final approval, make any final corrections to drawings, certify to the accuracy of each print by signature thereon and deliver same to Engineer for approval and drafting.

7. Underground site utilities shall be located by survey. Actual inverts and elevations shall be recorded.

1.09 MAINTENANCE AND OPERATING MANUALS

A. Submit four (4) bound copies, 8-1/2" x 11", in hard back 3-ring binders to the Engineer for review and obtain receipt for delivery.

B. Format of the manual shall be as follows:

1. First page, Each Volume: Title of Project, Owner, Address, Date of Submittal, Name and Address of Contractor, Name of Engineer.

2. Second page, Each Volume: Index of manual contents.

3. First section: A copy of each shop drawing and reviewed submittal with an index at the beginning of the section. Include operating and maintenance instructions, wiring/control diagrams, spare parts lists for each type of equipment.

4. Second section: A list of all major equipment used on the job, together with supplier's name and address and servicing agency's name and address.

5. Third section: Copies of Contractor and manufacturer warranties.

6. Fourth section: Test and balance reports, construction test reports, start-up reports, water treatment reports.

7. Fifth section:

   a. Include a list of any special keys, tools and wrenches required for operation.

   b. Include a list of all lubrication procedures, special lubricants and equipment.

   c. Include a list of all tagged valves with tag number, valve description, location, and function. Include a revised flow chart, obtained from the Engineer to show valve identification.

C. No faxed (Facsimile Transmitted) material will be accepted for M & O submittals and all drawings and text shall be clear original printed material or low-generation copies with no blurred, blotched or unreadable areas.

D. Final payments cannot be made and Project cannot be closed out until Maintenance and Operating Manuals have been approved.

1.10 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Arrange deliveries of products in accordance with construction schedules to avoid conflict with work and site conditions.

1. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.

2. Immediately on delivery, inspect shipments to assure compliance with the requirements of the Contract Documents and approved submittals, and that products are properly protected and undamaged.

3. Provide equipment and personnel to handle products by methods to prevent soiling and damage to products or packaging.

B. Store products in accordance with manufacturer's instructions with seals and labels intact and legible.

1. Store fabricated products above the ground, on blocking or skids, prevent soiling or staining. Cover products which are subject to deterioration with impervious sheet coverings. Provide adequate ventilation to avoid condensation.

2. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specific conditions, and free from damage or deterioration.

3. Provide substantial coverings as necessary to protect installed products from damage. Remove when no longer needed.

1.11 ENVIRONMENTAL REQUIREMENTS AND EXISTING CONDITIONS

A. Locate existing utilities prior to beginning work. Reroute or replace existing utilities where necessary to permit installation of the work. Provide adequate means of protection during work operations. Repair existing utilities damaged during work operations to the satisfaction of the utility owner and at Contractor's expense.

B. Should uncharted or incorrectly charted piping or other utilities be encountered during work operations, notify the Engineer immediately for procedure directions. Cooperate with utility companies in maintaining active utilities in operation.

C. Contractor shall not remove or disturb any known or suspected existing hazardous materials in buildings, above ground or underground, except work performed in compliance with EPA requirements, as instructed in this Contract, including, but not limited to, asbestos, lead-based paints, PCB's and radioactive materials. If such materials are encountered during the course of the Work, the Engineer shall be immediately notified and the materials shall be avoided.

D. All materials removed from the site including scraps, construction materials, excavated or demolished materials shall be disposed of in a legal manner.

1.12 WARRANTY

A. The Contractor shall guarantee all work, both labor and products against defects and failure under normal use for the period of one year from the official date of Substantial Completion, the date of official acceptance by the Owner or the date of occupation by the Owner of the complete project area, whichever is earliest. The Contractor shall leave the entire installation in complete working order and free from any and all defects in materials, workmanship or finish. He shall repair or replace at his own expense any part that may develop defects due to faulty material or workmanship during construction and the warranty period and shall guarantee also to repair or replace with like materials any existing work of the building or equipment which is damaged during the repairing of such defective apparatus, materials or workmanship. The signing of the Contract for this Work, covered by these Documents of which they shall become a part, shall become a written guarantee on the part of the Contractor to carry out all the provisions of this Division of these Specifications.

B. Refer to Division 1 for other specific requirements.

C. Refer to each Section of Division 15 for additional requirements.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS, STANDARD PRODUCTS AND SUBSTITUTIONS

A. All material and equipment shall be new and in good condition. Refer to Division 1 for additional requirements.

B. Design is based upon a specific make and model of equipment. However, except where noted, the specifications are not intended to limit competition or the Contractor's option to use alternate products of equivalent concept, quality, and performance.

C. Products of alternate manufacturers listed may be substituted without approval prior to the Bid, if they are regularly catalogued items and meet the criteria of equivalence in concept, quality, and performance in the opinion of the Engineer. It is recommended that the opinion of the Engineer be solicited prior to the bid if there are any questions. This opinion does not guarantee approval of the submittals at a later time. In the case where the equipment is unfamiliar to the Engineer, all vendors desiring to furnish equipment other than that specified must submit, in addition to ordinary shop drawings, a complete verification specification for the substituted equipment along with catalogs, literature, wiring diagrams, piping diagrams, and a list of similar sized installations where the proposed equipment is installed. This information may be required to be presented immediately after the Bid and lack of information or of qualifications, as judged by the Engineer, may result in a Bid not being accepted.

D. All products which require submittals, whether design basis or otherwise accepted, must be formally approved by the Engineer before shipment to the job.

E. The Contractor is responsible for any and all costs for changes to the mechanical work or the work of other trades necessitated by the optional substitution of approved alternate equipment. Approval of alternate equipment or modifications to the plans by the Engineer are not to be construed as relief from this responsibility. In the case of significant modification to the design, the Contractor may also be required to pay for the cost of design review and/or redesign by the Engineer.

F. Listing: The successful bidder shall furnish to the Engineer within one hour of the Bid opening, or as indicated in bidding instructions, a list of all major items of mechanical equipment to be provided, indicating the manufacturer and the general type. List shall include all items of major equipment such as boilers, chillers, towers, pumps, tanks, air handlers, packaged equipment, controls, plumbing fixtures, or other items to which whole Sections of Specifications are devoted. Do not include piping, sheet metal, small specialty items or the like unless specifically requested. In addition, a list of all Subcontractors to be involved in the project shall be furnished to include, in addition to the prime mechanical contractor, as a minimum, the plumbing, pipe fitting, sheet metal, controls, water treatment, thermal balancing, insulating, fire protection and asbestos removal subcontractors, as utilized in the project. Any list of required items included in the Bid Form, Instructions to Bidders or other Bid documents shall supercede these items. Changing manufacturers or subcontractors after the listing will not be acceptable,

unless initiated by the Owner or the Engineer. Final acceptance of the bids is contingent upon submission and approval of these lists.

2.02 QUANTITIES AND COMPLETENESS

A. Items may be referred to as singular or plural on drawings and specifications. Contractor is responsible for determining quantity of each item.

B. All components required for the complete installation and legal, proper and safe operation of equipment and systems indicated in the Documents shall be provided by the Contractor. Optional accessory items shall be included only as specified.

2.03 TESTING AND CERTIFICATION

A. Conduct tests and adjustments of equipment as specified and necessary to verify performance requirements. Submit test data to the Engineer. Pay all fees involved in required testing of equipment.

B. Provide necessary personnel and testing instruments required to perform test(s) of installation.

C. Refer to individual Sections for additional requirements.

D. Submit copies of all test reports, manufacturer's certifications and inspection reports to the Engineer. Include copies of each in each copy of the Maintenance and Operating Manual (Section 15010, Paragraph 1.10).

2.04 NOISE AND VIBRATION

A. Equipment shall be free of unusual or excessive noise and vibration in the opinion of the Engineer. No amount of rattling of loose, improperly isolated or ill-fitting parts will be acceptable. Vibration transmitted to the structure shall be reasonable and within recognized and specified limits.

2.05 HAZARDOUS MATERIALS

A. No materials or products containing known regulated hazardous materials shall be used in the Project, including asbestos, paint containing lead or products containing PCB's in amounts grater than current standards allow.

B. No solder containing lead shall be used on the Project.

C. Chemical products used in the construction process or for water treatment purposes shall be used in a manner in complete compliance with all OSHA and EPA regulations and guidelines. Formal Material Safety Data (MSD) Sheets shall be provided for each product used and shall be posted in the work area most accessible to the place of use of the product. In addition, MSD sheets shall accompany and be attached to water treatment products from the time they arrive on site through the end of Warranty.

PART 3 – EXECUTION

3.01 TEMPORARY SERVICES

A. Refer to Division 1 for specific requirements, responsibilities and methods for temporary water service, sanitation, heat and ventilation.

3.02 COORDINATION

A. The Contractor is responsible for sequencing of the work and coordination with all trades to prevent delays in the project. No extras will be allowed for changes made necessary by interference of work between trades.

B. Carefully check and coordinate location and level of all pipes, ducts, etc. Run preliminary levels and check with all trades so that conflicts in all locations may be avoided. Contractor shall rough sketch sections through the corridors or other tight mechanical/electrical spaces when requested to do so, in order to show that any possible conflicts have been resolved among all the trades. Where conflicts occur, if any, the following preference schedule shall be followed:

1. Recessed electrical light fixtures.
2. Sanitary and storm drainage piping on critical grade.
3. Ductwork.
4. Large HVAC or domestic water mains.
5. Sprinkler piping.
6. Communications wireway
7. Small HVAC piping.
8. Domestic water piping.
9. Electric and communications conduits.

C. Ductwork or Heating Main: No ductwork or heating main shall have preference over plumbing lines below plumbing fixtures, or over electrical conduits above or below electric switchgear and panels. No piping conveying fluids shall be installed directly over electrical equipment.

D. Unless otherwise indicated, coordinate all work with the arrival of materials on the site to prevent unnecessary delays between demolition or other preliminary phases of work and the installation of new materials. Periods of abandonment of work area, once work has begun shall be avoided unless necessary to allow other trades to complete their work.

E. The storage of materials on site shall be minimized. Materials delivered to the site far in advance of construction, and/or exposed to weather, mud or construction abuse for long periods, will not be eligible to be included in pay requests, and will be accepted for use in the project at the time of construction based upon condition at that time. Generally, rusted, beat-up products, including large equipment, will not be accepted for use.

3.03 INSPECTIONS

A. The Engineer or his representative may inspect the work at any time and for any reason, but, generally, inspections will be arranged to coordinate with phasing of the work and with regularly scheduled Project meetings. The Engineer will attempt to accommodate the Contractor where possible, but in general, it is the Contractor's responsibility to schedule the work in such a manner that inspections are not required more often than the regular meetings, except for substantial completion and final inspections.

B. No work shall be permanently concealed (underground, behind drywall or masonry, or any other inaccessible location) without being inspected by the Engineer or his representative, unless specific permission is granted to do so by the Engineer.

C. In general, piping and ductwork must be inspected by the Engineer or his representative before insulation is applied, unless specific permission to do otherwise is given by the Engineer.

D. The Contractor shall supply lights, ladders, tools, equipment and assistance to the Engineer, as required, for performing inspections and verifying the operation of mechanical systems.

3.04 CONCRETE WORK

A. Provide all concealed concrete work required for Division 15, including but not limited to pipe and duct anchors, foundations and encasement, inertia bases, and pads. Coordinate with other divisions.

B. Equipment pads, slabs and bases exposed to view and not part of the building structure (see architectural/structural plans) shall be provided by the Contractor. Coordinate with other divisions. The Contractor shall locate, dimension and furnish sleeves and anchors as required.

C. Concrete shall conform to Division 3 requirements.

3.05 PROTECTION

A. Protect equipment and materials during construction from damage from water, dirt, welding and cutting, spatters, paint droppings, etc., by use of shield and drop cloths. Damaged equipment or materials shall be repaired or replaced by the Contractor. Rusting, corroded or damaged materials or equipment is not acceptable, whether installed or not.

B. Products stored outside or in unheated spaces shall be covered with water-proof drop cloths or tarpaulins. Condensation shall be prevented by heating and ventilating. Method shall be acceptable to the Engineer. (See Section 15010, Paragraph 1.11).

C. During construction, maintain all materials and equipment in an orderly manner.

D. Protect floors from soiling and damages caused by tools, chips, cutting oil, pipe compound, paint and the like.

E. The Contractor shall use OSHA-approved ladders and lifts for Division 15 work. Workmen shall not be allowed to stand or sit on the unprotected surfaces of insulation, equipment jackets, conduit, control panels or any other location not intended for traffic.

3.06 CUTTING AND PATCHING

A. Avoid cutting of concrete, masonry and other finished work by use of sleeves and inserts.

B. Perform cutting and patching required for installation of the work. Methods and procedures shall be acceptable to the Engineer. Obtain written permission before any cutting.

C. Cut holes through concrete, brick, tile, etc., when necessary, by rotary core drilling or masonry saw.

D. Damages, patches, or work in areas previously finished under the work of other Divisions shall be repaired at the expense of the Contractor and to the satisfaction of the Engineer.

3.07 CLEANING

A. Upon completion, ductwork, piping and equipment shall be thoroughly cleaned of dirt, grease, rust and oil, primed where necessary, and left ready for painting. Vacuum clean the inside and outside of fan plenums, air handling units and equipment cabinets. Vacuum clean coils and comb out damaged fins.

B. Clean galvanized piping and ductwork in exposed areas with diluted acetic acid.

C. Clean copper piping in exposed areas with emery cloth and solvent.

D. Clean gauges, thermometers, traps, strainers and fittings.

E. Install new filters in throwaway and replaceable filter frames. Properly clean permanent filters.

F. Upon completion of Work, the Contractor shall remove all resulting rubbish, debris, and surplus materials from the premises, together with all disused instruments and equipment and shall leave the site in a neat, clean, and acceptable condition as

approved by Engineer. Contractor shall maintain Work areas of existing facilities in a reasonably clean condition on a daily basis, and shall not allow debris to create operational or safety problems for the Owner.

3.08 PAINTING AND FINISHING

A. Painting shall meet the requirements of Section 09961.

3.09 ACCESS

A. Equipment has been chosen to properly fit into the physical spaces provided and indicated, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearance in accordance with Code requirements. Physical dimensions and arrangements of equipment to be installed shall be subject to Engineer approval. Submit shop drawings of equipment layout for approval where it does not comply with plans.

B. Space Requirements: In the preparation of Drawings, a reasonable effort has been made to include all equipment manufacturer's recommendations. Since space requirements and equipment arrangement vary according to manufacturer, the responsibility for initial access and proper fit rests with the Contractor. The final arrangement of equipment and service connections shall allow the unit to be serviced. This shall include space to pull motors, filters, coils, tubes, etc. Contractor shall demonstrate that proper access has been provided to inspectors.

3.10 CONSTRUCTION DIRT, DUST AND NOISE CONTROL

A. All cutting or drilling of concrete, masonry, steel or wood shall be performed with absolute control of dirt and dust resulting from the cutting or drilling operation. Workers performing operations or in the immediate vicinity shall wear OSHA approved protective equipment.

B. The Contractor is required to minimize construction noise levels in all locations adjacent to or in occupied areas.

C. The Owner reserves the right to prevent use of any tools which cause detrimental vibration or noise.

3.11 TRAINING

A. Training and instruction to the Owner shall be provided for all Division 15 equipment, systems and controls. See individual Sections for additional specific requirements. Contractor shall submit a training agenda to the Engineer for approval, prior to Substantial Completion, including a proposed schedule, all items to be covered and who is to make the presentations. If the Owner chooses to decline training, or any part thereof, the Contractor will credit the Project for the cost of any unused hours of training

and instruction. Contractor shall keep record of attendance at the training sessions and submit to the Engineer upon completion.

B. Instruction shall be based upon material in the Maintenance & Operating Manuals, described above, which shall be approved by the Engineer, prior to the training. Any supplemental information required shall be provided by the Contractor.

C. Training and instruction to the Owner shall be video recorded at the Contractor's expense, in DVD format, and the original and one copy shall be submitted to the Engineer for approval, prior to Project Closeout. Video is not required to be made by professional photographers, but shall show technical competence, with clear pictures and sound, and useable for future personnel training by the Owner.

3.12 LEAKS

A. During the time period from date of Contract until termination date of the guarantee, Contractor shall be responsible for damages to the building, grounds, walks, roads, piping systems, insulation, electrical systems, refrigeration, heating, ventilating and air conditioning systems, building equipment, furniture, and other building contents caused by leaks in piping systems or equipment being installed or having been installed by him. All repair work shall be done as directed by, and in a manner satisfactory to the Engineer and at no cost to the Owner.

END OF SECTION

SECTION 15015
SLEEVES AND PENETRATIONS

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Provide sleeves for all piping passing through walls, partitions, beams, floors, and roof in new masonry and concrete construction above grade or in basements. Holes through existing masonry or concrete construction shall be core drilled.

B. Use sleeves where round or oval duct openings are required through exposed walls, smoke or fire walls, and equipment room walls.

C. The Contractor is responsible for correct location, size, and delivery of the sleeves so as not to delay construction. If sleeves are not properly installed and cutting and patching becomes necessary, it shall be done at no expense to the Owner by parties approved by the Engineer. Contractor shall undertake no cutting or patching without first securing the Engineer's written approval.

D. Provide seals and collars for rectangular duct penetrations of walls and floors. Coordinate openings with other divisions.

E. Provide flashings or pitch pockets where required around structural roof curbs or frames (See Section 15090 - Hangers, Supports and Anchors) for mechanical equipment.

F. Provide flashings or curbs for piping or duct penetrations of the roof.

PART 2 – PRODUCTS

2.01 SLEEVE MATERIAL

A. Sleeves up thru 8" diameter shall be Schedule 40 steel pipe, machine cut, and galvanized.

B. Sleeves, 10" diameter and larger, shall be fabricated from 10 gauge steel sheet, continuously welded seams and galvanized.

C. A pipe sleeve shall be one size larger than the size of pipe it serves, or 1/2" all around. Insulated pipe shall have sleeves 1/2" or larger all around than insulation, except for penetration of fire-rated assemblies. Sleeves set in concrete floors shall extend 1 1/2"-2" above the finished floor.

2.02 WATERTIGHT SEALS

A. Provide for outside and underground wall and floor penetrations.

B. "Linkseal" by Thunderline Corporation or approved equivalent as alternate to above. Provide correct sleeve size to match.

2.03 ESCUTCHEONS (EXCEPT REFRIGERANT PIPING)

A. Provide heavy chrome-plated or nickel-plated plates of approved pattern on pipe passing through walls and ceilings in finished areas. Escutcheons shall be chrome-plated steel plates with concealed hinges. Pattern shall be approved by the A/E, and shall be firmly held on pipe by springs or set screws.

2.04 FLASHINGS

A. Provide galvanized, stainless steel, or copper flashings and storm collars or counter-flashings for pipes and ducts penetrating the roof or outside walls.

B. Provide seamless lead flashings or previously approved alternate flashings for plumbing vents which are in compliance with the plumbing code of the project jurisdiction.

C. For all other piping penetrations, furnish minimum 4 pound lead or 16 oz. copper flashing assembly with minimum 8" skirt, and permaseal waterproofing compound.

PART 3 – EXECUTION

3.01 SLEEVE INSTALLATION

A. Size sleeves to provide 1/2" minimum clearance all around passing pipe or pipe insulation. Insulation shall be continuous through sleeves unless prohibited by Code.

B. Fill space around ducts and pipes in sleeves in exposed areas and through slabs, fire walls and partitions with non-flammable sealing compound equal to Dow Corning Silicone RTV Foam. Except on the wall penetrations associated with he wet well connector piping. See Drawings for notes.

C. Close off all openings around rectangular ducts through walls with sheet metal collars and sealing compound.

D. Sleeves in above grade floors of equipment rooms, and utility rooms shall extend 2" above floor and be cut flush with underside of floor construction.

E. Sleeves through walls shall be cut flush with each surface.

F. Install sleeves plumb and true to line, grade and position.

G. Unused sleeves shall be plugged and finished to match adjacent surface.

H. Sleeves and seals are not required on ducts passing through walls above ceilings, except for fire walls, if the penetrations are neatly cut. Rough, jagged or oversized penetrations will be provided with sleeves and patched.

I. Sleeving is not required for piping passing through underground foundation walls and footings except as required for sealing method.

J. Pipe sleeves penetrating outside walls shall be packed with insulating material, sealed and made waterproof. Option: Watertight seals specified above. Check for details.

K. Where a pipe passes through a sleeve, no joint in the pipe (or its insulation) shall touch the sleeve or be inside it.

L. Install all roof curbs and flashings required for mechanical equipment, including repair of existing roofs. For new work coordinate roof penetrations with Division 7 Sections rented to roofing.

M. Extend all pipes a minimum of 12" above finished roof line.

END OF SECTION

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SECTION 15022
LUBRICATION AND PACKING

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Lubricate all equipment with correct grade, type and quantity of lubrication before placing equipment into service.

B. Damages caused by not providing proper lubrication shall be repaired at the Contractor's expense.

PART 2 – PRODUCTS

2.01 LUBRICANTS

A. Provide manufacturer's recommended specific lubricants.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Each shaft or valve stem containing a packing gland shall be checked for condition and examined for proper packing.

B. Maintain all lubrication and packing seals during construction, and assure that all are operating properly at the time of final acceptance.

C. When filling systems initially for hydrostatic pressure tests, adjust valve packing glands to fingertight, and allow packing to absorb water for 5 minutes prior to tightening packing nuts.

D. All rotating pieces of equipment shall be properly lubricated prior to start-up. Damage to shafts, bearings, seals, etc., caused by lack of proper lubrication or over-lubrication shall be repaired by the Contractor. Items requiring factory start-up shall have their lubrication verified by the manufacturer's representative.

E. Where necessary, provide means for lubricating all bearings and other machine parts. If a part requiring lubrication is concealed or inaccessible, extend a lubrication tube with suitable fitting to an accessible location and suitably identify it.

F. A list of all Division 15 items requiring periodic lubrication shall be included in the bound reference manuals prepared at the end of the job. List shall include equipment

identification, lubricant type required, special tools, if any, required for application and manufacturer's recommendations for period (Section 15010).

END OF SECTION

SECTION 15060

PIPE AND PIPE FITTINGS - GENERAL

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Pipe, fittings, and connections.

B. Unless otherwise indicated in the Documents, these specifications cover all mechanical piping on the Project, including site work. Should specifications for site mechanical piping appear in other Divisions of the Specifications, they shall supercede this Section for the exterior portion of the work only and the work of this Section shall only include piping to five ft. outside the building for those systems so specified.

1.02 RELATED WORK, AS INCLUDED

A. Section 15080: Piping Specialties - General

B. Section 15090: Hangers, Supports and Anchors

C. Section 15095: Expansion Compensation and Vibration Isolation.

D. Section 15100 - Valves

E. Section 15410 - Plumbing Piping

F. Section 15535 - Refrigeration Piping and Specialties

1.03 REFERENCES

A. Note that any one reference may not apply to a given portion of the work. See other Sections for piping types required for each system. References shall always be assumed to mean the current or most recent edition, unless otherwise indicated.

1. ANSI/ASME SEC. - Boilers and Pressure Vessels VIIID Code, Rules for Construction of Pressure Vessels, with addenda.

2. ANSI/ASME SEC. - Boilers and Pressure Vessels Code, IX Welding and Brazing Qualifications, with addenda.

3. ANSI/ASME B1.1 - Unified Screw Threads

4. ANSI/ASME B2.1 - Pipe Threads (Except Dry Seal)

5. ANSI/ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, 25, 125, 250, and 800 pounds

6. ANSI/ASME B16.3 - Malleable-Iron Threaded Fittings Class 150 and 300.
7. ANSI/ASME B16.4 - Cast Iron Threaded Fittings, Class 125 and 250.
8. ANSI/ASME B16.5 - Steel Pipe Flanges and Flanged Fittings
9. ANSI/ASME B16.9 - Factory-Made Wrought Steel Buttwelding Fittings
10. ANSI/ASME B16.11 - Forged Steel Fittings, Socket Welded and Threaded
11. ANSI/ASME B16.18 - Cast Copper Alloy Solder-Joint Pressure Fittings
12. ANSI/ASME B16.20 - Ring-Joint Gaskets and Grooves for Steel Pipe Flanges
13. ANSI/ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges
14. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
15. ANSI/ASME B16.24 - Bronze Pipe Flanges and Flanged Fittings
16. ANSI/ASME B16.25 - Buttwelding Ends for Pipe, Valves and Fittings.
17. ANSI/ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes
18. ANSI/ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings - DWV
19. ANSI/ASME B18.2.1 - Square Head Bolts and Screws
20. ANSI/ASME B18.2.2 - Square and Hex Nuts
21. ANSI/ASME B31.1 - Power Piping
22. ANSI/ASME B31.5 - Refrigeration Piping
23. ANSI/ASME B31.9 - Building Services Piping
24. ANSI/ASME B36.10 - Welded and Seamless Wrought Steel Pipe
25. ANSI/ASME Z49.1 - Safety in Welding and Cutting
26. ANSI/ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc- Coated, Welded and Seamless
27. ANSI/ASTM A74 - Cast Iron Soil Pipe and Fittings
28. ANSI/ASTM A105 - Forgings, Carbon Steel, For Piping Components

29. ANSI/ASTM A106 - Seamless Carbon Steel Pipe for High-Temperature Service

30. ANSI/ASTM A120 - Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized), Welded and Seamless, for Ordinary Uses

31. ANSI/ASTM A126 - Gray Iron Castings for Valves, Flanges and Pipe Fittings

32. ANSI/ASTM A135 - Pipe, Steel, Black, Electric Resistance Welded

33. ANSI/ASTM A194 - Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service

34. ANSI/ASTM A197 - Cupola Malleable Iron

35. ANSI/ASTM A216 - Steel Casings, Carbon, Suitable for Fusion Welding, For High Temperature Service

36. ANSI/ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

37. ANSI/ASTM A307 - Carbon Steel Externally and Internally Threaded Standard Fasteners

38. ANSI/ASTM A395 - Ferritic Ductile Iron Pressure Retaining Castings for Use at Elevated Temperatures

39. ANSI/ASTM A795 - Specification for Black and Hot-dipped Zinc Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Prevention Use

40. ANSI/ASTM B32 - Solder Metal, 95-5 (Tin-Antimony - Grade 95-5TA).

41. ANSI/ASTM B36.10M - Wrought Steel Pipe

42. ANSI/ASTM B75 - Seamless Copper Tube

43. ANSI/ASTM B88 - Seamless Copper Water Tube

44. ANSI/ASTM B140 - Flexible Metal Hose

45. ANSI/ASTM B251 - General Requirements for Wrought Seamless Copper and Copper Alloy Tube

46. ANSI/ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

47. ANSI/ASTM B813 - Fluxes for Soldering Applications of Copper and Copper Alloy Tube

48. ANSI/ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe

49. ANSI/ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets

50. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings

51. ASTM C700 - Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated

52. ANSI/ASTM D1784 - Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride (CPVC) Compounds

53. ANSI/ASTM D1788 - Rigid Acrylonitrile-Butadiene-Styrene (ABS) Plastics

54. ANSI/ASTM D2104 - Polyethylene (PE) Plastic Pipe, Schedule 40

55. ANSI/ASTM D2146 - Polypropylene Plastic Molding and Extension Materials

56. ANSI/ASTM D2235 - Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings

57. ANSI/ASTM D2564 - Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings

58. ANSI/ASTM D2657 - Heat Joining of Thermoplastic Pipe and Fittings

59. ANSI/ASTM D2680 - Acrylonitrile-Butadiene-Styrene (ABS) Composite Sewer Piping

60. ANSI/ASTM D2729 - Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings

61. ANSI/ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings

62. ANSI/ASTM D2855 - Practice for Making Solvent-Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings

63. ANSI/ASTM D3033 - Type PSP Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings

64. ANSI/ASTM D3034 - Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings

65. ANSI/ASTM D3138 - Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly Vinyl Chloride (PVC) Non-Pressure Piping Components.

66. ANSI/ASTM D3212 - Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

67. ANSI/ASTM D3309 - Specification for Special Listed Polybutylene (PB) Pipe

68. ANSI/ASTM F437 - Specification for Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Threaded Fittings.

69. ANSI/ASTM F438 - Specification for Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Socket Type Fittings.

70. ANSI/ASTM F439 - Specification for Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Type Fittings.

71. ANSI/ASTM F442 - Specification for Special Listed Chlorinated Polyvinyl Chloride (CPVC) Pipe

72. ANSI/AWS A5.8 - Brazing Filler Metal (Class BCuP-3 or BCuP-4)...

73. ANSI/AWS D.1.1 - Structural Welding Code, Steel.

74. ANSI/AWS D10.9 - Specification for qualification of Welding Procedures and Welders for piping and Tubing.

75. ANSI/AWWA C105 - Polyethylene Encasement for Gray and Ductile Cast Iron Piping for Water and Other Liquids

76. ANSI/AWWA C111 - Rubber Gasket Joints for Ductile Iron and Gray-Iron Pressure Pipe and Fittings

77. ANSI/AWWA C151 - Ductile Iron Pipe, Centrifugally Cast 0in Metal Molds or Sand Lined Molds, for Water or Other Liquids

78. ANSI/AWWA C606 - Grooved and Shouldered Type Joints

79. The Copper Development Association Publication: Copper Tube Handbook

80. NFPA 51B - Standard for Fire Prevention in Use of Cutting and Welding Processes

81. CISPI No. 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary System

82. FS WW-P-521 - Pipe Fittings, Flange Fittings, and Flanges: Steel and Malleable Iron (Threaded and Butt Welding) Class 150

83. ASTM C1053 - Borosilicate Glass Piping Systems.

84. ASTM D2447 - Polypropylene Chemical-Resistant Pipe

1.04 QUALITY ASSURANCE

A. Codes and regulations referred to are minimum standards. Where the requirements of these Specifications or Drawings exceed those of the codes and regulations, the Drawings or Specifications govern.

B. Piping systems shall meet requirements of ANSI/ASME B31.9, Building Services Piping, ASME Boiler and Pressure Vessel Code, State Plumbing Code, State Boiler Code and Kentucky Building Code.

C. All plumbing work shall be accomplished by or under the direct supervision of a licensed plumber.

D. All fire protection work shall be accomplished by or under the direct supervision of a licensed sprinkler installer.

E. Welding Materials and Procedures: Conform to ASME Code and AWS standards referenced above. Employ certified welders in accordance with ASME Section 9, ANSI/AWS D1.1., ANSI/AWS D10.9 and Boiler Inspection Section, State Fire Marshal. Welders shall be certified under the rules of the National Certified Pipe Welding Bureau and qualified by either the National Certified Pipe Welding Bureau or an independent testing laboratory for the procedures used on this Project.

1.05 SUBMITTALS

A. In general, do not submit on ordinary pipe and fittings, except as noted in these Specifications. Submit on specialties per Section 15080.

B. See individual piping Sections for additional submittal requirements.

C. Submit a letter certifying that welders and welding procedures meet the requirements of AWS D10.9, Level AR-3.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide pipe and tubing systems of types called for in the individual piping system Sections of the Specifications. Provide materials and products meeting the standards referenced in those Sections and in Paragraph 1.03 above.

B. Provide work meeting the requirements referenced in this Section 15060 - Pipe and Pipe Fittings (General), and Sections 15080 - Piping Specialties (General), 15090 - Hangers, Supports and Anchors, 15095 - Expansion Compensation and Vibration Elimination, 15100 Valves.

C. Provide all new materials in good condition, unless otherwise indicated in the Documents. Rusted, dented, bent or otherwise damaged pipe and fittings will not be accepted and shall be removed from the site as soon as discovered.

D. Provide piping system components with appropriate identification, rating or approval labels, stamps or symbols as required by Code or to show compliance with the requirements of these Documents. Unlabeled pipe, valves missing appropriate markings or any other non-identifiable items shall not be installed.

2.02 PRESSURE/TEMPERATURE RATINGS

A. Pressure/temperature ratings of all components and accessories shall meet or exceed design conditions for the system in which they are installed. All piping components, joints, valves, accessories and specialties shall be designed for operating conditions of not less than that indicated in individual piping Sections of the Specifications and shall be designed to withstand continuous use at the following conditions as a minimum:

1. Domestic Cold Water (DCW, MU): 150 psig at 125 deg. F.

2. Domestic Hot Water (DHW, HMU) and recirculated water (DRW): 150 psig and 250 deg. F.

3. Fire water service and distribution (F, FP): 175 psig and 125 deg. F.

4. Hydronic heating piping (HWS, HWR, HCWS, HCWR): 125 psig SWP and 250 deg. F.

5. Water source heat pump, heat recovery and condenser water lines (HPWS, HPWR, CWS, CWR, HRS, HRR): 125 psig and 140 deg. F. Drainage spec piping may be used for tower open returns where allowed by notes.

6. Chilled water lines (CHWS, CHWR): 125 psig and 100 deg.F.

7. Low Pressure Steam (LPS), Low Pressure Return (LPR), Pumped Condensate Return (PCR): 125 psig SWP and 250 deg. F.

8. Medium and High Pressure Steam and Return (MPS, HPS, MPR, HPR): 150 psig and 350 deg. F.

9. Fuel Oil Supply, Return and Vent lines in general (FOS, FOR, FOV): 125 psig 250 deg. F. Some burner piping requires 350 psig or more.

2.03 PIPE AND FITTINGS

A. Where no detailed specification of pipe or fittings is given for a type of system, either in the Specifications or the Drawings, use the following general recommendations for material type.

1. Steel Pipe: ANSI/ASTM A53 Grade B, black; galvanized; Schedule 40 or as indicated. Steel Pipe Fittings: ANSI/ASME B16.3 or ANSI/ASTM A126. Weld fittings for black steel pipe shall be Tube Turns, Bonney Forge, Capital, or WFI, black steel butt welded type ASTM A234 Grade WPB of a service class to match the adjacent pipe, except that connections to valves shall be made with ASTM A105 welding neck flanges. Flanges shall have ASTM A307 Grade B bolts with hexagon heads and nuts and shall be provided with gaskets as specified and insulating sleeves where required.

2. Cast Iron Soil Pipe: ANSI/ASTM A74; coated; standard weight or as indicated. Cast Iron Pipe Fittings: ANSI/ASTM A74; ASTM C564, rubber gasket joints; ANSI/AWWA C606, grooved and shouldered joints; ANSI/AWWA C111, rubber gasket joints.

3. Hubless Cast Iron Soil Pipe: CISPI 301.

4. Ductile Iron Water Pipe: ANSI/AWWA C151, Class 50, cement-lined, bituminous coated.

5. Copper Water Tube: ASTM B88, Type K soft temper underground direct bury, Type K hard drawn for underground prefab systems, Type L hard drawn in building; Types M, DWV only as indicated. Wrought Copper and Brass Pipe Fittings: ANSI/ASME B16.22, pressure fittings or ANSI/ASME B16.29, drainage fittings. Solder shall be 95/5 tin antimony or tin/silver alloy type. Flux shall be non-acid type, approved by solder manufacturer.

6. Concrete Pipe: ASTM C14, Class 3. Concrete Pipe Fittings: ASTM C443

7. ABS Plastic Pipe: ANSI/ASTM D1788. ABS Pipe Fittings: ANSI/ASTM D2751. Solvent for ABS Jointing: ASTM D2235

8. ABS Plastic Sewer Pipe: ANSI/ASTM D2751. ABS Pipe Fittings: ANSI/ASTM D2751. Solvent for ABS Jointing: ASTM D2235

9. PVC Plastic Pipe: ANSI/ASTM D1784, Schedule 40 or 80; SDR 26, ASTM D2241; Pipe Fittings: ANSI/ASTM D2729. Solvent for PVC Jointing: ANSI/ASTM D2564. Solvent for Joining ABS to PVC: ANSI/ASTM D3138, non-pressure.

10. PVC Plastic Sewer Pipe: ASTM D3033, Type PSP or D3034, Type PSM. Solvent for PVC Jointing: ANSI/ASTM D2564. Solvent for Joining ABS to PVC: ANSI/ASTM D3138, non-pressure.

11. Polyethylene Sewer Pipe: ANSI/ASTM D2104, Schedule 40. Heat fusion for joining polyethylene: ANSI/ASTM D2657

12. Polypropylene Sewer Pipe: ANSI/ASTM D2146. Heat fusion for joining polypropylene: ANSI/ASTM D2657

13. Glazed Vitreous Clay Pipe: ASTM C700 standard strength.

2.04 UNIONS, COUPLINGS AND JOINTS

A. Unions - Pipe Size Under 2 inches: 150 psi bronze ground joint malleable iron for threaded ferrous piping; bronze for copper or brass pipe soldered joints. No wrought copper unions shall be used above 3/4" pipe size.

B. Unions - Pipe Size Over 3 inches: 150 psi forged steel or cast iron slip-on, or weld neck flanges for ferrous piping; bronze flanges for copper or brass piping; synthetic rubber gaskets for gas service.

C. Unions - Pipe Sizes 2 and 2 1/2 inch: Either of the types in A. and B.

D. Dielectric Unions: Vogt, Dart, Capitol or approved equal dielectric insulated unions for all copper to ferrous metal connections.

E. Dielectric flanges: Provide flange insulation kit for each copper to ferrous joint or as otherwise shown. Include electrically insulating gaskets, inserts and washers as required for complete isolation.

F. Couplings: Threaded steel pipe - Provide malleable iron sleeve coupling with right hand pipe thread on each end, standard or extra heavy as required for service.

G. Couplings: Copper pipe - Provide copper sleeve coupling with shoulder, socket sized for sweat connection or brazing.

H. Welded Joints: Provide joints in steel pipe executed by a properly certified pipe welder. Provide welding as required per Part 3 of this Section.

I. Grooved and Shouldered Pipe Ends: Malleable iron housing clamps to engage and lock, designed to permit some angular deflection, contraction and expansion; C-shape composition sealing gasket, steel bolts, nuts and washers; galvanized couplings for galvanized pipe.

PART 3 – EXECUTION

3.01 GENERAL

A. Joints in pipe and tubing shall be cut square with tubing or pipe cutter. Ends shall be reamed. Remove burrs. Bevel plain end ferrous pipe.

B. Remove filings, dust, scale and dirt, inside and outside, before assembly. Open ends of pipelines or equipment shall be properly capped or plugged during construction, until installation, to keep dirt and other foreign materials out of system.

C. Remove welding slag, splatter or foreign material from pipe and fitting materials before assembly and after joining.

D. Pipe shall be cut accurately to measurements established at the job site and worked into place without springing or forcing, and properly clearing all windows, doors, and other openings.

E. Cutting or other weakening of the building structure to facilitate piping installation will not be permitted without written approval. Supports shall be attached only to structural framing members and concrete slabs. Supports shall not be anchored to metal decking unless approved in writing. Where supports are required between structural framing members, suitable intermediate metal framing shall be provided and approved by the Engineer. Supports shall conform to Section 15090 - Hangers, Supports and Anchors.

F. Changes in direction shall be made with fittings unless otherwise indicated. Bent pipe showing kinks, wrinkles, flattening or other malformations will not be accepted.

G. Provide reducing fittings for changes in pipe sizes. Reducers (increasers) shall be concentric unless eccentric fittings are indicated or required for proper drainage.

H. Pipes shall be installed to permit free expansion and contraction without damage to joints or hangers. Expansion in the piping shall be accommodated by means of expansion loops and offsets or by expansion joints as indicated in the Documents. Refer to Section 15095 - Expansion Compensation and Vibration Elimination.

I. Flanges and unions shall be faced true. Flanges shall be provided with gaskets suitable for the fluid used and made square and tight. Except where copper tubing is used, unions or flange joints shall always be provided in each line immediately preceding the connection to each piece of equipment or material requiring maintenance such as coils, pumps, valves, and other similar items unless such items have integral flanges or unions.

3.02 COPPER PIPE CONNECTIONS

A. Form hot soldered joints in copper, brass, or bronze fittings with 95-5 solder for plumbing. Do not use for refrigeration or fuel lines. 50-50 solder or other lead-bearing solder shall not be used. Joints shall be soldered, using flux, with solder applied and drawn through the full fitting length. Excess solder shall be wiped from joint before solder hardens.

B. Joints for copper-copper, copper-brass, copper-bronze, shall be brazed where shown with specific alloy filler indicated (ANSI/AWS A5.8). During all brazing operations, the tubing and fitting being brazed shall have a continuous purge of dry nitrogen at a rate which will preclude oxidation of the tubing and fitting. All tubing and fittings shall be properly cleaned prior to brazing. All copper tubing joints that are assembled on the job site shall be assembled with fittings.

C. Joints for copper tubing may be made with flare fittings where indicated.

D. Work into place without forcing or springing.

3.03 STEEL PIPE CONNECTIONS - THREADED

A. Screw joint steel piping up to and including 1-1/2 inch, unless otherwise indicated. Weld piping 3 inch and larger, including branch connections. Screw or weld 2 or 2-1/2 inch piping.

B. Die cut screwed joints with full cut standard taper pipe threads, using cutting oil appropriate for operation.

C. Assemble with teflon paste joint compound applied to male threads only, unless otherwise indicated. Non-toxic compound shall always be used for water service piping.

3.04 STEEL PIPE CONNECTIONS - WELDED

A. Screw joint steel piping up to and including 1-1/2 inch, unless otherwise indicated. Weld piping 3 inch and larger, unless otherwise indicated, including branch connections. Screw or weld 2 or 2-1/2 inch piping.

B. Welding procedures shall be in accordance with ANSI/ASME B31.9 for the service involved. Welds shall be full penetration type, accomplished by proper beveling and spacing of pipe ends. Where backing rings are specified herein, root pass shall penetrate into the backing ring.

C. No field fabrication of jointed fittings, mitering or notching pipe to form elbows and tees or direct welding of pipe to pipe will be allowed unless specifically shown, except for buttwelding of properly aligned and prepared straight pipe sections.

D. Provide factory weld fittings for all turns in pipe. Weld bends may be field cut to proper angle as required for fit.

E. Provide manufactured weld tee fittings for branches from a main line which are main size or one size less for up to 6" pipe and for main size or up to two sizes less for 8 inch and larger mains, unless otherwise indicated. Take-off or saddle fittings such as "Weld-o-lets", "Thread-o-lets", "Latrolets", "Sweepolets", and "Elbolets" and the like may be used for smaller branch piping unless otherwise indicated. Do not project branch pipes or take-off fittings inside the main pipe.

F. Field and shop bevels shall be in accordance with the standards specified herein and shall be done by mechanical means or flame cutting. Where beveling is done by flame cutting, surfaces shall be cleaned of slag, scale and oxidation prior to welding.

G. Before welding, the component parts to be welded shall be aligned so that no strain is placed on the weld when finally positioned. Height shall be aligned so that no part of the pipe wall is offset by more than 20% of the wall thickness. Flanges and branches shall

be set true. This alignment shall be preserved during the welding operations. Connections larger than 6" shall be made with backing rings at welds.

H. Where the temperature of the component parts being welded reaches 32°F or lower, the material shall be heated to approximately l00°F for a distance of 3' on each side of the weld before welding, and the weld shall be finished before the material cools to 32°F.

I. Welders shall stamp each weld with their personal symbol or code number.

J. A random sample of completed pipe field welds may be chosen by the Engineer for non-destructive testing by an independent testing agency, not to exceed 5% of the total welds on the project. Costs for testing shall be borne by the Contractor. Test criteria shall be as specified by ANSI/ASME B31. If any of the tested welds are unsatisfactory, additional welds may be chosen for testing at the Contractor's expense. Defective welds shall either be cut out and rewelded or ground down to base metal and rewelded. All reworked welds shall be tested as specified herein.

3.05 STEEL PIPE CONNECTIONS - GROOVED

A. Groove type coupling system may be used wherever this piping type is specified as an option in the individual piping Sections listed in Paragraph 1.02.

3.06 PLASTIC PIPE CONNECTIONS

A. Use joint primer with dye (Oatey Purple Primer or equal) for all PVC or CPVC solvent welded joints. Follow manufacturer's recommendations in the use of primer.

B. Form solvent joints in PVC pipe and fittings to ANSI/ASTM D2855.

C. Form heat fusion joints in polyethylene and polypropylene pipe and fittings to ASTM D 2657.

3.07 VITREOUS PIPE CONNECTIONS

A. Joints for Bell and Spigot Pipe: Lead and oakum or patented Neoprene gasketing system.

B. Joints for Plain End Pipe: Neoprene gasket and clamp system.

END OF SECTION

SECTION 15080
PIPING SPECIALTIES

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Strainers

B. Gauges

C. Test plugs

D. Thermometers

E. Vacuum breakers

1.02 RELATED WORK

A. Section 15060 – Pipe and Pipe Fittings

B. Section 11295 – Interior Process Valves

1.03 SUBMITTALS

A. Submit shop drawings and product data under provisions of Sections 01300 and 15010. Include component sizes, rough-in requirements, service sizes, temperature and pressure ratings, performance data and finishes. Include product description, model and dimensions. Submit proposed ranges of gauges and thermometers for each service.

B. Submit operation and maintenance data under provisions of Sections 01780 and 15010. Include manufacturer's installation and application instructions, assembly views, lubrication and service instructions, and replacement parts list.

PART 2 – PRODUCTS

2.01 STRAINERS

A. Mueller Steam, Keckley, Sarco or approved equal per Section 15010.

B. 2½" and above: Screwed-cast iron for 175 psig working pressure, Y pattern, with bronze, monel metal or 18-8 stainless steel perforated screen; 20 mesh for steam and 0.045 inch diameter perforations for liquid.

C. 2½" and above: Flanged-iron body for 175 psig working pressure, Y pattern with bronze, monel metal or 18-8 stainless steel perforated screen; 0.045 inch diameter perforations for steam and 0.125 inch for liquids.

D. For high pressure steam (HPS), strainers shall be cast steel, rated for 300 psi and 500 deg. F.

E. Strainer element shall be removable without disconnecting piping.

2.02 GAUGES

A. Trerice, Ashcroft, Marsh, Marshalltown or approved equal per Section 15010.

B. Pressure, vacuum or compound gauges: 4½: diameter face, brass Bourdon tube type; aluminum, steel or phenolic case; 1/4" NPT bottom connection; dials black figures on white background, graduated as required for service and identity labeled; nonshatterable safety glass, and pressure blowout back in case of explosion. Range to suit application.

2.03 TEST PLUGS (P/T PLUGS)

A. Sisco BNO-25, Pete's Plug or equal per Section 15010.

B. Test plugs" ¼-inch MPT, brass body and cap, with Nordel self-closing valve cores, suitable for 250 deg. F. water, installed in water piping where shown.

C. Provide extended units for insulated piping as required.

2.04 THERMOMETERS

A. Terrice, Ashcroft, Marsh, Marshalltown or approved equal per Section 15010.

B. Dial thermometers" 3½" – 5" diameter adjustable angle face; mercury vapor tension or gas actuated; stainless steel, aluminum or black steel case, glass lens, black figures on white background, graduated with range as required, guaranteed to be accurate within one scale division/ recalibration adjustment feature; adjustable angle head and capillary. Provide range suitable to the application.

C. Provide swing check valve only where indicated, per Section 15100.

2.05 VACUUM BREAKERS

A. Johnson, Hoffman, Sarco or approved equal per Section 15010.

B. Use spring-loaded types unless otherwise indicated.

C. Brass Body, stainless steel spring and ball, EPR "O" ring, Johnson VB-8 series, ¾" or as indicated, opening pressure 5"-25" water.

D. Provide swing check valves only where indicated, per Section 15100.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install all items in accordance with manufacturer's instructions. In case of conflict, notify Engineer at once.

B. Provide blowoff ball valve for each wye-pattern water strainer, full size of tapping, with reducer, hose connection and cap.

C. Provide blowoff gate valve for each wye-pattern steam or condensate strainer, full size of tapping, with reducer, hose connection and cap.

D. Provide ¼" lever-handled brass gauge cock and snubber on all pressure gauge installations except steam, unless otherwise indicated. All gauge faces shall be upright.

E. Provide straight or angled pigtail siphon and needle valve, on all steam pressure gauge installations. Trim components shall match temperature and pressure ratings of piping.

F. Provide wells for all thermometers. Mount wells in piping deep enough to contact flow stream directly but not far enough to disturb flow. See details on Drawings. Use aluminum temperature-conducting paste (Honeywell or equal) in all thermometer wells to ensure contact with bulbs. Adjust the face of all adjustable angle thermometers to be visible from the floor and tighten locking screws or nuts for a rigid installation. Avoid excessive twisting or movement of thermometer heads.

G. Provide P/T plugs with caps at all points indicated. Mount P/T plug in such position as to allow insert thermometer to be placed in fluid stream.

H. Install vacuum breakers in the horizontal or vertical top outlet positions only, unless otherwise shown, and then only in the positions for which the valves are rated.

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SECTION 15090
HANGERS, SUPPORTS, AND ANCHORS

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Provide support and hangers for all piping, piping system components, and ductwork.

B. Provide pads, curbs, supports, anchors, frames and hangers for all equipment.

C. Provide steel angles and channels between structural members, framework and reinforcement as necessary to support piping and equipment.

1.02 RELATED WORK

A. Section 15060 - Pipe and Pipe Fittings.

B. Section 15095 - Expansion Compensation and Vibration Elimination.

C. Section 15810 - Ductwork.

D. Division 3 - Concrete.

E. Division 5 – Metals

1.03 QUALITY ASSURANCE

A. Meet the requirements of the following:

1. MSS SP 58 Pipe Hangers and Supports - Material, Design and Manufacture.
2. MSS SP 69 Pipe Hangers and Supports - Selection and Application.
3. ANSI Code for Pressure Piping.
4. Hangers and supports shall have a stress safety factor of 5.

1.04 SUBMITTALS

A. Submit manufacturer's product data for the following:

1. Hangers.
2. Supports.
3. Inserts.

4. Anchors.

5. Structural Curbs.

1.05 COORDINATION

A. Obtain Engineer's approval before welding, drilling or cutting any structural members.

B. Coordinate runs of piping and locate equipment to utilize structural members.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Products are based on Grinnell as a standard, unless specified otherwise.

B. Optional manufacturers: Automatic Sprinkler, Elcen, F & S, Fee & Mason, or Michigan.

2.02 STRUCTURE ATTACHMENT DEVICES

A. Riser clamp, steel: Grinnell Fig. 261. Provide masonry or concrete bearing.

B. Riser clamp, copper: Grinnell Fig. CT-121, copper plated. Provide masonry or concrete bearing.

C. Top beam clamp: Grinnell Fig. 227 with Fig. 157 extension.

D. Bottom beam clamp: Grinnell Fig. 229. (Use only where top clamps are not possible. Obtain approval from Architect).

E. Side beam bracket: Grinnell Fig. 202. (For wood construction only).

F. Horizontal traveler: Grinnell Fig. 170.

G. Concrete inserts: Grinnell Fig. 282, galvanized.

H. Concrete fasteners: Phillips "Red Head".

I. Copper tube strap: Grinnell Fig. 9124.

J. Pipe strap: Grinnell Fig. 262.

K. Pipe hanger flange: Grinnell Fig. 153.

L. Bottom channel clamp: Grinnell Fig. 226 with 157 extension. (Obtain approval from Engineer prior to use.)

M. Bottom beam/joist C clamp: Grinnell Fig. 87 with retaining clip and locknut (for use with pipes 2" and smaller, obtain approval from Engineer prior to use).

2.03 HANGERS AND ACCESSORIES

A. Adjustable copper tubing ring: Grinnell Fig. CT-99, copper plated.

B. Adjustable swivel split ring: Grinnell Fig. 104, black finish.

C. Adjustable pipe ring, plastic coated: Grinnell Fig. CT-99c, plastic coated.

D. Heavy adjustable clevis: Grinnell Fig. 260, black finish.

E. Lightweight adjustable clevis: Grinnell Fig. 65, black finish.

F. Pipe roll stand: (base supported): Grinnell Fig. 271, cast iron roll.

G. Adjustable pipe roll: Grinnell Fig. 181.

H. Pre-engineered spring hanger: Grinnell Figs. B-268, 82, or 98.

I. Insulated pipe saddle: Hot lines - high density precompressed fiberglass support segment with 18 ga. galvanized steel shield. Cold lines - provide "Foamglass" pipe insulation with jacket and 18 ga. galvanized steel shield. Insulation thickness shall be same as specified in 15900.

2.04 HANGER RODS AND ACCESSORIES

A. Provide plated steel threaded rods. Size according to 3.02 following.

B. Provide all necessary couplings, turn buckles, nuts, washers, and accessories for a complete installation.

2.05 TRAPEZE COMPONENTS

A. Horizontal trapeze member: Unistrut P-2700 series channel, standard or heavy duty according to load.

B. Trapeze clamp: Unistrut two piece bolted pipe clamp; steel for steel pipes, copper for copper pies.

2.06 EQUIPMENT SUPPORTS

A. Provide 3 x 3 x 1/4 angles or heavier, if required, spanning 3 structural joists to support hung equipment.

B. Provide channels (strength as required) to span between beams. Weld to beams. Obtain approval of Engineer before proceeding.

2.07 ROOF SUPPORTS

A. If not furnished with the equipment or otherwise detailed, provide 8" high support curbs of proper length to support piping and equipment. Curbs shall span 3 joists when supporting equipment. Curbs shall be Pate ES-1A, galvanized steel with wood nailer.

PART 3 – EXECUTION

3.01 PIPE SUPPORT METHODS

Condition	Support Method
Uninsulated copper pipe, horizontal hung	Adjustable copper tubing ring and hanger rod
Uninsulated copper pipe, horizontal bottom support	Copper tube strap. Provide necessary angle braces
Uninsulated copper pipe, vertical	Copper tube strap to walls with anchors. Riser clamp, copper at floors.
Uninsulated metal drain pipe horizontal hung	Heavy adjustable clevis, hanger rod.
Uninsulated metal drain pipe vertical	One hold clamp (at walls). Riser clamp, steel (at floors).
Insulated pipe horizontal, hung	Insulation pipe saddle, heavy adjustable clevis, hanger rod.
Insulated pipe horizontal, bottom support	Insulated pipe saddle, pipe roll stand.
Insulated pipe horizontal, hung with movement	Adjustable pipe roll hanger and with rod.
Insulated pipe vertical	Pipe strap to walls. Appropriate riser clamp, with sleeve at floors.
Bottom of storm and waste stacks at slab on grade floors	Concrete pipe foundation, poured after pipe is in place

Notes:

1. Install pipe saddles as pipe is installed.

2. Trapeze hangers may be used for multiple horizontal hung pipe runs. Trapeze consists of hanger rods, horizontal trapeze member, and trapeze clamps. Each pipe individually attached to trapeze.

3.02 SUPPORT SPACING AND HANGER ROD DIAMETERS

A. Cast iron, ductile iron, and copper pipes:

Pipe Size	Maximum Vertical And Horizontal Support Spacing	Rod Diameter
½", ¾"	5'	3/8"
1", 1¼ "	6'	3/8"
1½ ", 2"	9'	3/8"
2½", 3"	10'	½"
4", 5"	10'	5/8"
6", 8"	10'	¾"

Notes:

1. Maximum support spacing for horizontal cast iron drain and vent lines is one support at each joint. (i.e., 5' spacing for 5' lengths, 10' spacing for 10' lengths).

2. Provide additional supports at turns, valves, concentrated loads, connections to equipment and where necessary for proper alignment.

B. Plastic pipe:

1. All fluid filled services: Follow Paragraph A above. Maximum support spacing on horizontal lines shall be 4 ft.

2. Drain and vent lines: Support 4 ft. maximum centers with 3/8" diameter hanger rods.

3.03 STRUCTURE ATTACHMENT METHODS

Condition	Support Method
Hanger rod to steel bar joist or truss	Top beam clamp
Hanger rod to steel beam (corrugated metal deck above)	Top beam clamp
Hanger rod to steel beam (concrete deck above, temporary form)	Bottom beam clamp

Condition	Support Method
Hanger rod to precast or existing concrete deck	Concrete fasteners, pipe hanger flange
Hanger rod to new cast-in-place concrete deck	Concrete insert
Hanger rod to wood beam	Side beam bracket, lag bolt to beam (use bolt through entire beam when load exceeds manufacturer's recommended load for lag bolt application)
Hanger rod to any structure at elbows with significant lateral movement	Horizontal traveler
Hanger rod to any structure at risers with significant vertical movement	Pre-engineered spring hanger
Hanger rod to any structure at risers from vibrating equipment	Pre-engineered spring hanger

Notes:

1. Do not install hangers from metal roof deck.
2. Avoid drilling concrete by using inserts.
3. Explosive powder driven fasteners are allowed.
4. In wood construction: Where pipe is parallel to, and hanging form joists, rafters, or beams, bolt angles to side of members vertically, bolt horizontal angles to vertical angles, attach hanger rods to horizontal angles.
5. Check structural and mechanical details for methods of support.

3.04 VIBRATING EQUIPMENT

A. In-line pump support: Contractor shall provide a calibrated spring-hanger when recommended and approved by the pump manufacturer. The spring shall support the pump at approximately the center of gravity and shall reduce the piping load to less than 10% of the weight of the pump at room temperature.

B. Support piping at pumps and equipment from floor, ceiling, or walls, so that piping weight is not supported from pumps or equipment.

3.05 WET AREA AND EXTERIOR SUPPORTS

A. Use nonferrous, galvanized steel, plated steel or plastic coated steel supports and hangers in kitchens, locker rooms, shower rooms, and in exterior applications.

3.06 ANCHOR BOLTS

A. Furnish and install anchors bolts for all equipment placed on concrete equipment pads or on concrete slabs.

B. Bolts shall be of the size and number recommended by the manufacturer of the equipment and shall be located by means of suitable templates.

C. When equipment is placed on vibration isolators, the equipment shall be secured to the isolators and the isolator secured to the floor, pad, or support as recommended by the vibration isolation manufacturer.

3.07 SEISMIC REQUIREMENTS

A. Provide seismic restraints to all mechanical systems (equipment, pipes, ducts, etc.) in accordance with the latest edition of SMACNA Guidelines for Seismic Restraints and Mechanical Systems, where called for in individual sections of the specifications.

3.08 ADDITIONAL REQUIREMENTS

A. Properly support pipe to maintain required alignment, slopes, and expansion capabilities.

B. Piping and ductwork shall be supported independently from the building inner structure. Where interferences occur, provide trapeze type hangers or other suitable supports for each system. Locate hangers and supports where they will not interfere with access to air device boxes, fire dampers, valves, and other appurtenances requiring servicing.

   1. Ceiling grid systems shall not be supported from ductwork, conduits, heating or plumbing lines and vice versa.

C. Refer to Section 15095 for vibration isolation requirements for ductwork and piping.

END OF SECTION

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SECTION 16050
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 – GENERAL

1.01 REQUIREMENT

A. Contractors bidding work under this Contract shall read and understand Division Zero and Division 1 - General Requirements. If any discrepancies are discovered between the Basic Electrical Materials and Methods and General Requirements, the above mentioned documents shall overrule this section. The Basic Electrical Materials and Methods are intended as a supplement to the above mentioned documents.

B. The Contractor shall bid as outlined in the above mentioned Specifications and shall be governed by any alternates or unit prices called for in the form of proposal.

C. Each Contractor bidding on the work included in these Specifications shall view the building site and carefully examine the contract Drawings and Specifications, so that he/she may fully understand what is to be done, and to document existing conditions.

1.02 SCOPE OF WORK

A. Work included in this section of the Specifications shall include the furnishing of all labor, material, tools, approvals, utility connection fees, excavation, backfill, and other equipment necessary to install the electrical system as shown on the Contract Drawings and as specified herein.

B. It also includes installation and connection of all electrical utilization equipment included in this Contract but furnished by other contractors or suppliers.

C. It is the general intent that all motors shall be furnished with the particular object of equipment it drives, except where a new motor is to be provided for an item of existing equipment (a replacement motor), then it shall be provided under this Division of the Specifications.

D. The Contractor shall furnish and install all conduit, wire, disconnect switches and miscellaneous material to make all electrical connections to all items of utilization equipment or wiring devices except as otherwise specified.

E. Equipment connections shall be made with flexible or rigid conduit as required. Controllers for motors, disconnect switches, and all control, protective and signal devices for motor circuits, except where such apparatus is furnished mounted and connected integrally with the motor driven equipment, shall be installed, connected and left in operating condition. The number and size of conductors between motors and control or protective apparatus shall be as required to obtain the operation described in these

Specifications, and/or by the Contract Documents, and/or as shown in manufacturer furnished, Engineer reviewed Shop Drawings.

F. All devices and items of electrical equipment, including those shown on the Contract Drawings but not specifically mentioned in the Specifications or those mentioned in the Specifications but not shown on the Contract Drawings, are to be furnished under this section of the specifications. Any such device or item of equipment, if not defined in quality, shall be equal to similar Equipment and/or devices specified herein.

G. All devices and items of equipment mentioned in this section of the Specifications whether electrical or not or whether furnished under this or other Division of the Specifications, shall be installed under this Division of the Specifications, unless specifically indicated otherwise.

H. Where wiring diagrams are not shown on the Contract Drawings, they are to be provided by the supplier of the equipment served and such diagrams shall be adhered to except as herein modified.

I. The following is a list of items that may not be defined clearly on the Contract Drawings or in other parts of these Specifications. The list is meant to be an aid to the Contractor and is not necessarily a complete list of all work to be performed under this Contract:

1. Connect all motors and accessories furnished by equipment suppliers.

2. Furnish, install, and connect all motor controls.

3. Furnish, install, and connect lighting, indoor and outdoor.

4. Furnish, install, and connect power and signal lines to all instrumentation equipment, and accessories.

5. Furnish, install, and connect all electrical conduit, duct and cables.

6. Furnish, install, and connect all telephone boxes, outlets, etc.

7. Furnish, install, and connect all power distribution equipment.

8. Furnish and install standby power equipment.

9. Provide demolition of existing equipment and disposition of removed materials as shown on the Contract Drawings.

1.03 SHOP DRAWINGS, DESCRIPTIVE LITERATURE, INSTALLATION, OPERATION AND MAINTENANCE INFORMATION

A. Shop Drawings including descriptive literature and/or installation, operation and maintenance instructions shall be submitted per Section 01300.

B. Shop Drawings shall be submitted on the following materials specified in this Division:

1. Conduit - all types and sizes, including liquid-tight flexible.
2. Boxes - all types and sizes.
3. Wiring devices.
4. Device plates.
5. Metal framing system (Strut type channel).
6. Conduit fittings, expansion joints, support hardware.
7. Motor control equipment - including individually mounted items.
8. Power distribution equipment - including individually mounted items.
9. Adjustable speed equipment and accessories.
10. Miscellaneous spare parts and hardware.
11. Wire - all types and sizes.
12. Light fixtures - all types.
13. Wire markers, signs and labels.
14. Lightning/transient suppressors.
15. Motors.
16. Transformers.
17. Standby power equipment and accessories.

C. The Engineer reserves the right to make modifications to motor control and power distribution equipment ratings after Shop Drawing review, if the Shop Drawings are submitted prematurely (prematurely meaning submitted before all utilization equipment has been reviewed and accepted). Cost of modifications shall be the Contractor's responsibility.

1.04 SYMBOLS AND ABBREVIATIONS

A. The symbols and abbreviations general follow standard electrical and architectural practice, however, exceptions to this shall be as shown on the Contract Drawings.

1.05 COORDINATION WITH OTHER TRADES

A. The Contractor shall coordinate the electrical work with that of other trades to ensure proper final location of all electrical equipment and/or connections. The Contractor shall verify door swings to see that light switches are located properly.

1.06 CODES

A. The minimum standard for all work shall be the latest revision of the Kentucky Building Code (KBC), and the National Electrical Code (NEC). Whenever and wherever state and/or local laws or ordinances and/or regulations and/or the Engineer's design require a higher standard that the current NEC or KBC, then these laws and/or regulations and/or the design shall be followed.

B. Following is a list of other applicable Standards or Codes:

1.	KBC	Kentucky Building Code
2.	NEC	National Electrical Code
3.	NESC	National Electrical Safety Code
4.	UL	Underwriters Laboratories, Inc.
5.	FM	Factory Mutual System
6.	NFPA	National Fire Protection Association
7.	NEMA	National Electrical Manufacturers Association
8.	OSHA	Occupational Safety and Health Administration
9.	ICEA	Insulated Cable Engineers Association, Inc.
10.	IES	Illuminating Engineering Society of North America
11.	ISA	International Society of Automation
12.	IEEE	Institute of Electrical and Electronic Engineers, Inc.
13.	CBM	Certified Ballast Manufacturers Association
14.	ANSI	American National Standards Institute, Inc.
15.	AFBMA	Anti-Friction Bearing Manufacturers Association, Inc.
16.	JIC	Joint Industry Council

17. ASHRAE American Society of Heating, Refrigerating, Conditioning Engineers, Inc.

18. FCC Federal Communications Commission

19. ASTM American Society for Testing and Materials

20. AWPA American Wood Preservers Association

21. REA Rural Electrification Association

1.07 INSPECTIONS AND PERMITS

A. Inspection of the electrical system on all construction projects is required. If the local government has appointed a state licensed inspector, the Contractor shall be required to use that person to perform the inspections. If a locally mandated inspector does not exist, the Contractor shall select and hire a state licensed inspector, who has jurisdiction before any work is concealed. The Contractor shall notify the electrical inspector in writing, immediately upon notice to proceed, and a copy of the notice shall be submitted to the Engineer.

B. At the time of completion of the project, there shall be furnished to the Owner a certificate of compliance, from the agency having jurisdiction pursuant to all electrical work performed. The Engineer shall also receive a photostatic copy.

C. All costs incurred by the Contractor to execute the above mentioned requirements shall be paid by the Contractor at no extra cost to the Owner.

D. All permits necessary for the complete electrical system shall be obtained by the Contractor from the authorities governing such work. For further information, see Division 1.

1.08 STORAGE

A. All work, equipment, and materials shall be protected against dirt, water, or other injury during the period of construction.

B. Sensitive electrical equipment such as light fixtures, motor starters, controls, and panelboards, delivered to the job site, shall be protected against injury or corrosion due to atmospheric conditions or physical damage by other means. Protection is interpreted to mean that equipment shall be stored under roof, in a structure properly heated in cold weather and ventilated in hot weather. Provision shall be made to control the humidity in the storage area to 50 percent relative. The stored equipment shall be inspected periodically, and if it is found that the protection is inadequate, further protective measures shall be employed. Electrical equipment other than boxes and conduit shall not be installed until the structure is under roof with doors and windows installed.

C. No light fixtures or device plates shall be hung or installed until after painting is completed; however, temporary lighting shall be provided by the Contractor.

D. The Contractor shall not store submersible pump units in the wetwell. If it is absolutely necessary to do so, the open power cable ends are to be suspended above the maximum flood elevation or maximum expected water level. If not stored in this manner, the Contractor may be called upon to replace the pump motors and cables with new units to ensure that water has not penetrated the cable and entered the motor housing.

1.09 MATERIALS

A. All materials used shall be new and at least meet the minimum standards as established by the NEC and/or National Electrical Manufacturers Association (NEMA). All materials shall be UL listed for the application, where a listing exists. Additional requirements are found in Division 1. All equipment shall meet applicable FCC requirements and restrictions.

B. The material and equipment described herein has been specified according to a particular trade name or make to set quality standards. However, each Contractor has the right to substitute other material and equipment in lieu of that specified. other than those specifically mentioned at matching or for standardization, providing such material and equipment meets all of the requirements of those specified and is accepted, in writing by the Engineer.

C. The reuse of salvaged electrical equipment and/or wiring will not be permitted unless specified herein or indicated on the Contract Drawings.

D. All demolished electrical materials shall become the property of the Contractor and shall be removed from the job site upon completion of the project, unless otherwise noted on the Contract Drawings or specified herein.

1.10 ERRORS, CORRECTIONS, AND/OR OMISSIONS

A. Should a piece of utilization equipment be supplied of a different size or horsepower than shown on the Contract Drawings, the Contractor shall be responsible for installing the proper size wiring, conduit, starters, circuit breakers, etc., for proper operation of that unit and the complete electrical system at no extra cost to the Owner.

B. It is the intent of these Specifications to provide for an electrical system installation complete in every respect, to operate in the manner and under conditions as shown in these Specifications and on the Contract Drawings. The Contractor shall notify the Engineer, in writing, of any omission or error at least 10 days prior to opening of bids. In the event of the Contractor's failure to give such notice, he/she may be required to correct work and/or furnish items omitted without additional cost. Further requirements on this subject may be found in the General Requirements, Division 1.

C. Necessary changes or revisions in electrical work to meet any code or power company requirement shall be made by the Contractor without additional charge.

1.11 GUARANTEES AND WARRANTIES

A. The Contractor shall guarantee all work including equipment, materials, and workmanship. This guarantee shall be against all defects of any of the above and shall run for a period of 1 year from the date of acceptance of the work, concurrent with the one year guarantee period designated for the general construction contract under which electrical work is performed. Date of acceptance shall be considered to be the date on which all "punch list" items are completed ("punch list" is defined to be the written listing of work that is incomplete or deficient that must be finished or replaced/repaired before the Contractor receives final payment).

B. Repair and maintenance for the guarantee period is the responsibility of the Contractor and shall include all repairs and maintenance other than that which is considered as routine. (That is oiling, greasing, etc.) The Engineer shall be the judge of what shall be considered as routine maintenance.

C. Lamps shall bear the manufacturer's warranty.

1.12 TESTING

A. After the wiring system is complete, and at such time as the Engineer may direct, the Contractor shall conduct an operating test for acceptance. The equipment shall be demonstrated to operate in accordance with the requirements of these Specifications and the Contract Drawings. The test shall be performed in the presence of the Engineer or his authorized representative. The Contractor shall furnish all instruments and personnel required for the tests, as well as the necessary electrical power.

B. Before energizing the system, the Contractor shall check all connections and set all relays and instruments for proper operation. He shall obtain all necessary clearances, approvals, and instructions from the serving utility company and/or equipment manufacturers prior to placing power on the equipment.

C. Tests may be performed by the Engineer to determine integrity of insulation on wiring circuits selected by the Engineer at random.

D. Cost of utilities for testing done prior to beneficial occupancy by the Owner shall be borne by the Contractor.

1.13 CLEANUP

A. Cleanup shall be completed as soon as possible after the electrical installation is complete. All light fixtures, outlets, switches, starters, motor control centers, disconnect switches and other electrical equipment shall be free of shipping tags, stickers, etc. All painted equipment shall be left free of scratches or other blemishes, such as splattered

or blistered paint, etc. All light fixture diffusers shall be clean and the interior of all motor controls, etc., shall be free of dust, dirt, wire strippings, etc. Surplus material, rubbish and equipment resulting from the work shall be removed from the job site by the Contractor upon completion of the work.

B. During construction, cover all Owner equipment and furnishings subject to mechanical damage or contamination in any way.

1.14 CUTTING AND PATCHING

A. Cutting and patching shall be held to an absolute minimum and such work shall be done only under the direction of the Engineer or Owner. The Contractor shall be responsible for and shall pay for all openings that may be required in the floors or walls, and he shall be responsible for putting said surfaces back in their original condition. Every attempt shall be made to avoid cutting reinforcing steel bars when an opening is required in a reinforced concrete wall or floor slab.

1.15 EXCAVATION AND BACKFILL

A. Excavation

1. Excavation for conduits shall be of sufficient width to allow for proper jointing and alignment of the type conduit used. Conduit shall be laid in straight lines between pull boxes and/or structures unless otherwise notes on the Contract Drawings. The cost of solid rock excavation shall be included in the lump sum bid with no extra pay allowed (unclassified).

B. Encasement/Backfill

1. All buried conduits shall be concrete encased. Backfill over the ductbank may contain rocks but must be mixed with sufficient earth to fill all voids.

1.16 SLEEVES, CHASES AND OPENINGS

A. Sleeves shall be required at all points where exposed conduits pass through new concrete walls, slabs, or masonry walls. Sleeves that must be installed below grade or where subject to high water conditions must be installed watertight.

B. Wiring chases shall be provided where shown on the Contract Drawings. The Contractor shall have the option of installing chases below surface mounted panelboards provided all structural requirements are met.

C. It is the Contractor's responsibility to leave openings to allow installation of the complete, operational electrical system. Openings required but not left shall be cut as outlined under cutting and patching. The Contractor shall coordinate all holes and other openings with necessary diameters for proper firestopping.

1.17 TEMPORARY ELECTRICAL POWER

A. The Contractor shall be responsible for providing temporary electrical power as required during the course of construction and shall remove the temporary service equipment when no longer required. Temporary power is also addressed in Division 1.

1.18 OVERCURRENT PROTECTION

A. Circuit breakers or fused switches shall be the size and type as written herein and shown on the Contract Drawings. Any additional overcurrent protection required to maintain an equipment listing by an authority having jurisdiction shall be installed by the Contractor at no extra cost to the Owner.

B. The Contractor shall submit to the Engineer actual nameplate data from motors shipped to the site, stating motor identification as well as characteristics. Overload relay thermal unit selection tables shall accompany the motor data. The Engineer will select thermal unit sizes from this data for use by the Contractor in ordering proper thermal units.

1.19 MAINTAINING CONTINUOUS ELECTRICAL SYSTEM AND SERVICE

A. Existing service(s) continuity shall be maintained at all times. In no way shall the installation and/or alteration of the electrical work interfere with or stop the normal operation of the existing facilities, except where prior arrangements have been made

B. When additions and taps to existing service(s) require electrical outages of duration in excess of a few minutes, arrangements shall be made in advance for such outages. All outages shall be held to an acceptable minimum with none exceeding 8 hours continuous duration. If necessary, cuts shall be performed on premium time. If performed at night, requiring a general outage, the Contractor shall furnish an auxiliary source of light and power as required. Under no circumstances shall an electrical outage of any duration be initiated until the Owner and Engineer have concurred, and as far as possible in advance.

C. See Section 01520 for additional requirements.

1.20 GROUNDING AND BONDING

A. All metallic conduit, cabinets, equipment, and service shall be grounded in accordance with the latest issue of the National Electrical Code. All supporting framework and other metal or metal clad equipment or materials which are in contact with electrical conduit, cable and/or enclosures, shall be properly grounded to meet the code requirements.

1.21 RELATED SPECIFICATION DIVISIONS

A. The following divisions contain Specifications on utilization equipment, equipment accessories, and procedures related to execution of the electrical work, and are included here for the Contractor's information. Bids shall still be based on complete Contract Documents.

Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract

Division 1 - General Requirements

Division 11 - Equipment

Division 13 - Special Construction

Division 15 – Mechanical

Division 17 - Instrumentation

1.22 CONTRACTOR LICENSING

A. The Contractor performing the electrical work on this project shall be locally licensed, if required by local law or ordinance. If the Contractor has passed the State test, it may not be necessary to meet local testing requirements. It shall be the Contractor's responsibility to investigate these requirements and comply with same.

1.23 ANCHORING/MOUNTING

A. Electrical conduits and/or equipment shall be rigidly supported. Anchors used shall be metallic expansion type, or if appropriate to prevent spalling concrete, epoxy set type. Plastic or explosive type anchors are prohibited.

B. All supports shall be consistent with the latest edition of the KBC and ASCE 7.

1.24 ELECTRICAL COMPONENT MOUNTING HEIGHTS

A. Unless otherwise indicated, mounting height for components shall be as defined herein. In cases of conflicts with architectural or structural aspects, the components may be relocated. If an indicated height conflicts with a code requirement, the code shall govern.

B. Mounting heights are given from finished floor elevation to the centerline of the component, unless otherwise noted.

	Component	Height	Comments
1.	Wall type light switch	4'-0"	To top of box
2.	Low wall outlet	16"	To bottom
3.	Medium height wall outlet	4'-0"	
4.	Medium height telephone outlet	4'-0"	
5.	High wall outlet or fixture	7'-0"	
6.	Wall type buzzers, horns, etc.	8'-0" Max.	Top 2" below ceiling
7.	Push-button or control stations	4'-0"	

	Component	Height	Comments
8.	Top of panelboards or control panels	6'-6"	Maximum (except for handicapped areas)
9.	Top of telephone back boards	6'-6"	Maximum
10.	Top of switch handle on motor control center	6'-6"	Maximum
11.	Top of local motor controller	6'-0"	Maximum
12.	Top of local disconnect switch	6'-0"	Maximum
13.	Wall mount exterior light fixtures	8'-0"	or as shown
14.	Wall mount emergency light fixtures	6'-6"	Maximum to test button
15.	Wall thermostats	4'-0"	To top of thermostat

C. In situations where there appears to be a conflict with Americans with Disabilities Act (ADA) legislation, utilize the ADA requirements herein.

1.25 HAZARDOUS AREA CLASSIFICATIONS

A. The following table identifies the applicable hazardous areas for this project, and the classifications for each. All equipment used in these areas shall be UL listed for the application, and all wiring methods shall be in accordance with Chapter 5 of the National Electrical Code. All conduits to these spaces from non-hazardous areas shall be properly sealed.

Location	Area Classification	Extent of Hazardous Area
Wetwell	Class I, Division 1, Group D	Entire Wetwell
Valve Vault	Class I, Division 2, Group D	Entire Vault
Diversion Structure/ Screenings Area	Class I, Division 1, Group D	Entire Structure
Meter Vaults	Class I, Division 2, Group D	Entire Vault
Wet Weather Storage (covered)	Class I, Division 1, Group D	Entire Structure
Electrical Building	Unclassified	Entire Building

Note: These ratings are based on no continuous ventilation and some may be rerated if continuous ventilation is provided (per NFPA 820).

1.26 RECEIPTS

A. Some sections of the Specifications call for equipment, materials, accessories, etc. to be provided and "turned over to the Owner" or like requirements. The Contractor shall obtain a receipt for each item turned over, signed by the Owner or his representative. A copy of this receipt shall be transmitted to the Engineer.

B. When a question arises concerning whether items have been turned over to the Owner, and there is no signed receipt, it may be assumed that the items were not provided.

1.27 POWER SYSTEM STUDIES

A. General

1. The Contractor shall provide Short Circuit Studies, Protective Device Evaluation Studies, Protective Device Coordination Studies, and Arc Flash Studies performed by a professional registered electrical engineer currently registered in the State of Kentucky for the entire electrical system. The studies shall be performed in accordance with 399-1997, IEEE Recommended Practice for Industrial and Commercial System Power Analysis (IEEE Brown Book). The studies shall be submitted to the Engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment for manufacture. If formal completion of the studies may cause delay in equipment manufacture, approval from the Engineer may be obtained for a preliminary submittal of sufficient study data to insure that the selection of device ratings and characteristics will be satisfactory.

2. The studies shall include all portions of the electrical distribution system from the utility company protective devices, the normal and standby power sources down to and including the 480 volt feeder protective devices for each feeder. The study shall include all low and medium voltage switchgear, MCCs, and panelboards. System connections and those which result in maximum fault conditions shall be adequately covered in the study.

3. In the event that the short circuit study requires a higher interrupting and/or withstand rating of equipment than that which is indicated in the Contract Documents, the Contractor shall furnish and install the equipment as required based on the study with no extra cost to the Owner.

4. In the event that the protective device coordination study indicates that different settings or equipment is required than that which is specified, the Contractor shall furnish and install the equipment based on the study with no extra cost to the Owner.

B. Data Collection for the Studies

The Contractor shall provide the required data for preparation of the studies. The preparer of the studies shall furnish the Contractor with a listing of the required data immediately after award of the Contract.

1. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to release of the equipment for manufacture.

C. Short Circuit Study and Protective Device Evaluation Study

1. The short circuit study shall be performed with the aid of a digital computer program and shall be in accordance with the latest editions of IEEE Std. 399 and IEEE Std. 141.

2. The study input data shall include the utility company's short circuit contribution, resistance and reactance components of the branch impedances, the X/R ratios, base quantities selected, and other source impedances.

3. Short circuit close and latch duty values and interrupting duty values shall be calculated on the basis of assumed three-phase bolted short circuits at each bus, switchgear, medium and low-voltage motor control center, distribution panelboard, pertinent branch circuit panel and other significant locations through the system. The short circuit tabulations shall include symmetrical fault currents, and X/R ratios. For each fault location, the total duty on the bus, as well as the individual contribution from each connected branch, shall be listed with its respective X/R ratio.

4. A protective device evaluation study shall be performed to determine the adequacy of circuit breakers, molded case switches, automatic transfer switches, and fuses by tabulating and comparing the short circuit ratings of these devices with the calculated fault currents. Appropriate multiplying factors based on system X/R ratios and protective device rating standards shall be applied. Any problem areas or inadequacies in the equipment due to short circuit currents shall be promptly brought to the attention of the Engineer.

5. All equipment furnished shall meet the requirements of this study, with no extra cost to the Owner.

D. Protective Device Coordination Study

1. A protective device coordination study shall be performed to provide the necessary calculations and logic decisions required to select or to check the selection of power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated current transformers, and low voltage circuit breaker trip characteristics and settings.

2. The coordination study shall include all low voltage classes of equipment from the utility company service protective devices down to and including the main circuit breakers of motor control centers. The phase and ground overcurrent protection shall be included as well as settings of all other adjustable protective devices.

3. The time-current characteristics of the specified protective devices shall be drawn on log-log paper. The plots shall include complete titles, representative one-line diagram and legends, significant motor starting characteristics, complete parameters of transformers, complete operating bands of low voltage circuit breaker trip curves and fuses. The coordination plots shall indicate the types of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, transformer magnetizing inrush and ANSI transformer withstand parameters, cable thermal overcurrent withstand limits and significant symmetrical and asymmetrical fault currents. All restrictions of the National Electrical Code shall be adhered to and proper coordination intervals and separation of characteristic curves shall be maintained. The coordination plots for phase and ground protective devices shall be provided on a system basis. A sufficient number of separate curves shall be used to clearly indicate the coordination achieved.

4. The selection and settings of the protective devices shall be provided separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios and connections, manufacturer and type, range of adjustment and recommended settings. A tabulation of the recommended power fuse selection shall be provided for the medium voltage fuses where applied in the system. Any discrepancies, problem areas, or inadequacies shall be promptly brought to the attention of the Engineer.

E. Arc Flash Hazard Analysis

1. An Arc Flash Hazard Analysis shall be performed with the aid of a digital computer program in accordance with IEEE Std. 1584, "IEEE Guide For Performing Arc Flash Hazard Calculations", NFPA 70E, and OSHA 29-CFR, Part 1910 Subpart S.

2. Arc Flash Warning Labels and Bus Detail Sheets shall be produced for each bus. Labels shall be printed in color on adhesive backed labels. Labels shall be attached to the doors of the equipment. Each label and detail sheet shall list the following:

   a. Bus name

   b. System operating voltage

   c. Date of issue

   d. Flash hazard protection boundary

   e. Limited approach boundary

f. Restricted boundary

g. Prohibited boundary

h. Incident energy level

i. Required personal protective equipment class

j. In addition, each Bus Detail Sheet shall list the following:

1) Upstream Protective Devices Names, Type and Settings

3. Arc Flash Evaluation Summary Sheets shall be produced. Summary sheets shall list the following:

a. Bus name

b. Upstream protective device name, type and settings

c. Bus line-to-line voltage

d. Bus bolted fault

e. Protective device bolted fault current

f. Arcing fault current

g. Protective device trip / delay time

h. Breaker opening time

i. Solidly grounded column

j. Equipment type

k. Gap

l. Arc flash boundary

m. Working distance

n. Incident energy

o. Required personal protective equipment class

4. Analyze the short circuit, protective device coordination, and arc flash calculations and highlight any equipment that is determined to be underrated or causes an abnormally high incident energy calculation. Propose approaches to reduce the

energy levels. Proposed major corrective modifications will be taken under advisement by the Engineer and the Contractor will be given further instructions.

F. Study Report

1. The results of the power system studies shall be summarized in a report. The report shall be submitted to the Engineer. The report shall be submitted for review and acceptance prior to submittals for medium voltage switchgear, medium voltage motor control equipment, low voltage switchgear and switchboards, motor control centers, variable frequency drives, panelboards, and similar electrical equipment. In addition to the report, all files related to the program used to perform the study shall be submitted.

2. The report shall include the following sections:

   a. Description, purpose, basis and scope of the study and a detailed single line diagram with "nodes" cross-referenced to the calculated values tabulated in the study report of that portion of the power system which is included within the scope of the study.

   b. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties and commentary regarding same.

   c. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.

   d. Fault current calculations including a definition of terms and guide for interpretation of computer printout.

3. Prior to commencing the work, the preparer the studies shall meet with the testing firm that will do the relay field testing and the Owner's representative at the site for a walk through of the facility to insure that existing conditions are taken into account.

4. The study shall include a detailed explanation of all software programs and procedures used to arrive at the calculated values, settings, and drawings (e.g. single line diagrams) showing fault valves at all busses.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 16070
SUPPORTING DEVICES

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. All electric equipment shall be rigidly mounted, and installed using supporting devices as indicated on the Contract Drawings, as required by the work, and described herein.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. "Kindorf," "Unistrut," or equal.

2.02 MATERIALS

A. All mounting brackets and strut shall be aluminum. Fasteners used to mount equipment shall be stainless steel.

B. Aluminum support members shall not be installed in direct contact with concrete. Stainless steel or non-metallic "spacers" shall be used to prevent contact of aluminum with concrete.

PART 3 – EXECUTION

3.01 ANCHORING CABINETRY

A. All free standing equipment shall be anchored to its foundation using expansion bolts of the size and number recommended by the equipment manufacturer.

3.02 SEISMIC CONSIDERATIONS

A. Where indicated, seismic restraints shall be provided for electrical equipment.

END OF SECTION

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SECTION 16075
ELECTRICAL IDENTIFICATION

PART 1 – GENERAL

1.01 EQUIPMENT LABELING

A. All starters, feeder units in panelboards, switchboards, disconnects, instruments, etc. shall be marked to indicate the motor, outlet, circuit they control, or variable monitored. Marking is to be done with engraved laminated nameplates and shall bear the designation shown on the Contract Drawings where this information is given. Nameplates shall be fastened to equipment with stainless steel screws, minimum of one each side. In no way shall the installation of mounting screws void the NEMA enclosure rating of the equipment in which they are installed. If there are more than one identical unit, they shall be given consecutive numbers or other descriptions as designated by the Engineer. Nameplate background color shall be white, with black engraved letters, unless otherwise noted.

B. Branch circuits in lighting panels shall be typed on a card suitable for the card frame furnished with the panel. The card shall bear the panel designation listed on the Contract Drawings where this information is given, as well as indicate what each circuit controls.

C. Motor control centers, individual wall mounted starters, panelboards, and disconnect switch shall be labeled with vinyl self-adhesive signs that warn of "High Voltage" (state the specific voltage). Main service entrance conduits to a building, where exposed, shall be labeled with the voltage of the service they carry. Other major equipment such as transformers, transfer switches, generator sets, pump control panels, etc., shall be labeled as such. The type of labels to be used shall have orange as the basic color to conform with OSHA requirements, letters shall be black. The labels shall be of proper size to fit flatly on the surface of the enclosure to make for a neat appearance and not interfere with the operating function of the device it is attached to. These labels shall be as manufactured by the Brady Identification Systems Division, Safety Sign Company, or equal.

D. Furnish and install "Authorized Personnel Only" signs by doors into all power distribution equipment rooms/buildings. Furnish and install other signs as indicated on the Contract Drawings.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 16120
CONDUCTORS AND CABLES

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. All wire and cable shall conform to the latest requirements of the NEC and shall meet all ASTM/UL specifications. Wire and cable shall be new; shall have size, grade of insulation, voltage rating and manufacturer's name permanently marked on the outer covering at regular intervals. Complete descriptive literature shall be submitted to the Engineer for review and acceptance prior to installation.

B. Building wire #12 - #1 shall be applied based on a 60 degree Celsius temperature rise. Building wire larger than #1 may be applied at its 75 degree Celsius temperature rise.

1.02 DELIVERY, STORAGE AND HANDLING

A. Wire and cable shall be suitably protected from weather and damage during storage and handling and shall be in first class condition when installed.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Building Wire (types "THWN" and "THW"-cu.) – "Southwire," "Collyer," "American," "Carol," or equal.

B. Control Cables (Shielded or unshielded) 600V max. – "Belden," "Eaton-Dekoron," "Okonite," or equal.

C. Instrumentation Cables (Shielded) 600V mx. – "Eaton-Dekoron," "Manhatton," "American," "Belden," "Okonite," or equal.

2.02 MATERIALS

A. General

1. In general, all conductors shall be 98 percent conductive, annealed copper unless otherwise noted on the Contract Drawings.

2. Conductors shall be type THW or THWN insulation. Conductor size shall be AWG (American Wire Gauge) Standard. Minimum conductor size shall be AWG number 12 except branch circuits in excess of 75 feet from panel to first outlet not smaller than no. 10 AWG. Minimum voltage rating shall be 600 volts. Conductors for

small power may be solid (i.e. lighting, receptacles), but conductors for control work shall be stranded.

3. Conductors with high temperature rated insulations and special construction shall be used where required in connecting to light fixtures or appliances that have special requirements.

4. Control conductors shall be #14 AWG minimum.

5. Instrument Cable:

    a. All signal lines should be constructed of individually twisted pairs (6 to 10 twists per foot), including thermocouple extension leads. Cables should be made of twisted pairs, with all lays and pairs twisted in the same direction for maximum flexibility.

    b. Wire size is #16 AWG minimum.

    c. Stranded tinned copper conductor shall be used for all wiring other than thermocouple extension leads.

    d. Insulation resistance at 68 degrees Fahrenheit between conductors and between conductors and ground should be at least 500 megohms per 1,000 feet.

    e. Multi-pair cable should be jacketed with poly-vinyl-chloride, polyethylene or Teflon at least 0.045" thick. Voltage rating shall be 600 volts.

6. Submersible pump Power Cable

    a. Power cables for submersible pumps shall be of the extra hard usage type suitable for submerged duty and able to withstand common corrosive agents found in water and wastewater. They shall be provided with high grade non-magnetic stainless steel relief cable grips installed at the pump end and high grade non-magnetic stainless steel support cable grips anchored to the wet well structure where they enter the wet well. The strain relief and support cable grips shall be as manufactured by Kellems, Slater/Flexcor, or equal. Non-metallic corrosion resistant grips may be used in lieu of stainless steel if available for the cable size.

7. Ethernet Cables

    a. Ethernet cables shall be Category 6 rated.

    b. Ethernet cables inside VFD cabinets shall be Category 6 rated and shielded.

PART 3 – EXECUTION

3.01 INSTALLATION/APPLICATION/ERECTION

A. General

1. Conductors shall be continuous from outlet to outlet and no splices shall be made except accessible in junction or outlet boxes. Wire connectors of insulating material or solderless pressure connectors, properly taped, shall be used for all splices in wiring, wherever possible.

2. Conductors shall be color coded in accordance with the following schedule:

	480/277V 3 Phase	**208/240V 3 Phase**	**120/240 Single Phase**
Phase A	Brown	Black	Black
Phase B	Orange	Red	Red
Phase C	Yellow	Blue	
Neutral (Grounded)	White or Light Gray	White or Light Gray	White or Light Gray
3-Way Tracers			Blue
Grounding	Green	Green	Green
Remote Energized Conductors (Control)			Yellow
Control	Std. Code	Std. Code	

3. Conductors shall be pulled into raceways in strict accordance with manufacturer's recommendations.

4. Ample slack conductors shall be allowed at each terminal point, and pull or junction box, to permit installation with ease and without crowding.

5. All conductors terminating at terminal blocks shall be identified with numbers and/or letters identical to circuit or control identification.

6. No conductors shall be drawn into conduits until all work which may cause wire or cable damage is completed. Wire pulling shall be accomplished utilizing machinery and accessories intended for the purpose.

7. All connections and splices shall be made in accordance with conductor manufacturer's recommendations, and as written herein.

8. In general, feeder sizes shown are based on no more than three current carrying conductors in a conduit. Multiple small branch circuit feeders may be combined in

a common conduit, provided conductors are derated in accordance with NEC article 310-15.

9. Unless otherwise specifically indicated, neutrals may not be shared.

B. Feeders

1. All feeders are of the secondary type, below 600 volts, unless otherwise noted. Secondary feeder voltage shall be 480 volt, as noted in the Contract Drawings. Three phase, 4 wire for power and 208/120 volt, 3 phase, 4 wire for general lighting, unless otherwise noted. The Contractor shall furnish and install all feeders from the distribution center(s) to each of the other structures/subpanels as shown on the Contract Drawings.

2. Wire shall be factory color coded for each phase and neutral, with green used for the ground conductor. As far as practical, all feeders shall be continuous from origin to panel termination without running splices in intermediate pull boxes.

C. Control Cable

1. Control cable shall be the size and have the number of conductors shown on the control system drawings. Control cable shall be used for motor controls and monitoring only. Color coding shall be ICEA, Method 1. Control cables between buildings shall be underground in conduit of the size shown in the control system schematic. Cabling shall provide a minimum of 25 percent spare conductors. Voltage rating shall be 600 volts.

2. Signal Wiring

a. Low level analog (less than 500 millivolt d-c). Use twisted pairs which may be cabled with other pairs carrying similar voltage levels. Foil wraps or equivalent shielding is required for each cable with the shield insulated from ground.

b. High level analog (greater than 500 millivolts d-c). Use twisted pairs which may be cabled with other pairs carrying similar voltage levels and current levels less than 100 ma. Shielding is required.

c. Analog outputs (normally 0-4 d-c or 4-20 ma). Same as b.

d. Contact inputs - use twisted pairs and run in separate conduit.

e. Contact outputs - same as d.

f. Pulse inputs - same as d.

3. Signal and Shield Grounding

a. All shields must be grounded at one point only as close as possible to the signal source.

b. Thermocouples may be grounded or ungrounded.

c. Analog signals, if grounded, should be grounded as near the signal source as possible.

d. Resistance bulbs should not be grounded.

4. Signal and Wiring Separation

a. Analog signals shall be run in a separate conduit from contact or pulse signals.

b. A minimum separation of 12 inches between analog signal leads and a-c power leads should be maintained. For a-c power leads carrying 100 amps or greater, a 24 inch separation should be maintained. Parallel runs should be limited to less than 500 feet. Perpendicular runs may be as close as 6 inches.

3.02 FIELD QUALITY CONTROL

A. Testing

1. All testing shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

a. Witness Shop Tests

1) Not required.

b. Shop Test

1) Cable and wiring shall be tested in accordance with the applicable ICEA Standards. Wire and cable shall be physically and electrically tested in accordance with the manufacturer's standards.

c. Field Tests

1) Field testing shall be done in accordance with the requirements specified in the General Conditions, Division 1, and NETA acceptance testing specifications.

2) After installation, all wires and cables shall be tested for continuity. Testing for continuity shall be "test light" or "buzzer" style.

3) After installation, all wires and cables shall be tested for insulation levels. Insulation resistance between conductors of the same circuit and between conductor and ground shall be tested. Testing for insulation levels shall be as follows:

a) For 600V power and control cable, apply 1,000 VDC from a Megohmeter for one (1) minute for all 600V wires and cables installed in lighting, control, power, indication, alarm and motor feeder circuits. Resistance shall be no less than 100 Megohms.

b) 600V instrumentation signal cable shall be tested from conductor to conductor, conductor to shield, and conductor tc ground using a Simpson No. 260 volt-ohmmeter, or approved equal. The resistance value shall be 200 Megohms or greater.

2. Low voltage wires and cables shall be tested before being connected to motors, devices or terminal blocks.

3. Voltage tests shall be made successively between each conductor of a circuit and all other conductors of the circuit grounded.

4. If tests reveal defects or deficiencies, the Contractor shall make the necessary repairs or shall replace the cable as directed by the Engineer, without additional cost to the Owner.

5. All tests shall be made by and at the expense of the Contractor who shall supply all testing equipment. Test reports shall be submitted to the Engineer.

END OF SECTION

SECTION 16130
RACEWAYS

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. This section of the Technical Specifications includes all raceways for accommodation of electrical conductors, communications conductors, sleeves for underground electrical installations, conduit stubs for future installations, fittings therefore and accessories.

B. All raceways shall be marked with the manufacturer's name or trademark as well as type of raceway and size. This marking shall appear at least once every 10 feet and shall be of sufficient durability to withstand the environment involved. All raceways shall be furnished and installed as outlined under Part 3 of this Specification.

C. All raceways and fittings shall be painted to match existing or surrounding surfaces except in mechanical spaces.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Tubular Raceways

1. Steel, Galvanized, Rigid, Heavy-Wall, Threaded – "Wheatland Tube Co.," "Triangle," "Allied Tube & Conduit Corp.," or equal.

2. Plastic (PVC); Type A (Thin Wall); Type 40 (or Schedule 40); Type 80 (or Schedule 80) (Heavy -Wall) – "Carlon," "Cantex," or equal.

3. Flexible Metal Conduit – "AFC," "Southwire," or equal.

4. Liquidtight Flexible Metal Conduit – "Carol Cable Co., Inc.," "Superflex," "OZ Gedney," or equal.

5. Liquid-Tight Flexible Non-Metallic Conduit - Type "LNM-P" as manufactured by Electri-Flex, Type "Ultralite" as manufactured by Southwire, Type "CNP" as manufactured by Anaconda, or equal.

6. Aluminum Conduit - "Wheatland Tube Co.", "Allied Tube & Conduit Corp.", or equal.

7. PVC Coated Metallic Conduit (PCMC) - "Plasti-Bond Red" as manufactured by Robroy Industries, "OCAL-Blue" as manufactured by Ocal, Inc., Perma-Cote Supreme by Perma-Cote Industries, or equal.

B. Raceway Fittings

1. Conduit fittings – "Crouse-Hinds," "Appleton," "OZ Gedney," or equal.

2. Non-metallic conduit fittings –"Carlon," "Cantex," or equal.

3. Flexible conduit fittings – "Raco," "T & B," "OZ Gedney," or equal.

4. PVC Coated Metallic Conduit fittings - "Plasti-Bond Red" as manufactured by Robroy Industries, "OCAL-Blue" as manufactured by Ocal, Inc., Perma-Cote Supreme by Perma-Cote Industries, or equal.

2.02 MATERIALS

A. Rigid Steel Conduit

1. Rigid steel conduit and fittings shall be of mild steel piping, galvanized inside and out, and shall conform to UL standards. The conduit and fittings hall be listed and labeled by UL as well. The galvanized coating of zinc shall be of uniform thickness applied by the hot-dipped process, and shall be applied also to the threads. It shall be further dipped in a chromic acid bath so as to chemically form a corrosion resistant protective coating of zinc chromate which has a characteristic yellow-green color. Each piece of conduit shall be straight, free from blisters and other defects, cut square, and taper reamed. It shall be delivered with plastic protectors on the threads. Fittings, boxes, strut, and accessories used in conjunction with rigid steel conduit shall not be aluminum.

B. Polyvinylchloride (PVC) Conduit

1. PVC conduit and fittings shall be Schedule 40, 80 heavy wall, or thinwall, as indicated in these Specifications manufactured to conform to UL standards. It shall be listed and labeled by UL. It shall have at least the same temperature rating as the conductor insulation. Expansion joints shall be used as recommended by the manufacturer in published literature. PVC systems shall be 90 degrees Celsius minimum UL rated, have a tensile strength of 7,000 psi @ 73.4 degrees Fahrenheit, flexural strength of 11,000 psi and compressive strength of 8,000 psi.

C. Flexible Conduit

1. Flexible metallic conduit shall be constructed from flexibly or spirally wound elecro-galvanized steel. Connections shall be by means of galvanized malleable iron squeeze type fittings, or tomic twist-in type in sizes not exceeding 3/4 inch. Liquidtight conduit shall be light gray in color and have sealtight fittings, type UA.

2. In hazardous locations where flexible connections are required, flexible couplings UL listed for the application shall be used. The couplings shall consist of stainless steel tubing and outer braid, with insulating liner. Female end fittings shall also be

stainless steel, with removable steel close nipples. Couplings shall be O-Z/Gedney, or equal.

D. Liquid-Tight Flexible Metal Conduit

1. Liquid-tight flexible conduit (LFMC) shall be galvanized steel, single strip, with a copper strip interwoven and suitable as a grounding means. LFMC shall be UL listed. LFMC shall have an extruded moisture and oil-proof PVC jacket.

2. PVC coated or stainless steel watertight connectors shall be used with liquid-tight flexible metal conduit on both ends.

E. Liquid-Tight Flexible Non-Metallic Conduit

1. Liquid-tight flexible non-metallic conduit (LFNC) shall be constructed of PVC. LFNC shall be UL listed. LFNC shall have an extruded moisture and oil-proof PVC jacket.

2. Watertight connectors shall be used with liquid-tight flexible non-metallic conduit on both ends. LFNC shall be used to connect all vibrating equipment installed in sodium hypochlorite storage and transfer areas as specified herein, and other applications as directed by the Engineer or as indicated on the drawings.

F. Aluminum Conduit

1. Aluminum conduit shall be extruded from alloy 6063 and shall be the rigid type, non-toxic, corrosion resistant, and non-staining. It shall be manufactured per UL standards as well as listed/labeled by same.

2. Fittings, boxes, and accessories used in conjunction with aluminum conduit shall be die cast, copper free type. They shall be resistant to both chemical and galvanic corrosion. All covers shall have neoprene gaskets.

3. All aluminum conduit used for this project shall be UL listed for the purpose.

G. PVC Coated Metallic Conduit

1. PVC coated rigid steel conduit (PCMC) shall be rigid galvanized steel conduit covered with a bonded 40 mil (minimum) thickness PVC jacket and coated inside with urethane. The conduit shall comply with NEMA RN-1.

H. Conduit Fittings

1. Rigid Steel Conduit Fittings

a. Standard threaded couplings, locknuts, bushings, and elbows made only of steel or malleable iron are acceptable. Integral retractable type IMC couplings are acceptable also.

b. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.

c. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.

d. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted or use to complete a conduit run where conduit is installed in concrete. Use set screws of case hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.

e. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, installed fittings in flush steel boxes with blank coverplates having the same finishes as that of other electrical plates in the room.

f. Fittings for PVC coated rigid conduit shall be manufactured by the maker of the conduit.

2. Rigid Aluminum Conduit Fittings

a. Standard threaded couplings, locknuts, bushings, and elbows: Malleable iron, steel or aluminum alloy materials. Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are prohibited.

b. Locknuts and bushings: As specified for rigid steel and IMC conduit.

c. Set screw fittings: Not permitted for use with aluminum conduit.

3. Expansion and Deflection Couplings

a. Accommodate 1.9 cm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.

b. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL, and the NEC code tables for ground conductors.

c. Watertight, seismically qualified, corrosion-resistant, threaded for and compatible with rigid or intermediate metal conduit.

d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material and stainless steel jacket clamps.

PART 3 – EXECUTION

3.01 PREPARATION

A. Exterior underground metallic conduits shall be degreased, pretreated, and coated with 2 coats of Carboline 888 epoxy, or equal. Other finishes may be acceptable upon the Engineer's review.

3.02 INSTALLATION

A. Conduit

1. All conduit shall be installed in a first class workmanship manner. It shall be installed in horizontal and vertical runs in such a manner as to ensure against trouble from the collection of trapped condensation and shall be arranged so as to be devoid of traps wherever possible. Special care shall be used in assuring that exposed conduit runs are parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. No open wiring is allowed.

2. Fittings or symmetrical bends shall be required wherever right angle turns are made in exposed work. Bends and offsets shall be avoided wherever possible, but where necessary, they shall be made with an approved conduit bending machine. All conduit joints shall be cut square, reamed smooth and drawn up tight, using couplings intended for the purpose.

3. Conduits shall be securely fastened to all sheet metal outlets, junction and pull boxes with double galvanized locknuts and insulating-grounding bushings as required by the NEC. Conduit crossings in insulating roof fill will require both conduits to be secured to the roof deck, and these crossings can only be made where the insulating fill is a minimum of 3 inches deep. Runs of exposed conduit shall be supported in accordance with the NEC using cast aluminum or malleable iron one hole pipe straps with spacers to provide an air space behind the conduit. Stainless steel minerallaac, one piece conduit clamps shall be acceptable where located such that building occupants are not in danger of inadvertent contact, since this type fitting has several sharp edges. In general terms, they may be considered in areas such as on or above ceilings, or high on walls. All conduit in walls and slabs shall be securely braced, capped (wooden plugs are prohibited), and fastened to the forms to prevent dislodgement during vibration and pouring of concrete.

4. During construction, all conduit work shall be protected to prevent lodgement of dirt, plaster or trash in conduits, fittings or boxes. Conduits which have been plugged shall be entirely freed of accumulations or be replaced. All conduits in floors or below grade shall be swabbed free of debris and moisture before wires are pulled. Crushed or deformed conduit shall not be permitted.

5. Where GRS conduit penetrates a floor slab the conduit shall be painted with 2 coats of Koppers Bitumastic 300-M or equal to a point 6 inches above the penetration.

6. The final section of conduit connecting each motor or piece of utilization equipment subject to vibration shall be of the flexible type. Type "UA" shall be used in all process areas and in outdoor or wet locations. Flexible conduit to space heaters shall be long enough to allow swivel action.

7. All underground conduits entering a building shall be sealed against water/condensate entering around the conductors. Sealant may be silicone rubber based caulk.

8. In certain situations, conduit expansion joints shall be required to ensure against conduit and/or cable damage due to settling or thermal expansion and contraction. These expansion joints shall be required where required by the manufacturer or the Contract Drawings and shall be installed per manufacturer's instructions.

9. Aluminum conduits shall not be in contact with concrete surfaces. Where aluminum conduits are routed along concrete surfaces, they shall be installed with one hole cast straps with clamp-backs to space the conduit ¼" away from concrete surface. Where aluminum conduit passes through concrete, CMU or brick walls, the penetration shall be made such that the aluminum conduit does not come in contact with concrete, CMU, brick or mortar. All penetrations shall meet or exceed the UL design standards. Aluminum conduit shall transition to PVC coated steel conduit where entering a concrete encasement, floor or ductbank.

10. Unless specifically identified on the Drawings as "Direct Buried," all conduits in the earth, including conduits below slabs-on-grade, shall be concrete encased. Joints in conduit shall be staggered so as not to occur side by side. Rigid non-metallic (PVC) conduit shall be connected to PVC coated rigid steel conduit at the point where it leaves the ground, with the transition to metal conduit occurring inside the concrete encasement. PVC coated rigid steel conduit may transition to non-coated conduit after exiting the encasement. The transition coupling between PVC coated conduit and non-coated conduit shall be PVC coated.

11. It is the general intent that boxes for light fixtures, switches, receptacles, etc. in or on the building be flush mounted with concealed conduit to the device, except in areas designated to have all conduit installed exposed.

12. All metal raceway systems shall be grounding conductive, solidly bonded throughout and grounded in accordance with NEC requirements and/or as noted on the Contract Drawings. In addition, all raceway systems shall be provided with separate grounding conductors.

13. **Minimum conduit size shall be 3/4 inch.** The following table shows the minimum burial depth required for all exterior conduit or cable:

Schedule 40 PVC, Concrete Encased	18"
Schedule 40 PVC, Concrete Encased (for medium voltage service entrance)	42"

14. Wire pulling shall be facilitated by the use of a UL approved pulling compound in pulls over 30 feet in length or where there are 2 or more 90 degree bends. Only polypropylene, nylon, or manila pulling ropes will be permitted. Standard industry recognized wire pulling equipment shall be used.

15. All conduits entering and leaving instrument enclosures shall be sealed around the wires with silicone caulk.

16. All conduits for emergency lighting systems shall be separate from other building power conduits.

17. Areas of use for each type of conduit:

Location	Schedule 40 PVC	Schedule 80 PVC	Aluminum	RGS	PCMC
Electrical Room – Exposed			X	X	X
Electrical Room – Concealed in Wall		X	X	X	X
Garage – Exposed			X	X	X
Garage – Concealed in Wall		X	X	X	X
Screenings Room – Exposed Only			X		X
Odor Control Room – Exposed			X		X
Odor Control Room – Concealed in Wall		X	X		X
Chemical Storage Areas		X			
Restroom – Concealed Only		X	X		X
Janitor's Closet – Exposed			X	X	X

Location	Schedule 40 PVC	Schedule 80 PVC	Aluminum	RGS	PCMC
Janitor's Closet – Concealed in Wall		X	X		X
Valve Vault – Exposed Only			X	X	X
Attic Space			X		X
Exterior Exposed			X	X	X
Exterior Underground, Underslab, or In Slab	X	X			X
Exterior Underground Service Entrance (Primary and Sec.)	X	X			X

18. All conduit shall have an insulated ground wire pulled to all equipment and receptacles.

19. All raceway runs are shown diagrammatically to outline the general routing of the raceway. The installation shall be made to avoid interference with pipes, ducts, structural members or other equipment. Should structural or other interference prevent the installation of the raceways, or setting of boxes, cabinets, or the electrical equipment, as indicated in the Drawings, deviations must be approved by the Owner, and after approval, shall be made without additional charges and shown on the Record Drawings.

20. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.

21. No conduit shall be run exposed across roofs without first obtaining permission from the Engineer.

22. Conduit may be run inside concrete slabs as long as the slab is at least 6-inches thick and conduit will have at least 1 2-inches of cover on both sides.

23. Runs of flexible conduit above accessible ceilings shall be limited to 10 ft. Runs of exposed flexible conduit shall be limited to 5 ft. All runs of flexible conduit shall be supported in accordance with NEC requirements.

24. All PVC coated conduit shall be installed in accordance with manufacturer's instructions. The Contractor shall use tools that are specifically suited for coated conduit systems. The use of pipe wrenches and other such tools on PVC coated RGS conduit is prohibited. The Engineer and Owner reserve the right to reject any installation of coated conduit that does not meet the requirements of the Section or

the manufacturer's instructions. The Engineer and Owner also reserve the right to reject any installation that exhibits damage due to the improper use of tools. All rejected installations shall be replaced by the Contractor at no additional cost to the Owner. The use of PVC coated conduit repair compounds to repair damages or improper installation is prohibited.

25. All Contractor personnel that install PVC coated RGS conduit shall be trained by the PVC coated RGS conduit manufacturer. Training shall include proper conduit system assembly techniques, use of tools appropriate for coated conduit systems, and field bending/cutting/threading of coated conduit. The Contractor shall furnish evidence of such training as specified herein. Training shall have been completed within the past 24 months prior to the Notice to Proceed on this Contract for all coated conduit installation personnel. Contractor personnel not trained within this timeframe shall not be allowed to install coated conduit, or shall be trained/re-trained as required prior to commencement of conduit installation.

26. Sealing fittings shall be installed where conduits pass from non-hazardous locations to hazardous locations and as required by Chapter 5 of the NEC. See section 16050 for hazardous area classifications.

END OF SECTION

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SECTION 16131
BOXES

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Outlet and junction boxes shall be furnished and installed where indicated on the Contract Drawings, and\or as required by the work in accordance with the NEC.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Boxes – "Wiegmann," "Appleton," "Raco," "Crouse-Hinds," "Hoffman," "Robroy Industries," "Spring City," "Carlon," or equal.

2.02 GENERAL

A. All junction and/or pull boxes for dry (non-corrosive) areas shall be of code gauge sheet metal construction, of the inside dimensions as required by code, with covers.

B. Outlet boxes for wet or damp locations shall be cast metal, rust and corrosion resistant (NEMA 4X), with at least 5-1/2 full threads for each (bossed) conduit opening, and shall be suitable for flush or surface mounting as required with drilled external, cast mounting extensions (bossed to provide at least 1/8" between back of box and mounting surface for drainage). Box covers shall be hinged or cap screw retained as required, of the same material as the box and provided with stainless steel (rustproof) hardware.

C. Junction and/or pull boxes for out-of-doors use or indoor process areas, not mounted in concrete may be sheet metal (NEMA 4X), waterproof, rustproof, rain and sleetproof, with hinged covers and latches and provided means of locking by means of keyed locks, tamper-resistant screws or padlocking as required and with clamping cap-screws top and bottom door edges to provide firm contact with gasketing. All gaskets shall be molded (unbroken) neoprene or butyl rubber.

D. NEMA 4X junction and/or pull boxes may be stainless steel, if called for on the Contract Drawings; or non-metallic or cast aluminum.

E. Underground junction or pull boxes shall be constructed of reinforced concrete cast-in-place or pre-fabricated as detailed on the Contract Drawings.

F. Junction boxes for use in wet-wells and other hazardous areas shall be watertight, rustproof and corrosion resistant, and explosionproof with threaded conduit openings (5-1/2 full threads - minimum) and provided with rustproof hardware.

G. Explosionproof sealing fittings shall be furnished and installed in accordance with NEC requirements.

H. Junction and/or pull boxes for chemical storage and transfer areas shall be Schedule 80 PVC where Schedule 80 PVC conduit is specified in 16130.

PART 3 – EXECUTION

3.01 INSTALLATION, APPLICATION, AND ERECTION

A. General

1. Outlets shall be installed in the locations shown on the Contract Drawings. The Contractor shall study the general building plans in relation to the space surrounding each outlet, in order that his work may fit the other work required by these Specifications. When necessary, the Contractor shall relocate outlets so that when fixtures or other fittings are installed, they will be symmetrically located according to room layout and will not interfere with other work or equipment.

2. All supports for outlet boxes shall be furnished and installed by the electrical trades.

B. Concealed Work

1. All outlet boxes shall be standard galvanized steel type at least 2 inches deep, single or gang type of size to accommodate devices shown. Exceptions shall be noted on the Contract Drawings.

2. Standard deep type outlet boxes (concrete rings with appropriate covers) shall be used in floor slab construction so concealed conduits entering sides of boxes can clear reinforcing rods.

3. Outlet boxes for concealed telephone and signaling systems shall be the 4-inch square type, unless otherwise noted or required by the telephone company.

4. Boxes for use in masonry construction shall be 2-1/2 inches deep for 4-inch block and 3-1/2 inches deep for 6- and 8-inch block. Through wall boxes are prohibited for outlets opposite each other.

C. Exposed Work

1. Outlet or junction boxes for use with exposed aluminum conduit shall be copper free, cast aluminum type.

2. Outlet or junction boxes for use with exposed PVC conduit shall be PVC.

D. Pull Boxes

1. Pull boxes for exterior underground work are shown on the Contract Drawings and are the minimum number required. Others may be added at the Contractor's option, but no extra pay shall be allowed. Interior pull boxes are not shown but shall be used as needed. Pull box types are as follows:

   a. Exterior - Per detail on the Contract Drawings.

   b. Interior - Interior pull boxes in dry areas shall be of code gauge steel of not less than the minimum required by the NEC and shall be provided with hinged covers. In wet areas or pipe galleries, they shall be rated watertight, of stainless steel, cast aluminum, PVC, fiberglass, or equal. Hardware shall be stainless steel.

E. Openings in Electrical Boxes

1. All openings in electrical equipment, enclosures, cabinets, outlet and junction boxes shall be by means of welded bosses, standard knockouts, or shall be sawed, drilled, or punched with tools specially made for the purpose. The use of a cutting torch is prohibited. Unused openings shall be plugged per the NEC.

END OF SECTION

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SECTION 16150
WIRE CONNECTIONS AND CONNECTING DEVICES

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Wire connection and connecting devices shall be as herein specified.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Connectors, Lugs, etc. – "T & B", "Anderson", "Burndy", or equal.

B. Termination and splice connectors – "3M Scotchlok", "Anderson", "T & B", "Burndy", or equal.

2.02 MATERIALS

A. Wire Splicing and Terminations (600 Volts and Below)

1. Electrical Terminal and Splice Connectors (#22 - #4 AWG)

a. Terminals and splice connectors from #22 - #4 AWG shall be compression types with barrels to provide maximum conductor contact and tensile strength. Performance, construction, and materials shall be in conformance with UL standards for wire connectors and rated for 600 volts and 105 degrees Celsius.

b. Connectors shall be manufactured from high conductivity copper and entirely tin plated. Terminal barrels shall be serrated on the inside surface and have a chamfered conductor entry. Terminals shall have funnel entry construction to prevent strand fold-back. All barrels shall be brazed seam or seamless construction.

c. Spade type terminals shall be sized for the appropriate stud and shall be locking type that snap firmly onto studs with a close fit for maximum retention. Spade type terminals shall be insulated with an insulation suitable for maintaining a high dielectric strength when crimped and be made form nylon, PVC, or equal.

2. Electrical Lugs and Connectors (#6 AWG - 1000 Kcmil)

a. Lugs and splice connectors from #6 AWG - 1000 Kcmil shall be compression types with barrels to provide maximum conductor contact and tensile strength. They shall be manufactured from high conductivity copper and entirely tin plated. They shall be crimped with standard industry tooling. The

lugs and connectors must have a current carrying capacity equal to the conductors for which they are rated and must also meet all UL requirements. All lugs above 4/0 AWG shall be 2 hole lugs with NEMA spacing. The lugs shall be rated for operation through 35 KV. The lugs shall be of closed end construction to exclude moisture migration into the cable conductor.

3. Twist-on Wire Connectors (#22 AWG - #10 AWG)

   a. All twist-on wire connectors must have a corrosion resistant spring that is free to expand within a steel jacket. The steel jacket must be insulated with a flexible vinyl jacket capable of withstanding 105 degrees Celsius ambient temperatures and of sufficient length to cover wires that are inadvertently overstripped.

   b. Each connector size must be listed by UL for the intended purpose and color coded to assure that the proper size is used on the wire combinations to be spliced. The connectors must be compatible with all common rubber and thermoplastic wire insulations.

4. Solderless/re-usable lugs shall be used only when furnished with equipment such as control panels, furnished by others, where specification of compression type lugs is beyond the Contractor's control. In the event their use is necessary, the Contractor shall be responsible for assuring that they are manufactured to NEMA standards, with proper number and spacing of holes and set screws.

PART 3 – EXECUTION

3.01 INSTALLATION, APPLICATION, & ERECTION

A. Insulation of Splices and Connections

1. Connections/splices with a smooth even contour shall be insulated with a conformable 7 mil thick vinyl plastic insulating tape which can be applied under all weather conditions and is designed to perform in a continuous temperature environment up to 105 degrees Celsius. The tape shall have excellent resistance to abrasion, moisture, alkalies, acids, corrosion, and varying weather conditions (including sunlight). The tape shall be equal to Scotch 33+ and shall be applied in conformance with manufacturer's recommendations. In addition, it shall be applied in successive half-lapped layers with sufficient tension to reduce its width to 5/8 of its original width. The last inch of the wrap shall not be stretched.

2. Connections/splices with irregular shapes or sharp edges protruding shall be first wrapped with 30 mil rubber tape to smooth the contour of the joint before being insulated with 33+ insulating tape specified in the previous paragraph. The rubber tape shall be high voltage (69 KV) corona-resistant based on self-fusing ethylene propylene rubber and be capable of operation at 130 degrees Celsius under emergency conditions. The tape must be capable of being applied in either the stretched or unstretched condition without any loss in either physical or electrical

properties. The tape must not split, crack, slip, or flag when exposed to various environments. The tape must be compatible with all synthetic cable insulations. The tape must have a dissipation factor of less than 5 percent at 130 degrees Celsius, be non-vulcanizing, and have a shelf life of a least 5 years. The rubber tape shall be applied in successive, half-lapped wound layers and shall be highly elongated to eliminate voids. Other manufacturer's recommendations on installation shall be adhered to. The rubber tape shall be equal to Scotch 23 or 130C electrical splicing tape.

3. Splices made in wet or damp locations shall be made submersible and watertight with special kits made for the application and compatible with type of cables employed.

B. Connection Make-up

1. Connections of lugs to bus bars, etc., shall be made up with corrosion resistant steel bolts having non-magnetic properties with matching nuts, and shall utilize a Belleville spring washer (stainless steel) to maintain connection integrity. Connections shall be torqued to the proper limits. Prior to bolting up the connection, electrical joint compound shall be brushed on the contact faces of the electrical joint.

2. All motor lead connections shall be made up to match the type of lead furnished on the motor. If the lead is not lugged, then twist-on wire connectors may be used. To prevent possible vibration problems, twist-on connectors shall be taped after installation.

3. All lugged motor lead connections (excluding motors over 200 horse-power) shall be made up using ring tongue compression lugs with proper size stainless steel nuts and bolts. Belleville type spring shall be used to maintain tension on the connections. The connections shall then be insulated using the procedure described for irregular shapes, utilizing rubber tape in conjunction with vinyl electrical tape.

4. At the time of final inspection, the Engineer may request the Contractor to disassemble 3 randomly selected motor lead connections in the Engineer's presence, to assure conformance with these Specifications.

5. The Contractor shall include all necessary tools, materials, and labor in his bid for disassembly of the connections and for remaking them with new insulating materials after inspection.

END OF SECTION

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SECTION 16170
SAFETY SWITCHES

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Provide horsepower-rated, quick-make, quick-break, safety switches provided with the number of poles and fuses as required.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS/EQUIPMENT

A. Safety switches shall be as manufactured by General Electric, Square D Company, Eaton, or equal.

B. Switches shall be NEMA Type HD, single-throw, externally operated, non-fused or fused with Class R fuse clips.

C. Switches shall have arc shields, shall be of enclosed construction and fusible or non-fusible as indicated. Switches shall be rated for either 250-volt AC or 600-volt AC service as required.

D. All switches shall be capable of interrupting locked rotor current of motor which it serves.

E. Enclosures shall be NEMA-1 for interior non-process area use and NEMA-4X for exterior and process area use unless noted otherwise.

F. Provide dual-element Bussman type FRN (250 volt) or type FRS (600 volt) fuses for any fusible safety switch serving a motor circuit.

G. For non-motor loads, provide dual element Bussman type LPN (250 volt) or type LPS (600 volt).

H. All switches shall be capable of being padlocked in either the "On" or "Off" position.

I. Safety switches shall be provided with auxiliary contacts where indicated on Contract Drawings.

J. Safety switches shall be UL listed and shall conform to NEMA Standards. NEMA 4X enclosed safety switches where called for shall be stainless steel. Enclosures for switches located in sodium hypochlorite storage or transfer areas shall be NEMA 4X non-metallic. Safety switches installed within classified areas shall be NEMA 7.

K. NEMA 1 enclosed switches shall be phosphate coated as equivalent, code gauge steel with baked enamel finish.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Provide non-fusible switches at remote motor locations as indicated on drawings.

B. Provide fusible disconnects at package A/C units, fused as specified on unit nameplate.

C. Mount switches to walls or to equipment enclosures with a minimum of 4 bolts using toggle anchors for masonry construction, Phillips "Red Head" anchors for poured concrete construction and bolts, jumbo washers, lock washers and nuts for equipment enclosure mounting.

D. All safety switches to be identified with nameplates per Section 16075.

END OF SECTION

SECTION 16220
MOTORS

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Motors are to be furnished with driven equipment except where otherwise noted on the Contract Drawings or elsewhere in this Division of the Specifications. All motors shall conform to the following Specifications and any special requirements of the driven equipment. Special requirements of the driven equipment shall take precedence over these Specifications should a discrepancy occur. Starting torque and slip ratings shall conform to the requirements of the driven equipment.

B. Polyphase motors shall be of the squirrel cage induction type and single phase of the capacitor start-induction run type except as otherwise noted. Conduit boxes shall be tapped for the size conduit shown on the Contract Drawings.

C. All motors shall be manufactured and installed in accordance with applicable NEMA standards and NEC provisions, latest revisions.

1.02 DELIVERY, STORAGE, & HANDLING

A. All electrical motors shall be protected against the accumulation of moisture, dust and debris and physical damage during the course of installation of the job.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Motors – "General Electric", "Westinghouse", "U.S. Motors", "Gould Century", "Lincoln", "Baldor", "Marathon", "Reliance", "Magnatek", "Siemens", or equal.

2.02 EQUIPMENT

A. Motors 200 Horsepower and Under for Service Under 600 Volts

1. Ratings and Electrical Characteristics

a. Time: All motors shall be rated for continuous duty.

b. Temperature: Based on NEMA standards for a maximum ambient temperature of 40 degrees Celsius and an altitude of 3,300 feet or less, according to service factor and insulation class employed.

c. Voltage: All single phase motors shall be rated 115/208/230 volts and all polyphase motors 230/460 volts. Submersible polyphase motors to be operated at 460 volts may take exception to the dual voltage requirement. All motors shall be capable of normal operation at balanced voltages in the range of ±10 percent from rated winding voltage.

d. Frequency: All a-c motors shall be rated for 60 Hz. operation. All motors shall be capable of normal operation at frequencies 5 percent above or below the nominal rating of 60 Hz.

e. Horsepower: Horsepower of the motors shall be as given in the Specification Division on the driven equipment or as shown on the Contract Drawings. Submersible motors shall be allowed to be furnished even though the horsepower rating may not be in accordance with standard NEMA assignments. In many cases, the horsepower specified is a minimum requirement and certain alternate manufacturers may require larger horsepower motors. The larger motor shall be furnished at no extra cost to the Owner.

f. Locked Rotor Current: Locked rotor current shall be in accordance with NEMA standards.

g. Efficiency and Power Factor: Efficiency and power factor shall be given consideration during Shop Drawing review. The ratings at full, 3/4, and 1/2 load shall be compared to similar motors manufactured by acceptable suppliers listed in these Specifications. Excessive variation shall be considered grounds for rejection.

h. Speed: Synchronous speed of motors shall correspond to standard NEMA ratings. Actual speed shall be as given in the Specification Division on the driven equipment. Slip shall not exceed 5 percent at full load.

i. Service Factor: The service factor shall be 1.15 unless requirements of the driven load necessitate a higher service factor. The service factor for inverter duty rated motors shall be 1.0.

j. Insulation Class: Insulation shall be NEMA Class F, except as otherwise noted. Submersible motors shall be Class F, and inverter duty motors to be operated at variable speed shall be Class F. Motors shall operate at a Class B rise at nameplate horsepower loading regardless of Insulation Class.

k. Design Level: Motors shall be NEMA design B, except as otherwise noted.

l. Enclosure: Motors for process equipment 2 HP and smaller shall be totally enclosed. All motors for process equipment larger than 2 HP shall be TEFC (totally enclosed fan cooled), suitable for use indoors or outdoors, except as otherwise noted. Totally enclosed non-ventilated (or air-over) motors may

be used for ventilators and other auxiliary equipment that by virtue of the load are provided with more than adequate ventilation. ODP (open dripproof) motors may be used for ventilators where the motor is outside the air stream yet still protected from the weather. Division 15 of the Specifications and the HVAC Contract Drawings will detail the type of enclosure required for ventilators. Submersible motors shall be air or oil filled and of watertight construction. Motors used in classified atmospheres shall be properly rated for that hazard.

m. Frame Size: Frame designations shall be in accordance with NEMA standards.

n. Winding Overtemperature Sensors: All motors 15 horsepower and over shall be provided with motor winding thermostats. The devices shall be hermetically sealed, snap-acting thermal switches, actuated by a thermally responsive bi-metallic disk. A minimum of 1 per phase is required, with switches wired into the control circuit of the starter to provide deenergization should overheating threaten. All submersible motors shall be equipped with motor winding thermostats.

o. All submersible pump/motor assemblies shall be equipped to detect presence of moisture and alarm at the controller.

p. Motors specified for operation with variable frequency drives shall be inverter duty and shall be designed to output 100 percent of nameplate horsepower under continuous duty service without exceeding the temperature rise specified herein when controlled by the actual drives furnished. Inverter duty motors shall be designed to operate down to 10% of full load speed without the need for a line powered cooling fan.

2. Mechanical Characteristics

a. Integral Horsepower Motor Construction

1) Motor frames for horizontal motors shall be cast iron, heavy fabricated steel, or cast aluminum (alloy 356 or 360). A steel insert ring shall be set into the aluminum alloy endshield when cast to minimize wear of the bearing support. Aluminum alloy motors shall not be used in areas where exposed to chlorine gas.

2) Motor frames for vertical motors shall be cast iron, heavy fabricated steel, or extruded aluminum (alloy 6063-T4 or 6063-T6). Endshields for vertical motors must be cast iron.

3) If an aluminum frame is used, the endshields and/or all other steel hardware must be plated with zinc or cadmium and coated with grease

before assembly to minimize the galvanic action between the steel and aluminum.

4) Motor frames and endshields shall be of such design and proportions as to hold all motor components rigidly in proper position and provide adequate protection for the type enclosure employed. Lifting lugs of all motors shall conform to NEMA standards.

5) Windings shall be random or form wound, adequately insulated and securely braced to resist failure due to electrical stresses and vibration. If the windings are aluminum, there shall be a cold welded aluminum-copper transition joint at the termination of the windings to permit the use of standard copper to copper connection techniques by the electrician and to prevent galvanic action between the copper power wires and the aluminum windings.

6) The motor shaft shall be made of high grade machine steel or steel forging of size and design adequate to withstand the load stresses normally encountered in motors of that particular rating. Bearing journals shall be ground and polished.

7) Rotors shall be made from high grade steel laminations adequately fastened together and to the shaft. Rotor cage windings may be cast aluminum of bar type construction with brazed end rings.

8) Integral horsepower motors shall be equipped with cone, roller, or ball bearings made to AFBMA standards, Grade 1 and shall be of ample capacity for the motor ratings. The bearing housing shall be large enough to hold sufficient lubricant to minimize the need for frequent relubrication (ten years normal operation without lubrication), but facilities shall be provided for adding new lubricant and draining out old lubricant without motor disassembly. The bearing housing shall have long, tight running fits or rotating seals to protect against the entrance of foreign matter into the bearings or leakage of lubricant out of the bearing cavity.

9) See the specification division relating to each piece of motor driven equipment for additional motor requirements to those listed above.

b. Fractional Horsepower Motor Construction

1) Motor and shell shall be rigid welded steel designed to maintain accurate alignment of motor components and provide adequate protection. End shields shall be reinforced, lightweight, die cast aluminum. Windings shall be of varnish insulated wire with slot insulation of polyester film and baked on bonding treatment to make the stator winding strongly resistant to heat, aging, moisture, electrical

stresses, and other hazards. Motor shafts shall be made from high grade, cold rolled, shaft steel with drive shaft extensions carefully machined to standard NEMA dimensions for shaft coupled drive connection. Bearings shall be carefully selected precision ball bearings with extra quality, long life grease and large reservoir providing 10 years normal operation without relubrication, AFBMA Grade 1.

c. Submersible Motor Construction

1) See Equipment Specifications.

3. Tests, Nameplates, and Shop Drawings

a. Tests

1) Tests shall be required on integral horsepower motors only. A factory certified test report of "electrically duplicate motors previously tested" shall be supplied on all motors under 200 horsepower. The test shall be certified by the factory and shall contain a statement to the effect that complete tests affirm the guaranteed characteristics published in the manufacturer's catalogs or descriptive literature.

2) Tests will be in accordance with IEEE test procedures.

b. Nameplates

1) Each motor shall have a permanently affixed nameplate of brass, stainless steel, or other metal of durability and corrosion resistance. The data contained on the nameplate shall be in accordance with NEMA standards.

c. Shop Drawings

1) Shop Drawings shall consist of motor dimensions, nameplate data from each motor and tests as outlined above. Also included shall be efficiency and power factor at 100, 75, and 50 percent load. Operation, maintenance, and lubrication information (including bearing catalog numbers) shall be submitted with Shop Drawings for review.

4. Efficiency Requirements

a. The following motor full load efficiency requirements shall be met as a minimum for totally enclosed 3 phase integral horsepower motors, per NEMA test methods:

Horsepower	Nominal 3600 RPM (Minimum %)	Nominal 1800 RPM (Minimum %)	Nominal 1200 RPM (Minimum %)
1	75.5	82.5	80.0
1.5	82.5	84.0	85.5
2	84.0	84.0	86.5
3	85.5	87.5	87.5
5	87.5	87.5	87.5
7.5	88.5	89.5	89.5
10	89.5	89.5	89.5
15	90.2	91.0	90.2
20	90.2	91.0	90.2
25	91.0	92.4	91.7
30	91.0	92.4	91.7
40	91.7	93.0	93.0
50	92.4	93.0	93.0
60	93.0	93.6	93.6
75	93.0	94.1	93.6
100	93.6	94.5	94.1
125	94.5	94.5	94.1
150	94.5	95.0	95.0
200	95.0	95.0	95.0

Open Motors where specified shall also comply with NEMA efficiency minimums.

b. Motors shall be energy efficient type to comply with requirements of the Energy Policy Act of 1992.

PART 3 – EXECUTION

3.01 INSTALLATION/APPLICATION/ERECTION

A. Installation of motors shall comply with motor manufacturer's instructions as well as applicable NEMA recommendations and requirements of the driven equipment OEM (original equipment manufacturer).

B. Motors shall be aligned to acceptable tolerances and shall not vibrate excessively.

C. Motors shall not be energized until they have been accepted by the OEM start up personnel.

END OF SECTION

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SECTION 16710
COMMUNICATION SYSTEMS

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. This Section of the specifications addresses Contractor's requirements for communication systems. The work includes raceways, cables, runways, entrance facilities, cabling, labor and equipment to execute communication systems as detailed on the Drawings.

B. The Contractor is responsible for furnishing and installing all raceway and cables with 14 feet of slack at terminals and cabinets.

C. The structured telecommunications cable and pathway distribution and wiring system shall include permanently installed horizontal cabling, horizontal pathways, telecommunications outlet assemblies, conduit, raceway, and hardware for splicing, terminating, and interconnecting. The horizontal system includes the cabling and pathway between the PLC cabinets. Hardware and terminating equipment shall consist of UL approved, 110 RJ-45 connectors. Horizontal cable shall consist of Category 6 (1,000 MPBS) 100 ohm four (4) pair cable, unshielded twisted pair (UTP).

D. Use shielded cables inside VFD cabinets.

E. Use multi-mode FO cable for interface with existing plant SCADA.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Drawings and General Provisions of this Contract including General and Supplementary Conditions and Division 1 Specifications Sections, apply to work of this Section.

B. Related Work in Other Technical Sections

1. Section 16050 - Basic Electrical Materials and Methods
2. Section 16120 - Wire and Cables
3. Section 16130 - Raceways
4. Section 16131 - Boxes

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Telephone and Data Cables: AT&T, General Cable, Okonite, Belden, Alpha, Houston, American, Anixter, or equal.

B. FO Cables: Optical Cable Corp.

2.02 MATERIALS

A. Components

1. Cabling passages shall be accessible via junction boxes and equipment cabinets. All cable installation will be facilitated with pull wires. Fixed cables and pathway systems for telecommunications systems shall be UL listed or third party independent testing laboratory certified, and shall comply with NFPA 70.

B. Pathways (Horizontal)

1. EIA/TIA-569 Pathway shall be conduit. Provide grounding and bonding as required by EIA/TIA-607.

C. Telecommunications Cabling

1. Cabling shall be UL listed for the application and shall comply with TIA-568 and ANSI/TIA/EIA-568-B.2-1 and NFPA 70. Cabling shall consist of Category 6 (1,000 MBPS) UTP cable. Provide a labeling system for cabling as required by EIA/TIA 606 and UL 969. Cabling manufactured more than 12 months prior to date of installation shall not be used.

D. Telecommunications Outlet/Connector Assemblies

1. Jacks shall comply with FCC Part 68.5, and TIA/EIA-568. Jacks shall accommodate UTP. UTP jacks shall be RJ-45 designation T568A type, UL 1863 listed, eight position, constructed of high impact rated thermoplastic housing rated for Category 6 (1,000 MBPS) service. UTP jacks for data shall be Category 6 (1,000 MBPS) hardware and shall comply with the attenuation requirements contained in ANSI/TIA-568-B.2-1. Telecommunications cover plates shall comply with UL 514C, and TIA/EIA-568.

E. Fiber Optic Cable

1. ~~1~~The fiber optic cable shall be a round, water-resistant, tight buffer cable suitable for both indoor and outdoor installation. The fiber optic cable shall consist of, but not be limited to the following components:

a. Multimode, helically arranged, optical fibers with Aramid strength member and 900 micro meter tight buffer

b. Elastomeric subcable jacket to prevent moisture intrusion

c. A synthetic yarn strength member helically laid directly over the stranded core

d. PVC core-locked outer jacket

2. Each optical fiber shall be all glass, graded index, with a core diameter of 62.5 microns and cladding diameter of 125 microns. The optical fiber shall have an attenuation no greater than 3.0dB/km at a wavelength of 850nm supporting a bandwidth of no less than 220MHz-km. The fiberglass shall be manufactured by AT&T, or equal.

3. The minimum bend radius of the cable under full long-term tensile load shall be no longer than 10-times the outside diameter of the cable. The outer jacket of the cable shall be surface printed with the manufacturer's identification, the cable part number and sequential numerical footmarks.

4. The cable manufacturer shall be ISO 9001 certified, UL listed and optimized for Gigabit Ethernet applications. Gell-filled cables are not acceptable. The cable shall be manufactured by Optical Cable Corp., B Series Ultra-Fox Plus Breakout Cables (fiber part no. W3RB/1GC), or equal.

F. Fiber optic waterproof termination shall be of ST all polymer type (including body and ferrule) as manufactured by Methode Electronics, Inc. Termination fiber must be bonded within the ST connector ferrule utilizing two part anaerobic bonding compound. Crimp type connectors and/or epoxy heat cure connectors that require ovens shall not be deemed acceptable. The fiber optic ST connector shall be the 908 Series MST Style by Methode Electronics, Inc. Upon proper termination of the fiber optic cabling, the Contractor shall measure dB losses over the cable length using an Engineer approved fiber testing device. This device shall be capable of producing hard copy test results for submittal to the Engineer. Official fiber tests are to be witnessed by the Engineer. In addition to allowing 1dB loss per connector, losses exceeding 3dB per kilometer of fiber will not be acceptable. All fiber technicians must be trained and certified by the fiber connector manufacturer. All connections must be approved by the fiber connector manufacturer. SC Connectors may be used as well.

PART 3 – EXECUTION

3.01 INSTALLATION/APPLICATION

A. Telecommunications cabling and pathway systems, including the horizontal cabling and pathway systems, telecommunications outlet/connector assemblies, and associated

hardware shall be installed in raceway in accordance with TIA/EIA-568, EIA/TIA-569, NFPA 70, and UL standards as applicable.

B. Cabling

1. Install Category 6 (1,000 MBPS) UTP, telecommunications cabling and pathway system as detailed in TIA/EIA-568. Each RJ-45 connector shall have run to it one dedicating cable containing four pairs. Cabling installation shall comply with EIA TSB4O and EIA TSB-36. Screw terminals shall not be used except where specifically indicated on drawings. Use an approved insulation displacement connection (IDC) tool kit for copper cable terminations. Do not untwist Category 6 (1,000 MBPS) UTP cables more than 12 mm (one half inch) from the point of termination. Provide service loop on each end of the cable (one meter) for future additions. Do not exceed manufacturers' cable pull tensions for copper cables. Provide a device to monitor cable pull tensions. Do not exceed 110 N(25 pounds) pull tension for four pair copper cables. Do not chafe or damage outer jacket materials. Use only lubricants approved by cable manufacturer. Do not over cinch cables, or crush cables with staples.

C. Pathway Installations

1. Comply with EIA/TIA-569. Keep conduit minimum 150 mm (6-inches) away from parallel runs of electrical power equipment, flues, steam, and hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit is visible after completion of project. Install no more than two 1.57 rad (90 degree) bends for a single horizontal cable run.

2. All wiring shall be installed in conduit or a metal raceway. 3/4-inch minimum conduit size.

3. To facilitate future cable installations, a new pull string shall be pulled in conduit simultaneously with cables being installed.

4. All communication junction boxes shall be marked "DATA" or painted green.

3.02 TESTING

A. Telecommunications Cabling Field Testing

1. Perform telecommunications cabling inspection, verification, and performance tests in accordance with TIA/EIA-568.

B. Inspection

1. Visually inspect cabling jacket materials for UL or third party certification markings. Visually inspect UTP and OFO jacket materials for UL or other certification markings. Inspect cabling terminations in telecommunications rooms and at

workstations to confirm color code for tip and ring pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568. Visually confirm Category 6 (1,000 MBPS) marking of outlets, wallplates and jacks.

C. UTP Verification Tests

1. 1. UTP copper cabling shall be tested for DC loop resistance, shorts, opens, intermittent faults, near-end cross talk, proper pinning and termination and polarity between conductors. Test operation of shorting bars in connection blocks. Perform 250 MHz near-end cross talk (NEXT), far-end cross talk (FEXT) return loss, propagation delay, delay skew requirements, and attenuation tests for Category 6 (1,000 MBPS) 100 ohm 4-pair systems installations.

D. FO Cable Verification Tests

1. Contractor's Field Test: The Contractor shall verify the complete operation of the data transmission system in conjunction with field testing associated with systems supported by the fiber optic data transmission system prior to formal acceptance testing. Field tests shall include a flux density test. These tests shall be performed on each link and repeated from the opposite end of each link.

2. Optical Time Domain Reflectometer Tests: Optical time domain reflectometer tests shall be performed using the FO test procedures of EIA 455-59. An optical time domain reflectometer test shall be performed on all fibers of the FO cable on the reel prior to installation. The optical time domain reflectometer shall be calibrated to show anomalies of 0.2 dB as a minimum. An optical time domain reflectometer test shall be performed on all fibers of the FO cable after it is installed. The optical time domain reflectometer shall be calibrated to show anomalies of 0.2 dB as a minimum. If the optical time domain reflectometer test results show anomalies greater than 1 dB, the FO cable segment is unacceptable. The unsatisfactory segments of cable shall be replaced with a new segment of cable. The new segment of cable shall then be tested to demonstrate acceptability.

3. Power Attenuation Test: Power attenuation test shall be performed at the light wavelength of the transmitter to be used on the circuit being tested. The flux shall be measured at the FO receiver end and shall be compared to the flux injected at the transmitter end. There shall be a jumper added at each end of the circuit under test so that end connector loss shall be validated. Rotational optimization of the connectors will not be permitted. If the circuit loss exceeds the calculated circuit loss by more than 2 dB, the circuit is unsatisfactory and shall be examined to determine the problem. The Engineer shall be notified of the problem and what procedures the Contractor proposes to eliminate the problem. The Contractor shall prepare and submit a report documenting the results of the test.

4. Gain Margin Test: The Contractor shall test and verify that each circuit has a gain margin which exceeds the circuit loss by at least 6 dB.

END OF SECTION

SECTION 16900
CONTROLS

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Equipment controls shall be as specified herein and shown on the Contract Drawings. Legends for starter nameplates shall be taken from the one line diagram in the Contract Drawings.

B. Certain equipment starters contain nonresettable elapsed time meters as shown in the Contract Drawings. Also, certain motor starters have remote control devices and require connections to operate these control devices as shown on starter schematics (control circuits).

C. All starters contain indicating lights, control transformers, and auxiliary contacts to operate as defined on the control circuits of the Contract Drawings. Indicating lights shall be green for on/running, red for failure/stopped, and yellow for fault. Reset pushbuttons shall also be provided for overloads built into the starters.

1.02 CUSTOM CONTROL PANELS

A. All control panels furnished under this Contract shall be manufactured in accordance with industry standards and as herein specified. Some control panels are specified to be furnished with the equipment controlled and others are to be furnished by the Contractor, as written elsewhere.

B. Panel construction shall comply with OSHA and other code requirements as applicable, and may be attested to by UL listing the panels as an assembly. Otherwise, panel modifications as required by the Electrical Inspector shall be performed by the supplier at no extra cost to the Owner.

C. Control panels to be furnished on this project shall be wired to function according to schematics shown on the contract Drawings. In addition to the requirements shown on the Contract Drawings, the panels shall adhere to additional requirements as written herein, and in the utilization equipment specifications.

D. Enclosures shall be dead front with all operators' devices accessible without opening the enclosure door. All relays, timers, terminal strips, etc., shall be mounted to a subpanel inside the enclosure. All wiring must be stranded and sized to be protected by a 20 A circuit breaker. Supplemental overcurrent protection may be used in lieu of oversized wiring. All panels mounted outside shall have operators devices mounted on an inner door with an outdoor door that is blank.

E. All terminal strips and lugs shall be of a type UL listed to terminate the size and quantity of wires encountered. Myers hubs shall be installed to maintain the enclosure rating where conduits enter NEMA 4X rated enclosures. The exterior of stainless steel NEMA 4X enclosures shall be unpainted. The exterior of NEMA 12 panels shall be painted ANSI 49 light gray, lacquer or enamel.

F. Enclosures shall be provided with a locking hasp and any exterior hardware shall be stainless steel or other corrosion resistant material. Enclosures for use in process or outdoor areas shall be NEMA 4X and enclosures for interior use in dry areas shall be NEMA 12, unless otherwise indicated.

G. Elementary control schematics and connection diagrams showing the spatial relationship of components and wiring shall be submitted for review. Also, a bill of materials, drawing of device arrangement on front, and enclosure fabrication drawings shall be submitted. Further, descriptive literature is required on all components. A copy of the shop drawings shall be furnished and stored in a pocket inside the enclosure.

H. Sleeve type wire markers or other "permanent" type marker shall be installed on all wires, keynoted back to the elementary schematic or the connection diagram, and all terminals identified.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED

END OF SECTION

SECTION 17311
PLC HARDWARE AND SOFTWARE

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. This Section includes Programmable logic controllers for control of process equipment, process oriented machinery, and process systems.

B. The Contractor shall furnish and install all PLCs and accessory items as shown on the Contract Drawings and as specified herein.

C. The Contractor shall revise PLCs and accessory items as shown on the Contract Drawings and as specified herein. Some components within this section are reflect existing PLC panel components and are included for reference only.

1.02 RELATED WORK

A. The following Sections of this Specification Division contain requirements on instrumentation and control equipment and software which are considered to be covered by applicable requirements of this section (and shall be included in the bid by a single Instrumentation Supplier for this Project):

1. Section 17410 - Basic Measurement and Control Instrumentation Materials and Methods

2. Section 17420 - Instruments

3. Section 17430 - Boxes, Panels and Control Centers

4. Section 17480 - Instrument Lists and Reports

5. Section 17490 - Measurement and Control Commissioning

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.03 SUBMITTALS

A. Refer to Sections 01300 and 17410.

B. Product Data: For each type of PLC include dimensions, mounting arrangements, and weights. Also, include manufacturer's technical data on features, performance, electrical ratings, characteristics, and terminal connections.

C. Operation and Maintenance Data: Provide literature detailing routine maintenance requirements (if any) for each PLC component including:

1. System specifications
2. Electrical power requirements
3. Application considerations
4. Assembly and installation procedures
5. Power-up procedures
6. Programming procedures
7. Explanation of internal fault diagnostics
8. Shut down procedures
9. Recommended spare parts list

1.04 REFERENCE STANDARDS

A. ASTM D999-91: Vibration

B. (CFR) Title 47, Part 18 (European EN 55011 (formerly C1SPR 11))

C. CSA Certification Class I, Division 2, Group A, B, C, D Hazardous or non-hazardous locations

D. IEC 60068-2.1 Environmental testing — Part 2-1: Tests - Test A: Cold, 2.2 Environmental testing - Part 2: Tests. Tests B: Dry heat, 2.3, 2.6 Environmental testing - Part 2: Tests - Test Fe: Vibration (sinusoidal) and 2.27 Environmental testing. Part 2: Tests. Test Ea and guidance: Shock

E. IEC 61000 Electromagnetic compatibility (EMC) - Testing and measurement techniques

1. Part 4-2: Electrostatic discharge immunity test
2. Part 4-3: Radiated, radio-frequency, electromagnetic field immunity test
3. Part 4-4: Electrical fast transient/burst immunity test
4. Part 4-5: Surge immunity test
5. Part 4-6: Immunity to conducted disturbances, induced by radio-frequency fields

F. IEC 61131-3: Programmable controllers - Part 3: Programming languages

G. IEC 801-3: RFI Immunity

H. IEC 801-5: Ground Continuity

I. IEC 801-2: Electrostatic Discharge

J. IEEE 472-1974/ANSI C37.90/90A-1974 (Surge Withstand) IEEE Standard for Relays and Relay Systems Associated with Electric Power Apparatus

K. MIL STD 461B CS02: RFI/EMI Susceptibility

L. NEMA Pub No ICS2-230.42: Showering Arc Test

M. NSTA Project 1 A

N. UL 508 and CSA Standard C22.2 No. 142 (Isolation Voltages)

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer shall be capable of providing training, parts, and coordination of emergency maintenance and repairs.

B. The programmable controller and all of the corresponding components within the family of controller products shall be manufactured by a company that regularly manufactures and services this type of equipment.

C. The manufacturer shall comply with IS09001 standards for "Quality Systems- Model for Quality Assurance in Design/Development, Production, Installation, and Servicing".

D. The manufacturer shall provide complete technical support for all of the products. This shall include factory or on-site training, regional application centers, local or factory technical assistance, and a 24/7/365 technical support phone service.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver PLC components in packaging designed to prevent damage from static electricity and physical damage.

B. Store PLC equipment according to manufacturer requirements. At a minimum, store indoors in clean, dry space with uniform temperature to prevent condensation. Protect PLCs from exposure to dirt, fumes, water, corrosive substances, and physical damage. Also, protect the PLC from all forms of electrical and magnetic energy that could reasonably cause damage.

1.07 NOMENCLATURE AND IDENTIFICATION DEFINITIONS

A. AI: Analog Input

B. AO: Analog Output

C. Fixed I/O: A PLC style consisting of a fixed number of I/0, a processor, and a power supply all in one enclosure. Some fixed PLCs have limited expansion ability.

D. CPU: Central Processing Unit

E. DI: Discrete Input

F. Distributed I/O: Hardware specially designed to function as Remote I/O.

G. DO: Discrete Output

H. HMI: Human-Machine Interface

I. I/O Input and/or Output

J. Modular: A PLC style consisting of cards that are assembled to comprise a complete unit. All I/O, CPU, and Power Supply are dedicated cards. Typically, these cards are inserted into a chassis.

K. Master/Slave: Communication between devices in which one device, the master, controls all communications. The other devices, the slaves, respond only when queried by the master. Typically used in a Remote I/O application.

L. Peer to Peer: Communication between two or more devices, typically PLC's, in which each device can control the communication exchange.

M. PID: Control action, proportional plus integral plus derivative.

N. PLC: Programmable Logic Controller

O. Remote I/O: I/O that is located remotely from the processor. Remote I/O can communicate over a variety of communication protocols and can use standard rack based I/O, or special Remote I/O hardware referred to as Distributed I/O.

P. SCADA: Supervisory Control and Data Acquisition

1.08 SPARE I/O

A. Each I/O drop and I/O location shall include at least 20 percent (minimum of four) points of each type (AI, AO, DI, and DO) for future use, regardless of whether any of those point types are used in that drop or location or not. The spares shall be the same type of I/O modules supplied.

B. Spare output points that require the use of an external relay shall be supplied with the external relay.

C. Regardless of the spare requirement, all installed unused points on all I/O modules shall be wired to terminal blocks in the order that they occur on the I/O modules. Unwired spares shall not be acceptable.

1.09 SPARE PARTS

A. General requirements for spare parts are specified in section 17490.

B. The following PLC spare parts shall be furnished:

1. Processors: Provide spare processor unit(s) for each unique processor installed.

2. Memory Cards: Provide spares for each type of card installed.

3. I/O Cards: Provide spares for each unique I/O module type installed. Provide two or 10 percent of installed quantity, whichever is greater.

4. Network interface, remote I/O, and communication modules: Provide one spare communication module for each unique communication module installed.

5. Specialty Modules: Provide as a minimum a spare of each type of module identified. Provide an additional spare for every ten modules of a specific type installed.

6. PLC Power supplies: Provide spare power supplies for each unique power supply installed.

7. Chassis: Provide spare chassis for each unique chassis installed.

8. Fixed PLCs: Provide spares for each unique type of PLC installed.

9. Miscellaneous components (including cables): Provide spares for each unique component installed.

1.10 MANUFACTURER SUPPORT

A. Provide a written proposal for a manufacturer support agreement for PLC hardware and software for a minimum of 12 months starting at final completion of the project. The cost of this manufacturer support agreement shall not be included in the Contract Price. The support agreement shall be executed in the name of, and for the benefit of, the OWNER. At a minimum, this agreement shall provide the OWNER with:

1. Twenty-four hour, 7 day per week manufacturer telephone support

2. Access to the manufacturer's technical support web site

3. Software and firmware updates.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide Programmable Logic Controller equipment with the required memory and functional capacity to perform the specified sequence of operation with the scheduled input and output points.

B. Processor Systems shall include processor, power supply, input/output modules, communication modules, redundancy modules, and remote interface modules as required to meet system requirements.

C. Furnish products listed and classified by Underwriters Laboratories (UL), CSA, or FM approval as suitable for purpose specified and indicated.

D. All equipment and devices furnished hereunder shall be designed for continuous industrial service. The system shall contain products of a single manufacturer, insofar as possible, and shall consist of equipment models that are currently in production.

E. All equipment furnished shall be designed and constructed so that in the event of power interruption the systems shall go through an orderly shutdown with no loss of memory, and resume normal operation without manually resetting when power is restored.

F. The PLCs shall communicate between the operator workstation and field-mounted transducers, switches, controllers, and process actuators. Communications protocol shall be completely transparent to process operators at the Human Machine Interface (HMI).

G. The PLC shall be capable of stand-alone operation in the event of failure of the communication link to the HMI subsystem.

H. Backup Processor Systems, if indicated on the drawings, shall consist of two chassis with power supplies, each containing a processor, redundancy module and communications module(s). Remote chassis shall be provided with communication modules to meet I/O and communication requirements.

I. Remote Input/Output Units shall include input/output modules, interface modules, communication modules, and power supply to meet system input and output requirements.

J. Agency and environmental specifications:

1. Electrical supply voltage to the PLC shall be 120 Vac, plus or minus 15 percent, 48-63Hz. PLC system power supplies shall be fused for overload protection.

2. Vibration: 3.5 mm Peak-to-Peak, 5-9 Hz: 1.0G, 9-1501Hz. The method of testing is to be based upon IEC 68-2-6 and JIS C 0911 standards for vibration. The system is to be operational during and after testing. Vibration Rating of 2.0G maximum peak acceleration for 10 to 500Hz. in accordance with at least one of the following:

    a. Installed rating: DIN rail mounted PLC: 10-57 Hz, amplitude 0.075 mm, acceleration 25-100 Hz, and

    b. Panel or plate mounted PLC: 2-25 Hz, amplitude 1.6mm, acceleration 25-200 Hz.

    c. In compliance with IEC 60068 and IEC 61131.

3. Shock: 15G, 11 msec. The method of testing is to be based upon IEC 68-2-27 and JIS C 0912 standards for shock. The system is to be operational during and after testing.

4. Temperature: All PLC hardware shall operate at an ambient temperature of 0 to +55 degrees C (+32 to +140 degrees F), with an storage ambient temperature rating of -25 to +70 degrees C (-40 to +185 degrees F).

5. Relative Humidity: The Programmable Controller hardware shall function continuously in the relative humidity range of 30 percent to 95 percent non-condensing.

6. Noise Immunity: The Programmable Controller system shall be designed and tested to operate in the high electrical noise environment of an industrial plant as governed by the following regulations: IEEE 472, IEC 801, MILSTD 461B, IEC 255-4, NEMA ICS 2-230.40, and ANSI/IEEE C-37.90A-1978.

7. Altitude:

    a. Operation: 0-6,500 feet

    b. Storage: 0-9,800 feet

8. Degree of protection: NEMA 1 (IP20)

9. All products shall have corrosion protection.

K. All major assemblies and sub-assemblies, circuit boards, and devices shall be identified using permanent labels or markings indicating:

1. Modules product type such as analog or digital

2. Modules catalog number

3. Modules major revision number

4. Modules minor revision number

5. Module manufacturer vendor

6. Module serial number

L. All necessary cables shall be included. All cables and connectors shall be as specified by the manufacturer. Cables shall be assembled and installed per the manufacturer recommendations.

M. Manufacturers

1. Provide all PLCs from a single manufacturer. If the PLC manufacturer has authorized third party vendors to provide modules that are compatible with their platforms, then products manufactured by these authorized third party vendors will be acceptable.

2. Provide the PLC system by one of the following:

a. Rockwell Automation Allen-Bradley

1) 1756-L71 ControlLogix (at plants)

2) MicroLogix 1400 (Vendor Panels with no communications to facility Control System)

3) CompactLogix (Vendor Panels with communications to facility Control System)

b. Or Engineer approved equal

N. Central Processing Unit (CPU)

1. The CPU shall be, at a minimum, a 16-bit microprocessor that provides system timing and is responsible for scheduling I/O updates, with no user programming required to ensure discrete or analog update. It shall execute user relay ladder logic programs, communicate with intelligent I/O modules, and perform on-line diagnostics. The CPU shall consist of a single module which solves application logic, stores the application program, stores numerical values related to the application processes and logic, and interfaces to the I/O.

2. The CPU shall sample all the discrete and analog inputs and outputs including internal coils and registers, and service special function modules every scan. The CPU shall process the I/O with user program(s) stored in memory, then control the outputs based on the results of the logic operation.

3. Supply the CPU with a battery-backed time of day clock and calendar.

4. The CPU family shall allow for user program transportability from one CPU model to another.

O. Diagnostics

1. The CPU shall perform on-line diagnostics that monitor the internal operation of the PLC. If a failure is detected, the CPU shall initiate system shutdown and fail-over. The following, at a minimum, shall be monitored: Memory failure, memory battery low, and general fault, communications port failure, scan time over run, I/0 failure, and analog or special function I/O module failure.

2. All diagnostic information shall be accessible to the host communications interfaces and to the PLC program.

3. The PLC shall have indicators and on board status area to indicate the following conditions:

   a. CPU run

   b. CPU error or fault

   c. I/O failure or configuration fault.

   d. Battery good

   e. Communications indicator

P. Memory

1. The user program and data shall be contained in non-volatile battery backed memory, of type CMOS RAM program memory.

2. Memory Backup System: provide lithium battery backup capable of retaining all memory for a minimum of three months and a Flash memory system capable of reloading program in the event of memory loss.

   a. Backup Battery: The backup battery shall be capable of being replaced without disrupting memory integrity. Provide a visual indication of low battery voltage and a low battery alarm contact.

   b. Flash Memory Card: Memory card storage capacity shall be a minimum of processor memory capacity. Memory cards shall be installed in processors for factory testing.

3. The operating system shall be contained in non-volatile firmware. The memory containing the operating system shall be field updateable via a separate update tool.

Q. Programming Environment

1. Programming port: The PLC shall utilize a serial USB or Ethernet port for programming.

2. On-Line programming: Application programs may be modified or stored while the CPU is running, with minimal impact on the scan time.

3. Online programming including runtime editing

4. IEC 61131-3 programming languages supported: Ladder logic, function block, sequential function chart, and structure text.

5. Supply all hardware and software necessary to program the CPU in these languages.

R. Communication Ports

1. The CPU shall be expandable and supplied with additional modules to support the required communication interfaces.

S. Remote I/O Communications

1. The CPU shall be capable of communicating with up to 12 remote base locations at a combined distance of 2500 feet. The CPU shall automatically sample and update all local and remote I/O modules each scan cycle of the CPU.

2. The communication link between the CPU and any RIO chassis shall be as recommended by the PLC manufacturer. For racks located on a link of less than 2500 cable feet, the speed of the communications link shall be greater than 230K baud with RIO scan rate of less than 5 millisecond per RIO.

3. Diagnostic and equipment status information shall be available from each RIO.

4. It shall be possible to communicate with remote I/O racks or other PLCs via fiber optic cable.

5. The remote I/O system shall have available a remote input/output arrangement capable of operation at locations physically separated from the PLC CPU by up to 5,000 feet as detailed on the drawings.

6. Communication with the remote I/O arrangement shall be through cable as recommended by the PLC manufacturer and provided by the PLC system supplier under this specification section.

2.02 REDUNDANCY

A. The PLC shall be supplied with all hardware and software required to produce a completely operational redundant system if shown in the Drawings. Redundancy shall be implemented using a minimum amount of user programming. Warm backup, which is not a standard offering from the PLC manufacturer, is not acceptable.

B. The backup system shall consist of redundant controllers located in separate chassis.

C. The back-up system shall provide bumpless switchover for system outputs. All remote I/O shall maintain their last position until either communications is re-established or the remote I/O watchdog timer expires.

D. Switch-over between the on-line PLC and the back-up PLC shall occur within 100 milliseconds if any of the following conditions occurs in the on-line unit: Power failure, CPU fault, communications module fault, or change in the on-line unit's mode from RUN to PROGRAM.

E. The switchover shall be transparent to any devices networked to the redundant controller chassis.

F. The system shall automatically cross-load the primary controller's program to the secondary controller.

G. System diagnostics and debugging tools shall be provided to assist in troubleshooting all redundancy equipment.

2.03 POWER SUPPLIES

A. The PLC shall have chassis mounted power supplies to power the chassis backplane, and provide power for the processor and applicable modules.

B. Power supplies shall have a clearly visible LED to indicate that the incoming power is acceptable and the output voltage is present.

C. Power supplies shall feature over-current and over-voltage protection and should be designed to operate in most industrial environments without the need for isolation transformers.

D. Power supplies shall be sized to accommodate the anticipated load plus 30%.

E. DC power supplies shall be capable of handling ripple up to 2.4V peak to peak.

F. AC Line Voltage rating of 85 to 265Vac, 47-63Hz

G. The power supplies shall allow for brown outs of at least 1/2 of a cycle, a harmonic rate of 10%, and will sustain continuous operation through momentary interruptions of AC line voltage of 10ms or less.

H. Automatically shut down the Programmable Controller system whenever its output power is detected as exceeding 125% of its rated power

I. Provide surge protection, isolation, and outage carry-over up to 2 cycles of the AC line.

J. Redundant power supplies will comply with all the requirements of non-redundant power supplies in addition to the features stated below.

1. The redundant power supplies shall be designed to share the current required by the chassis. In the event of a failure of one redundant power supply, the remaining supply will accommodate the entire load of the chassis without disruption to the chassis activity.

2. Provide a failsafe fuse that is not accessible by the customer.

3. Provide a solid state relay connection to allow for failure annunciation when wired to an input module.

4. Diagnostic LED status indicators for Power and redundancy.

2.04 CHASSIS

A. Medium and large PLC models shall be chassis based.

B. All system and signal power to the CPU and support modules shall be distributed on the backplane. No interconnecting wiring between these modules via plug-terminated jumpers shall be acceptable.

C. All system modules, main and expansion chassis shall be designed to provide for free air flow convection cooling. No internal fans or other means of cooling, except heat sinks, shall be permitted.

D. All system modules including the processor shall be removable from the chassis or inserted in to the chassis while power is being supplied to the chassis without faulting the processor or damaging the modules.

E. Modules shall be designed to plug into a chassis and to be keyed to allow installation in only one direction. The design must prohibit upside down insertion of the modules as well as safeguard against the insertion of a module into the wrong slot or chassis via an electronic method for identifying a module. Electronic keying shall perform an electronic check to insure that the physical module is consistent with what was configured.

2.05 DISCRETE INPUT AND OUTPUT MODULES

A. General

1. Digital input and output modules shall provide ON/OFF detection and actuation.

2. The I/O count and type shall be as required to implement the functions specified plus an allowance for active spares, as noted below.

3. Modules shall be designed to be installed or removed while chassis power is applied.

4. Modules shall have indicators to display the status of communication, module health and input / output devices.

5. Each module shall have the following status indicators.

   a. The On/Off state of the field device.

   b. The module's communication status.

6. I/O modules shall contain a maximum of 16 points per module.

B. Module Specifications (120Vac Isolated Input Module)

1. Nominal Input Voltage of 120V ac

2. On-State Current of 15inA @132V ac, 47-63Hz maximum

3. Maximum Off-State Voltage of 20V

4. Maximum Off-State Current of 2.5mA

C. Module Specification (120Vac Isolated Output Module)

1. Each triac type discrete output shall have an associated interposing relay located in the same control panel. 120 VAC power for relay outputs shall be provided from the associated motor starter control circuit (when used with motor starters) or other 120 VAC source (when I/O is not associated with a particular motor starter).

2. Output Voltage Range of 74-265V ac, 47-63Hz.

3. Output Current Rating:

   a. Per Point - 2A maximum @ 30 degrees C; 1.0A maximum @ 60 degrees C; Linear Derating

   b. Per Module - 5A maximum @ 30 degrees C; 4A maximum @ 60 degrees C; Linear Derating

4. Surge Current Per Point of 20A for 43ms each, repeatable every 2s @ 60 degrees C

5. Minimum Load Current of 10mA per point

6. Maximum On-State Voltage Drop of 1.5V peak @2.0A and 6V peak @load less than 50mA

7. Maximum Off-State Leakage of 3mA per point

D. Module Specifications (Contact Output Module)

1. Output Voltage Range of 10-265V ac, 47-63Hz

2. Output Current Rating:

a. Resistive - 2A @ 125V ac

b. Inductive - 2A Steady State, 15A make @125V ac

3. Power Rating (Steady State) of 250VA maximum for 125V ac inductive output

4. Maximum Off-State Leakage of 0 mA per point

5. Configurable States

a. Fault Per Point - Hold Last State, ON or OFF

b. Program Mode Per Point - Hold Last State, ON or OFF

2.06 ANALOG INPUT AND OUTPUT MODULES

A. General

1. Analog input modules shall convert an analog signal that is connected to the module's screw terminals into a digital value. The digital value representing the magnitude of the analog signal shall be transmitted on the backplane. Analog output modules shall convert a digital value that is delivered to the module via the backplane into an analog signal on the module's screw terminals.

2. Modules shall be designed to be installed or removed while chassis power is applied.

3. Modules shall have indicators to display the status of communication, module health and input / output devices.

4. Each analog module shall provide both hardware and software indication when a module fault has occurred. Each module shall have an LED fault indicator and the programming software shall display the fault information.

5. Analog modules shall be software configurable through the I/O configuration portion of the programming software.

6. The following status shall be capable of being examined in ladder logic

a. Module Fault Word — Provides fault summary reporting.

b. Channel Fault Word — Provides under-range, over-range and communications fault reporting.

c. Channel Status Words — Provides individual channel under-range and over-range fault reporting for process alarm, rate alarms and calibration faults.

7. The 24 VDC power for analog instrument loops shall be provided as a part of the system. The 24 VDC power supply shall be derived from the 120 VAC input power circuit to the PLC. The field side of the 24 VDC power sources(s) shall have individual or grouped (of logically associated circuits) fusing and be provided with a readily visible, labeled blown fuse indicator.

B. Isolated Analog Input Module

1. Input Range of 4-20 mA

2. Resolution of approximately 16 bits across range

3. Input Impedance of Greater than 249 Ohms

4. Overvoltage Protection: 8V ac/dc with on-board current resistor

5. Normal Mode Rejection of 60dB at 60Hz

6. Common Mode Noise Rejection of 120dB at 60Hz, 100dB at 50Hz

7. Isolation Voltage

a. Channel to Channel - 100% tested at 1700V dc for Is based on 250V ac

b. User to System - 100% tested at 1700V de for is based on 250V ac

C. Isolated Analog Output Current Module

1. Output Current Range of 4 to 20 mA

2. Current Resolution of 12 bits across 20 mA

3. Open Circuit Detection — None

4. Output Overvoltage Protection - 24V ac/dc maximum

5. Output Short Circuit Protection — 20 mA or less (electronically limited)

6. Calibration Accuracy - Better than 0.1% of range from 4mA to 20 mA

7. Calibration Interval - 12 months typical

2.07 COMMUNICATION INTERFACES

A. The PLC will be capable of the following communication protocols as shown on the drawings:

1. 10BASE-T/100BASE-TX Ethernet communication.

2. Modbus (RTU and ASCII) for up to 247 slaves

3. Rockwell Automation's RIO Protocol

4. DeviceNet

5. Asynchronous serial link capable of communicating up to 19.2Kbps

B. When required provide a Communications Interface Module mounted in the chassis or the equivalent port directly on the CPU.

1. Provide Modbus TCPIP module for Modbus/TCP communications **ProSoft model MVI56-MNET** installed in existing spare slot or new PLC rack as needed to accommodate all existing and new modules.

2.08 PLC SOFTWARE

A. Provide a PLC configuration and application development software package complete with documentation and disks. The PLC software package and associated licensing and/or activation shall be installed on the computers shown on the drawings.

B. The software package shall allow on-line/off-line program development, annotation, monitoring, debugging, uploading, and downloading of programs to the PLCs.

C. All required hardware (including cables, cable adapters, etc.) for connection to PLCs shall be furnished.

D. All software licenses required to achieve the functionality described in the Specifications shall be provided.

E. The software package shall include a software license agreement allowing the Owner the right to use the software as required for any current or future modification, documentation, or development of the PLCs furnished for this project.

F. The software provided shall be capable of the following IEC 61131-3 functions:

1. Ladder logic.

2. Function block.

3. Sequential function chart.

4. Structure text.

G. In addition to the above editors, an add-on instruction editor shall work with any of the above-mentioned editors to create custom reusable function blocks. This software shall allow any of the derived function blocks to be modified on-line.

H. The software shall be Microsoft Windows-based and run on the supplied computers.

I. The software shall include a security feature to prevent unauthorized personnel from modifying and downloading the programs.

J. Provide an I/O simulator which allows the PLC application load program to be tested on a PC with simulated analog and digital inputs and outputs, allowing I/O testing and debugging to be performed in a safe, isolated environment without the need for running the PLC CPU and process I/O boards.

2.09 OPERATOR INTERFACE TERMINALS (OIT)

A. OITs shall be mounted on control panels and shall run interface software separate from the existing SCADA HMI software.

B. Manufacturers

1. Provide operator interface terminals (OIT) from one of the following:

a. Allen-Bradley Panel View Plus 6 series

b. Or equal

C. Software

1. The Operator Interface Terminal shall be pre-packaged with all configuration and programming software necessary to perform functions as shown on drawings and within the specifications.

2. The integrated OIT software shall have the following features

a. Trending

b. Data Logging

c. Alarms

d. Graphic Symbols

e. Animations

D. I/O Ports and Devices

1. The OIT shall have a minimum of one Ethernet 10/100 Mbps for connectivity or programming

2. The OIT shall have a minimum of one Serial RS232 port.

3. Include the following communication expansion modules in the selected OIT: a. ControlNet, DeviceNet, RIO, DH+, DH485, Modbus Plus and PROFIBUS

4. Compact flash ports shall be Type 2.

5. The OIT shall have a minimum of one USB port.

E. Display

1. The OIT display size shall be 6.5"

2. The type of display for the OIT shall be Color Active Matrix TFT.

3. The display resolution shall be a minimum of 640 x 480.

4. Display shall support touch screen input.

F. Environmental

1. Rating: OIT shall be rated to maintain the rating of the control panel it will be mounted in.

2. Operating Temperature: 0-50 degrees C.

G. Manufacturers:

1. Rockwell Automation Allen-Bradley Panel View Plus 6

PART 3 – EXECUTION

3.01 GENERAL INSTALLATION

A. Maintain area free of dirt and dust during and after installation of programmable controller products.

B. Anchor PLCs within enclosures as recommended by the PLC manufacturer.

C. Ventilation slots shall not be blocked, or obstructed by any means.

D. Examine areas, surfaces, and substrates to receive PLCs for compliance with requirements, installation tolerances, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

E. Install in accordance with manufacturer's instructions.

F. Unload, unpack and transport equipment to prevent damage or loss.

G. Replace damaged components as directed by Engineer.

3.02 PANEL LAYOUT

A. Coordinate size and configuration of enclosure to meet project requirements. Drawings indicate maximum dimensions for PLCs, minimum clearances between PLCs, and adjacent surfaces and other items.

B. Comply with indicated maximum dimensions and clearances, or with PLC vendors required distances if they are greater than the distances indicated.

1. Provide spacing around PLC as required by the PLC manufacturer to insure adequate cooling. Insure that the air surrounding the PLC has been conditioned to maintain the required temperature and humidity range.

2. Wires entering and exiting PLC components shall be sized to comply with the PLC manufacturers requirements. Doors on all components shall be able to be fully closed when all the wires are installed.

3. For chassis mounted PLCs, no wiring, wire ducts, or other devices shall obstruct the removal of cards from the rack.

4. PLC lights, keys, communication ports, and memory card slots shall be accessible at all times. Lights shall be visible at all times when enclosure door is opened.

C. Control panel designer shall provide independent line fuses or circuit breakers, per the PLC manufacturer recommendation, for each power supply, input module, output module, and other modules with separately derived power requirements.

D. Control panel designer shall insure that communication signals, 4-20mA signals (including those with embedded HART), are properly conditioned for the PLC and protected from all sources of radiated energy or harmonics.

E. Each PLC (including all I/O) shall be powered from the UPS power conditioning system in Section 17430.

F. Where multiple mechanical components are provided for process redundancy, their field connections to I/O modules shall be arranged such that the failure of a single module will not disable all mechanical components associated with the process redundancy (e.g., inputs and outputs for redundancy device 1 shall reside on different modules than the inputs and outputs for redundancy device 2, etc.), irrespective of the number of used points resulting from this configuration.

G. Provide all required cables, cords, and connective devices for interface with other control system components.

END OF SECTION

SECTION 17410

BASIC MEASUREMENT AND CONTROL INSTRUMENTATION MATERIALS AND METHODS (ADD #3)

PART 1 – *GENERAL*

1.01 *WORK INCLUDED*

A. *The Contractor, through the use of a Pre-Approved System Supplier, shall furnish all materials, labor, tools, equipment, supplies and services necessary to install all process control and instrumentation equipment complete as specified herein and shown on the Drawings. System Supplier services include installation, PLC/OIT/HMI programming, instrument calibration, testing, commissioning, training, documentation, and requirements as further defined in the Contract Documents. The Contractor shall be responsible for the expense of changing Drawings or structures, or any other expense necessitated by reason of installing alternative equipment. The Contractor will assume the responsibility for the satisfactory operation of any and all equipment offered.*

B. *The following equipment specification is included to establish the quality of equipment to be obtained. It is the intent of these Specifications to obtain industrial quality instrumentation and control equipment. Equipment furnished shall be accepted by the Engineer, prior to purchase by the Contractor.*

C. *Auxiliary and accessory devices necessary for system operation or performance, such as transducers or relays to interface with equipment provided under other Sections of this Specification, shall be included whether specified or not, at no extra cost.*

D. *In order to ensure proper integration and compatibility of the plant instrumentation and control systems, the systems must be supplied by a single provider of instrumentation and control equipment. This is not to say that all equipment being supplied shall be manufactured by a single manufacturer, but rather that a single provider of instrumentation and control equipment shall be responsible for supplying the complete system. To facilitate the Owner's future operation and maintenance, products performing the same function shall all be of the same manufacturer, type, and model number.*

E. *Substitutions on functions or equipment specified will not be acceptable. In order to ensure the interchangeability of parts, the maintenance of quality, the ease of interfacing between the various subsystems, and the establishment of minimums with regard to ranges and accuracy, strict compliance with the above requirements shall be maintained. In order to ensure compatibility between all equipment, it shall be the responsibility of the system supplier hereunder to coordinate all interface requirements with mechanical and electrical system suppliers and furnish any signal isolation devices that might be required.*

F. *Equipment shall be fabricated, assembled, installed, and placed in proper operating condition in full conformity with detail drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer as accepted by the Engineer.*

G. *The instrument supplier for this Contract shall be responsible for making the modifications shown on the Drawings and for recalibrating all instruments and placing them in proper working order.*

1.02 *RELATED WORK*

A. *The following Sections of this Specification Division contain requirements on instrumentation and control equipment and software which are considered to be covered by applicable requirements of this section (and shall be included in the bid by a single Instrumentation Supplier for this Project):*

1. *Section 17311 – PLC Hardware and Software*
2. *Section 17420 - Instruments*
3. *Section 17430 - Boxes, Panels and Control Centers*
4. *Section 17480 - Instrument Lists and Reports*
5. *Section 17490 - Measurement and Control Commissioning*

B. *The following Divisions of these Specifications contain requirements on equipment furnished by other suppliers that must interface with the instrument system, or on methods and materials to be performed/used in the installation and/or wiring of the instrumentation system.*

1. *Division 1 - General Requirements*
2. *Division 11 - Equipment*
3. *Division 16 - Electrical*

1.03 *QUALITY ASSURANCE*

A. *The system supplier shall be required to demonstrate a minimum of 4 years recent, past experience in the design, manufacture, PLC/OIT/HMI programming, and commissioning of instrumentation and control systems of comparable size, type, and complexity to the proposed project. Further, the manufacturer must have at least 10 similar systems in operation currently. The system supplier shall be required to have his own in-house capability to handle complete system engineering, fabrication, and testing.*

B. *The system supplier shall have in his employ the capable personnel for detail engineering, coordination, drafting, procurement and expediting, scheduling*

construction, testing inspection, installation, PLC/OIT/HMI programming, start-up service for calibration and commissioning, and warranty compliance for the period specified.

C. *Pre-Approved System Suppliers are as listed below:*

Rawdon Myers, Inc.

LOVO Systems

AEES

1.04 *REFERENCES*

A. *The Contractor is referred to Standards and Practices for Instrumentation published by the International Society of Automation (latest edition), for terminology, symbols, methods and practices used or described herein or on the Drawings.*

1.05 *SUBMITTALS*

A. *General*

1. *Complete detail Drawings of the instrumentation and control systems and all components shall be submitted in 3 copies in a 3-ring loose-leaf cardboard reinforced vinyl binder to the Engineer for preliminary review. They shall include installation instructions, operation and maintenance instructions, descriptive literature, connection drawings, and parts list for each item as well as individual control schematic drawings for each item.*

2. *The Contractor shall make any corrections or changes required by the Engineer, within the scope of the Drawings and Specifications, and return copies in 3-ring loose-leaf cardboard reinforced vinyl binders for final review and distribution. Number of copies shall be as specified in Special conditions and as agreed at the pre-construction conference.*

3. *Should any system submitted in the shop drawings not meet with the Engineer's acceptance as to conformity with requirements of the Drawings and Specifications, it shall be the responsibility of the successful Contractor to make whatever changes are necessary for acceptance at no extra cost to the Owner.*

B. *Detailed Requirements - Instruments/Hardware*

1. *Detailed information for each instrument or control device shall be submitted, including manufacturer's descriptive literature and a specific data sheet for each device which shall include as a minimum:*

a. *Tag number assigned by the Contract Documents.*

b. *Product (item) name used herein and on the Contract Drawings.*

c. *Manufacturer's complete model number.*

d. *Location of the device.*

e. *Input - output characteristics.*

f. *Electrical characteristics.*

g. *Range, size, and graduations.*

h. *Physical size with dimensions, enclosure NEMA classification, and mounting details.*

i. *Materials of construction of all components.*

j. *Instrument or control device sizing calculations where applicable.*

k. *Certified calibration data on all flow metering devices.*

2. *Submit a detailed loop diagram, for each monitoring or control loop, each on a single 8 ½ in. x 11 in. sheet. The format shall be the Instrument Society of America, Standard for Instrument Loop Diagrams, ISA-S5.4.*

3. *The data sheets shall be provided with an index and proper identification and cross-referencing. Partial submittals will be rejected.*

4. *Submit detailed drawings concerning control panels and/or enclosures including:*

   a. *Cabinet assembly and layout drawings to scale.*

   b. *Fabrication and painting specifications.*

   c. *I/O layout.*

   d. *Elementary panel wiring diagrams*

   e. *Point to point wiring diagrams depicting wiring within the panel as well as connections to external devices.*

   f. *Color samples for paint selection by the Engineer and/or Owner.*

   g. *Panel submittal drawings shall be on 11 in x 17 in. sheets.*

5. *Exceptions to the Specifications or Drawings shall be clearly indicated in the submittal by the system supplier. Data shall contain sufficient details so a proper evaluation may be made by the Engineer.*

6. *Prior to final acceptance, the final shop drawing submittal, which is to include Installation, Operation, and Maintenance instructions, shall be updated to reflect "As Constructed" status, and shall provide at least the following as a minimum:*

   a. *A comprehensive index.*

   b. *A complete "As Constructed" set of accepted shop drawings.*

   c. *A complete list of the equipment supplied, including serial numbers, ranges, and pertinent data.*

   d. *Full specifications on each item.*

   e. *System schematic drawings "As Constructed", illustrating all components, piping and electrical connections of the systems supplied under this Section.*

   f. *Detailed service, maintenance, and operation instructions for each item supplied.*

   g. *Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.*

   h. *The operating instructions shall also incorporate a functional description of the entire system, with reference to the systems schematic drawings and instructions.*

   i. *Complete parts lists with stock numbers and name, address, and telephone number of the local supplier.*

1.06 *DELIVERY, STORAGE, AND HANDLING*

A. *Shipping Precautions:*

1. *After completion of shop assembly, factory test, and acceptance, all equipment, cabinets, panels, and consoles shall be packed in protective crates and enclosed in heavy duty polyethylene envelopes or secured sheeting to provide complete protection from damage, dust, and moisture. Dehumidifiers shall be placed inside the polyethylene coverings. The equipment shall then be skid-mounted for final transport. Lifting rings shall be provided for moving without removing protective covering. Boxed weights shall be shown on shipping tags together with instructions for unloading, transporting, storing, and handling at the job site.*

2. *Special instructions for proper field handling, storage and installation required by manufacturer for proper protection, shall be securely attached to each piece of equipment proper to packaging and shipment.*

B. *Identification:*

1. *Each component shall be tagged to identify its location, tag number and function in the system. Identification shall be prominently displayed on the outside of the package.*

2. *A permanent stainless steel or other non-corrosive material tag firmly attached and permanently and indelibly marked with the instrument tag number, as given in the tabulation, shall be provided on each piece of equipment supplied under this Section.*

C. *Storage:*

1. *Equipment shall not be stored out-of-doors. Equipment shall be stored in dry permanent shelters including in-line equipment, and shall be adequately protected against mechanical injury. If any apparatus has been damaged, such damage shall be repaired by the Contractor at his own cost and expense. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such tests as directed by the Engineer. This shall be at the cost and expense of the Contractor, or the apparatus shall be replaced by the Contractor at his own expense.*

1.07 *WARRANTY (MAINTENANCE CONTRACT)*

A. *A written total instrument maintenance contract shall be provided to the Owner, executed by the system supplier as a part of the work under this Section. The maintenance contract shall include all labor, parts, and emergency calls providing on-site response within 48 hours, to provide complete instrument system maintenance for a period of one year after the date of final acceptance of the system. The maintenance contract shall also include a minimum of 2 semi-annual preventive maintenance visits by a qualified serviceman of the supplier who is familiar with the type of equipment provided for this project. Each preventive maintenance visit shall include routine adjustment, calibration, cleaning, and lubrication of all system equipment and verification of correct operations. Emergency maintenance procedures or plant visits may coincide with a scheduled preventive maintenance visit, however, they shall not replace the work intended to be performed during a preventive maintenance visit. The system supplier shall have full responsibility for the preventive and corrective maintenance including replacing of defective components, maintaining sufficient spare parts on-site, and complete calibration of all components under this section, all at no cost to the Owner. The maintenance contract shall not begin until both the instrumentation training course and the system acceptance test have been successfully completed, at which time the Owner shall be capable of performing necessary preventive maintenance, and all instruments shall be functional.*

B. *During the one-year maintenance period, observation of maintenance operations by designated Owner personnel, and the instruction of said personnel in the details of the maintenance work being performed shall be provided.*

C. *A complete written report shall be furnished the Engineer and Owner after each scheduled and unscheduled visit, giving problems corrected, systems needing recalibration, and recommendations to prevent recurrence, if applicable.*

D. *The costs for the one-year maintenance service contract shall be included in the Contract price.*

1.08 *TRAINING*

A. *A training program shall be set up and conducted by the major equipment manufacturer furnishing the instrumentation package. The training session shall be for a minimum period of 1 day uninterrupted and shall be conducted at the pump station.*

B. *A course outline showing the material to be covered shall be submitted to the Engineer for review. The training program shall include both classroom and "hands-on" instruction for each instrument supplied under this group of the Specifications and shall furthermore include operational training, maintenance training, and training on use of calibration equipment.*

C. *As the equipment installed at the plant shall be used for the "hands-on" training, the training program shall not be conducted until all of the systems are operational, and operational related "punch list" items are corrected.*

D. *Training on equipment supplied by a manufacturer other than the major equipment manufacturer shall be by the original equipment manufacturer, and shall be scheduled in the training programs by the major equipment manufacturer. Exceptions may be granted if the instructor demonstrates adequate knowledge on the care and operation of the other manufacturers' equipment.*

E. *The training programs shall be conducted at a time mutually agreeable to the Engineer, Owner, Contractor, and Supplier. The Owner shall decide how many of his personnel shall attend the training. A representative of the Engineer may observe the training in progress. The Owner shall have the right to videotape all training as it is conducted.*

F. *The supplier shall make use of audio-visual aids in the training courses and shall provide the OWNERS staff his undivided attention (i.e., shall not conduct his company business during training hours) for the full 1 day. The supplier shall furnish training participants with written handouts, preferably copies of the shop drawing submittal books, up to a maximum of 6 copies, for purposes of familiarization with the shop drawings, and to assist in explanations.*

PART 2 – *PRODUCTS*

2.01 *GENERAL*

A. *All instrumentation supplied shall be of the manufacturer's latest design and shall produce or be activated by signals which are established standards for the water industry.*

B. *All electronic instrumentation shall be of the solid-state type and shall utilize linear transmission signals of 4 to 20 mAdc (milliampere direct current), however, signals between instruments within the same panel or cabinet may be 0-10 V.d-c (volts direct current), or other manufacturer standard.*

C. *Outputs of equipment that are not of the standard signals as outlined, shall have the output immediately raised and/or converted to compatible standard signals for remote transmission. No zero based signals will be allowed for remote transmission.*

D. *All instruments shall be provided with mounting hardware and floor stands, wall brackets, or instrument racks as shown on the Drawings or as required.*

E. *All indicators and LED readouts shall be linear, direct reading in process units, unless otherwise noted. Percentage scales and indicators are prohibited.*

F. *All transmitters shall be provided with either integral indicators or conduit mounted indicators in process units, accurate to two percent, unless otherwise noted.*

G. *Electronic equipment shall be of the manufacturer's latest design, utilizing printed circuitry and suitably coated to prevent contamination by dust, moisture and fungus. Solid state components shall be conservatively rated for their purpose, to assure optimum long term performance and dependability over ambient atmosphere fluctuations and 0 to 95 percent relative humidity. The field mounted equipment and system components shall be designed for installation in dusty, humid, and slightly corrosive service conditions.*

H. *All equipment, cabinets and devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single manufacturer, in-so-far as possible, and shall consist of equipment models which are currently in production. All equipment provided shall be of modular construction and shall be capable of field expansion.*

I. *All equipment shall be designed to operate on a 60 Hertz alternating current power source at a nominal 115 volts, plus or minus 10 percent, except where specifically noted. All regulators and power supplies required for compliance with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.*

J. *All analog transmitter and controller outputs shall be 4-20 milliamperes into a load of 0-750 ohms, unless higher load capacity is required.*

K. *All switches shall have double-pole double-throw contacts rated at a minimum of 600 VA, unless specifically noted otherwise.*

L. *Materials and equipment used shall be UL listed (or other independent lab listed) wherever such listed equipment and materials are available.*

M. *All equipment shall be designed and constructed so that in the event of a power interruption, the equipment specified hereunder shall resume normal operation without manual resetting when power is restored.*

N. *All circuit boards in instruments mounted in damp locations or mounted outdoors shall be fungus proofed. All field transmitters mounted outside shall be equipped with sunshields and shall be capable of operation to -20° Fahrenheit.*

O. *Equipment installed in a hazardous area shall meet Class, Group and Division as shown on the contract drawings, to comply with the National Electrical Code. All power supply and signals coming from and going to hazardous areas shall have intrinsic safety barriers provided.*

2.02 *INSTRUMENTS AND ACCESSORY EQUIPMENT*

A. *Refer to other Division 17 Instrumentation Specification Sections for equipment requirements for field mounted primary devices, transmitters and secondary instruments, receivers and central control equipment.*

PART 3 – *EXECUTION (NOT USED)*

END OF SECTION

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SECTION 17420
INSTRUMENTS

PART 1 – GENERAL

1.01 WORK INCLUDED

A. The CONTRACTOR shall furnish and install all primary devices, transmitters, primary and secondary receivers, analyzers and accessory items as shown on the Contract Drawings and as specified herein.

1.02 RELATED WORK

A. The following Sections of this Specification Division contain requirements on instrumentation and control equipment and software which are considered to be covered by applicable requirements of this section (and shall be included in the bid by a single Instrumentation Supplier for this Project):

1. Section 17311 – PLC Hardware and Software
2. Section 17410 - Basic Measurement and Control Instrumentation Materials and Methods
3. Section 17430 - Boxes, Panels and Control Centers
4. Section 17480 - Instrument Lists and Reports
5. Section 17490 - Measurement and Control Commissioning

B. The following Divisions of these Specifications contain requirements on equipment furnished by other suppliers that must interface with the instrument system, or on methods and materials to be performed/used in the installation and/or wiring of the instrumentation system.

1. Division 1 - General Requirements
2. Division 11 - Equipment
3. Division 16 - Electrical

PART 2 – PRODUCTS

2.01 INSTRUMENTS AND ACCESSORY EQUIPMENT

A. Product Descriptions

1. Loop Isolator/Signal Converter:

   a. Loop isolators or signal converters shall be furnished and installed where indicated, to isolate signals or to increase the load capacity of a system required to have many devices in the loop. Isolators shall provide 3-way isolation, and shall have a power supply voltage of 115 VAC unless otherwise indicated. 2 wire style isolators are not acceptable. Isolators shall be Moore SCT, AGM, RIS, or equal, enclosed as appropriate for the application, or as indicated.

2. Computing Relays/Integrators:

   a. Computing relays or integrators for such purposes as batching, summing, totalization, etc., shall be Moore Industries, AGM, RIS, or equal.

3. Transient/Lightning Suppressors:

   a. Device Locations: As a minimum, provide surge protection devices at the following locations:

      1) At any connections between ac power and electrical and electronic equipment, including panels, assemblies, and field mounted analog transmitters.

      2) At both ends of all analog signal circuits that have any portion of the circuit extending outside of a protecting building.

      3) At both ends of all copper-based communications cables which extend outside of a building, including at field instruments and the field side of analog valve position signals.

      4) On all external telephone communications lines.

   b. Surge protection device assemblies for connections to AC power supply circuits shall:

      1) Be provided with two 3-terminal barrier terminal strips capable of accepting No. 12 AWG solids or stranded copper wire. One terminal strip shall be located on each end of the unit.

      2) Have a nonflammable enclosure that meets or exceeds UL 94 V0 flammability requirements. The surge protection device shall be provided with provisions for mounting to interior of equipment racks, cabinets, or to the exterior of freestanding equipment.

      3) Be constructed as multistage devices consisting of gas tube arrestors, high energy metal oxide varistors, or silicon avalanche suppression

diodes. Assemblies shall automatically recover from surge events, and shall have status indication lights.

4) Comply with all requirements of UL 1449, second edition.

5) Be able to withstand a peak surge current of 10,000 amps based on a test surge waveform with an 8-microsecond rise time and a 20-microsecond exponential decay time, as defined in UL 1449.

6) Have the following characteristics:

   a) Maximum Continuous Operating Voltage: 150VAC

   b) Maximum Operating Current: 20 amps

   c) Ambient Temperature Range: -20 degrees C to +65 degrees C

   d) Response Time: 5 nanoseconds

c. Surge protection device assemblies for analog signal circuits shall:

1) Have four lead devices with a threaded mounting/grounding stud or DIN Rail mounting.

2) Have a nonflammable enclosure that meets or exceeds UL 94 V0 flammability requirements.

3) Be constructed as multistage devices consisting of gas tube arrestors and silicon avalanche suppression diodes. Gas tube arrestors and diodes shall be separated by a series impedance of no more than 20 ohms. Assemblies shall automatically recover from surge events.

4) Comply with all requirements of UL 497B.

5) Be able to withstand a peak surge current of 10,000 amps based on a test surge waveform with an 8-microsecond rise time and a 20-microsecond exponential decay time, as defined in UL 1449.

6) Limit line-to-line voltage to 40 volts on 24VDC circuits.

7) Have the following characteristics:

   a) Maximum Continuous Operating Voltage: 28VDC

   b) Ambient Temperature Range: -20 degrees C to +65 degrees C

   c) Response Time (Line-to-Line): 5 ns

d. Acceptable manufacturers shall be Phoenix Contact, Weidmuller, Transtector, or equal.

4. Intrinsically Safe Barriers

a. The Contractor is responsible for providing all intrinsically safe barriers for float switches, devices, and instruments requiring barriers to meet hazardous area approvals.

5. Altitude and Pressure Gauges:

a. All indicating gauges are pipe mounted with male and brass threaded pipe connections. Gauges shall be 4 1/2 inch liquid filled for maximum vibration and corrosion protection. Gauges shall have phosphor bronze Bourdon tubes, white laminated phenol dials. Gauges shall have micrometer adjustment of pointers and black phenol, black cast iron, brass, or aluminum case and ring, original rotary gear design, corrosion resistant, stainless steel movement, blowout protection, and bronze socket with wrench flats. Accuracy shall be within 1/2 of 1 percent of the scale range. They shall be as manufactured by Helicoid Gage Division, "410"; Ashcroft; U.S. Gauge; Wika; or equal.

b. All gauges shall be piped with provisions for venting pressure to allow calibration (zero) checks. Valves for gauge shutoff and zeroing shall be 1/4 turn ball valves with lever handle, corrosion-resistant.

c. Liquid filled diaphragm seals shall be installed on all gauges as indicated in the Gauge Schedule in Section 17480 of the Specifications. Diaphragm seals shall be of the continuous duty type, 3 piece construction with 1/4 inch flushing connection, 1/4 inch fill connection, 316 stainless steel lower housing and diaphragm material 1/4 inch gauge connection and 1/2 inch lower connection. Housing bolts shall also be stainless steel. Acceptable models are Marsh 42-01, Helicoid 100H, Ashcroft, or equal. Viton diaphragms are required on low range pressure applications (less than 15 psig). To prevent accidental loss of fluid, diaphragm seals shall be permanently attached to gauges by installation of a lead sealed wire connecting the two. Fill fluid shall be factory installed silicone. All gauges shall be precalibrated, as an assembly, with the seal.

6. Submersible Pressure Transducer

a. The submersible pressure transducer shall be a continuous level measuring device that converts the measured pressure to a level reading and provides a continuous 4-20 mADC output.

b. The sensor shall be constructed of titanium and shall be suitable for installation in a well, tank, pipe, etc. Wetted materials shall be suitable for

installation in nearly all fluids, including wastewater. The sensor cable shall contain a vent tube to reference the measured pressure to atmosphere.

c. The cable shall be constructed of tefzel, and shall be integrally connected at the sensor with internal potting to prevent ingress of fluid back into the transmitter. Length of the cable shall be as required for the installation shown.

d. The sensor shall contain an internal lightning arrestor and voltage spike protection.

e. Operating temperature range shall be -4 to 140° F. The sensor shall be furnished and calibrated for the operating pressures encountered for the application, and the sensor shall be capable of four times the rated pressure without damage to the sensor.

f. The sensor/cable assembly shall be rated NEMA 4X, NEMA 6P, and NEMA 7 for Class I, Division 1 hazardous locations.

g. The submersible pressure transmitter shall be Druck PTX 1835 series, or equal.

7. Eccentric Weight Float Type Level Sensors

a. The level monitor shall be the integral eccentric weight non-mercury float switch type, Flygt Model ENM-10, or approved equal.

b. Float switches in hazardous locations shall be provided with intrinsically safe barriers.

8. Ultrasonic Level for Open Channel Flow Monitoring

a. The system shall be of the ultrasonic type for continuous level and/or open channel flow measurement. System shall consist of transmitter, transducer and interconnecting cable. The system accuracy shall be +/- 2mm + 0.17% of measured distance.

b. The transmitter shall be microprocessor based with an integral operator interface housed within a NEMA 4X corrosion resistant enclosure with a separate wiring connection compartment. There shall be no jumpers, trimpots, dip switches or external devices required to fully commission the transmitter. The operator interface shall have an illuminated 6 line graphic display with country specific menu guidance, on-site diagnosis with envelope curve on display. All error codes, process variables and internal values shall be accessible and displayable on the display. The transmitter shall contain a fuzzy logic implementation manager to allow untrained operators to commission the system without assistance. Transmitter shall support

Floating Average Curve (FAC), fixed target suppression, zone evaluation, and agitator filtering algorithms.

c. The transmitter shall support transducers covering a span of one inch to 230 feet without modification or hardware adjustment. One or two fully isolated 0/4-20 outputs @ 600 ohms maximum shall be supplied, as required by the contract documents. Output shall be proportional to level, flow, or volume as indicated. A minimum of five fully programmable 4 amp SPDT relay outputs shall be provided as well as companion LED status indicators on the operator interface. An integral six digit non-resetable counter and remote totalizer counter driver shall be provided. Pump sequencing, differential level, open channel flow, solids level, liquid level applications shall be supported.

d. Remote HART or Profibus DP digital communication shall be supported. The standard transmitter shall support the local connection of a PC based operator interface.

e. The transmitter shall support the input of a separate overfill/under fill level switch for enhanced fill control.

f. The transducer shall be powered by the transmitter with less than 50 V up to 1000 feet away via standard twisted shielded two conductor cabling. EMI/RFI effects on the combined system shall be less than 1% at 10volts/meter (NAMUR, IEC 801-3 standards) allowing installation in standard aluminum conduit. The transducer shall have polypropylene or Tefzel housings and be rated Class I Division 1 or Class II Division 1 by Factory Mutual (FM), and NEMA 6P (submersible). A 1 inch NPT connection shall be provided to mount the transducer.

g. The transducer shall be provided with interconnecting cable, length as required, and shall be capable of being extended from the transmitter up to 1000 feet away. Transducers shall have integral temperature sensors to support speed of sound compensation and be weather proof and fully submersible.

h. The transmitter shall be the Endress+Hauser Prosonic FMU 90 or equal. The transducer shall be the Endress+Hauser Prosonic FDU 90F, or equal.

9. Non-Contact Radar Type

a. Where non-contact level measurement is indicated, the system shall consist of an integral sensor/transmitter assembly complete with housing, transmitter, microwave module and Wave-Guide (antenna). The radar assembly will transmit energy in the form of microwave pulses, target the microwave pulses returning to the antenna, measure the transit time of the microwave pulses and calculate the distance to the target. The radar

assembly shall have the following features: integral level indicator and adjustment module for field calibration and display of process variable: 6" ANSI 150# 316SS process connection with 316SS cone antenna: 4-Wire Universal power supply (24VDC or 120VAC) with intrinsically safe barrier and 4-20 mA HART output; programmable electronics shall provide linear 4-20mA output signal proportional to level or flow. The housing shall be a dual chamber aluminum style rated Class I, Division I Explosion proof.

b. Radar assemblies shall be 2-Wire (or 4 wire as shown on P&ID's) with D-Housing for level and open channel flow measurement; PLICSCOM adjustment module for integral display and field calibration; use optional Waveguide Extension for applications that require a longer antenna length to protrude into the tank/channel (mounting through concrete slabs, etc.).

c. Non-contact radar level measuring systems shall be **Ohmart Vega PS66** series, or equal.

d. Where local field indicators are called out in the P&ID's, they shall be two wire condulet style, DC milliameter with a range of 4-20 mAdc, thermally compensated, explosionproof and weatherproof, for mounting on rigid conduit. The housing shall be aluminum with a glass viewing window, and connections shall be made through screw terminals. Accuracy shall be +/- 2 percent of full scale, with 0.1 percent repeatability. The indicators shall be linear, scaled in engineering units (not percent). Actual display may be analog or digital LCD.

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 17430

BOXES, PANELS, AND CONTROL CENTERS

PART 1 – GENERAL

1.01 WORK INCLUDED

A. The Contractor shall furnish and install all new boxes, panels and control centers and accessory items as shown on the Contract Drawings and as specified herein.

B. The Contractor shall revise existing panels and control centers and accessory items as shown on the Contract Drawings and as specified herein. Some components within this section are reflect existing PLC panel components and are included for reference only.

1.02 RELATED WORK

A. The following Sections of this Specification Division contain requirements on instrumentation and control equipment and software which are considered to be covered by applicable requirements of this section (and shall be included in the bid by a single Instrumentation Supplier for this Project):

1. Section 17311 – PLC Hardware and Software
2. Section 17410 – Basic Measurement and Control Instrumentation Materials and Methods
3. Section 17420 – Instruments
4. Section 17480 – Instrument Lists and Reports
5. Section 17490 – Measurement and Control Commissioning
6. Section 16900 – Controls

B. The following Divisions of these Specifications contain requirements on equipment furnished by other suppliers that must interface with the instrument system, or on methods and materials to be performed/used in the installation and/or wiring of the instrumentation system.

1. Division 1 - General Requirements
2. Division 11 - Equipment
3. Division 16 - Electrical

PART 2 – PRODUCTS

2.01 FABRICATION

A. Instrument Panels

1. Furnish and install the following instrument panels:

   a. Grinder Vendor Control Panels (2)

   b. Super Oxygenation Vendor Process Control Panel (1)

   c. Super Oxygenation Vendor Oxygen Control Panel (1)

2. The instrument panels shall be similar in design to that shown on the Drawings or as specified herein. The panels shall be of all-welded Type 316 stainless steel construction, shall be rated NEMA 4X, and shall have a continuous drip lip over the door(s). Panels shall be suitable for surface wall mounting, unless indicated as freestanding.

3. The panel shall have double doors. Doors shall have a triple latch with continuous hinge with chrome plated handle and lock. The top of the panel shall be covered. The panel shall mount on the floor and be anchored down, similar to the way Motor Control Centers are anchored.

4. Panels shall contain an interior light with switch by the door inside, and an interior GFCI duplex receptacle. The duplex receptacle shall be powered upstream of the UPS.

5. The panels shall be sized to provide heat dissipation such that the maximum operating temperature for the lowest rated component is not exceeded with an ambient temperature of 100 deg F. Calculation shall include direct mid-summer sun exposure for exterior-mounted panels.

6. Provide thermostatically-controlled panel heater to maintain an interior panel temperature of not less than 50 degrees F with an ambient temperature of -20 deg F. Panel heater shall not be powered from the UPS.

7. All conductors running from the field to the panels shall be a single, continuous length, without splices, except at accepted junction boxes. Junction boxes shall have terminal blocks with 20 percent spares in addition to terminals for all wires including spare wires. Special care shall be exercised to carry grounding lines through such junction boxes with the least possible resistance.

8. All panel equipment shall be mounted and wired on or within the cabinet. Wiring shall comply with the latest National Electrical Code. All wiring within the panel shall be grouped together with harnesses or ducts and secured to the structure. All wiring shall be numbered in accordance with the numbering system used on

the wiring/connection diagrams. Power wiring shall be routed in separate wireways from low voltage DC signal wiring. Where crossing power and low voltage DC wiring is necessary, crossing shall be at right angles. Parallel troughs for different voltages shall be separated by a minimum of 12 inches. Power wire shall be 12 AWG type THWN stranded, insulated for not less than 600 volts, unless specified otherwise. Signal wire shall be 16 AWG, THW stranded, insulated for not less than 600 volts.

9. Wire color shall be as follows:

   a. Line Power – Black

   b. Neutral or common – White

   c. AC Control – Red

   d. DC Control – Blue

   e. Equipment or Chassis Ground – Green

   f. Externally powered circuits - Yellow

10. Wiring and connection diagrams shall conform to ISA S5.4 Instrument Loop Diagrams and shall be submitted by the manufacturer as part of the shop drawings for review by the ENGINEER.

11. All wiring in the panels shall terminate in a terminal blocks. Terminal blocks shall have a minimum of 25 percent spares of each type. Terminal blocks shall be arranged in vertical rows and separated into groups (Power, AC control, DC signal, alarm). Terminal blocks shall be barrier type with the appropriate voltage rating (600 volts minimum). They shall be the raised channel mounted type. Wiring trough for supporting internal wiring shall be plastic type with snap-on covers. The sidewalls shall be open top type to permit wire changing without disconnecting. Wire connectors shall be the hook fork type with non-insulated barrel for crimp type compression connection to the wire. Wire and tube markers shall be the sleeve type with heat impressed letters and numbers. Terminal strips shall be provided for the purpose of connecting all control and signal wiring. Direct interlock wiring between equipment will not be allowed. Only one side of a terminal block row shall be used for internal wiring. The field wiring side of the terminal shall not be within 6 inches of the side panel or adjacent terminal. Wiring troughs shall not be filled to more than 60 percent visible fill. Wiring trough covers shall be match marked to identify placement. If component identification is shown on covers for visibility, the ID shall also appear on the mounting sub-panel.

12. All wiring to hand switches and devices which are live circuits independent of the panel's normal circuit breaker protection shall be clearly identified as such.

13. Nameplates shall be provided for all flush mounted equipment. The nameplates shall be approximately 1 inch by 3 inch constructed of black and white laminated, phenolic material having engraved letters approximately 1/4 inch high, extending through the white face into the black layer. Nameplates may be omitted if a nameplate of approximately the same dimension is more conveniently and suitably located on the instrument door or face. Nameplates shall be attached to panels by self-tapping screws.

14. Print storage pockets shall be provided on the inside of each panel. Its size shall be sufficient to hold all of the prints required to service the equipment.

15. The instrument panel shall be factory-tested prior to shipment. Field installation by the Subcontractor shall consist only of setting the panel in place and making necessary electrical connections.

16. All components shall be mounted in a manner that shall permit servicing adjustment, testing and removal without disconnecting, moving or removing any other component. All gages, meters, receivers, switches, pushbuttons and accessories shall be flush mounted.

17. Components mounted on the inside of panels shall be mounted on removable plates and not directly to the enclosure. Mounting shall be rigid and stable unless shock mounting is required otherwise by the manufacturer to protect equipment from vibration. Component mounting shall be oriented in accordance with the component manufacturer's and industries' standard practices. All internal components shall be identified with suitable plastic or metal engraved tags attached with drive pins adjacent to (not on) each component identifying the component in accordance with Drawings, Specifications, and Supplier's data.

18. Pushbuttons shall be heavy-duty, oil tight, 30.5 mm, with momentary contacts. Switches shall be supplied with the number of poles required for the application, an escutcheon plate, and contacts rated for 10 amperes at 120 volts AC.

19. Relays shall be double pole, double throw, octal plug-in type with a transparent dust cover. The relay shall be equipped with an indicating light to indicate when its coil is energized. The relays shall have contacts rated for 10 amperes at 120-volts AC. The mechanical life of the relay shall be 10,000,000 operations minimum (ampere rating shall be increased as necessary for load handling capacity where needed.)

20. Timing relays shall be solid-state plug-in type with a dust and moisture resistant case. The timers shall be of the multi-range/analog or digital type with selectable ranges, between 1 second and 10 hours full scale. The output contacts shall be rated at 2.5 amperes minimum at 120 volts AC. The timing relay shall have a "timing in progress" indication. The mechanical life shall be 10,000,000 operations minimum.

21. Selector switches shall be heavy-duty 30.5 mm, oil tight. Switches shall be supplied with the number of poles required for the application, an escutcheon plate, and contacts rated for 10 amperes at 120 volts AC.

22. General layout of instruments and controls are shown on the Drawings. Minor deviations from the layout may be allowed after review by the ENGINEER.

23. The instrument panels shall be furnished by the instrumentation and control system supplier. Complete shop drawings, including wiring diagrams and panel structural drawings, shall be required for review prior to shipment.

24. Furnish Cutler-Hammer Oxidation Inhibitors and install one in each panel at time of start-up.

25. Instrument panel power supply shall wire to a cord end inside the panel. A properly sized UPS system as specified elsewhere shall sit inside the enclosure and be plugged into the receptacle. UPS output shall power the instrument panel.

26. Loop isolators called out or intrinsic safety barriers shall mount inside the instrument panels.

27. An uninterruptible power supply, Liebert GXT3, or equal shall be provided for power to all PLC equipment for a minimum of 8 hours, as well as field instruments. Provide alarm relay card.

28. Provide a 4 port Modbus Gateway for interface with valve and gate actuators; Prosoft or equal. Provide all configuration software and the software development kit.

29. The main Ethernet switch in PLC-EHPS shall be an Allen Bradley Stratix 8300 or equal, Layer 3 managed switch. Provide the base switch with ten copper ports and two additional 8-port copper expansion modules, for a total of 26 copper ports. Provide redundancy module and redundant 24-volt power supplies. Two fiber optic ports shall be provided to operate in a redundant ring topology.

30. The Contractor shall provide a fiber cross connect cabinet to be bracket-mounted in PLC enclosure as shown on the Network Block Diagram. The Contractor shall provide fiber optic patch cables which meet the performance characteristics of the primary plant network fiber optic cabling. Fiber patch cables shall be obtained from the primary fiber optic cable manufacturer. The Contractor shall provide all appurtenances necessary to complete a functional fiber run to the fiber transceivers via the fiber cross connect cabinet. The fiber cross connect cabinet shall be as manufactured by Fiber Optic X or Black Box.

31. Provide Modbus TCP/IP module, **ProSoft model MVI56-MNET,** for Modbus/TCP communications interface to the Pump Monitoring Panel. Install Modbus TCP/IP

module in existing spare slot or new PLC rack as needed to accommodate all existing and new modules.

32. Provide Ethernet media converters as indicated on the Contract drawings. Media converters shall be ST multi-Mode fiber to twisted pair, 1000 Mbps, stand-alone units. Provide **Hirschmann Spider model 1Tx/1Fx, Phoenix Contact Model 2891315**, or approved equal.

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 17480
INSTRUMENT LISTS AND REPORTS

PART 1 – GENERAL

1.01 WORK INCLUDED

A. The CONTRACTOR shall furnish and install all instrumentation equipment and accessory items as shown on the Contract Drawings and as specified herein.

1.02 RELATED WORK

A. The following Sections of this Specification Division contain requirements on instrumentation and control equipment and software which are considered to be covered by applicable requirements of this section (and shall be included in the bid by a single Instrumentation Supplier for this Project):

1. Section 17311 – PLC Hardware and Software Section
2. Section 17410 - Basic Measurement and Control Instrumentation Materials and Methods
3. Section 17420 – Instruments
4. Section 17430 - Boxes, Panels and Control Centers Section
5. Section 17490 - Measurement and Control Commissioning

B. The following Divisions of these Specifications contain requirements on equipment furnished by other suppliers that must interface with the instrument system, or on methods and materials to be performed/used in the installation and/or wiring of the instrumentation system.

1. Division 1 - General Requirements
2. Division 11 – Equipment
3. Division 16 - Electrical

1.03 LOOP DESCRIPTIONS

A. Loop 100-118 – Existing Miscellaneous Alarms and Status

1. The Automatic Transfer Switch (ATS) shall be equipped with power meter that shall connect to the PLC. The Contractor shall setup and program the meters and calibrate them locally. The System Integrator shall configure and program the local PLC HMI device.

2. In addition, the ATS shall be equipped with digital contact outputs as indicated on the drawings.

3. The local HMI for the PLC shall have a page created that displays all the ATS data monitored.

4. The generator shall be monitored as indicated on the drawings.

5. The PLC shall have the surge protection devices monitored as well as the power coming from the UPS system.

6. Electrical room smoke and heat detectors shall be monitored.

7. Valve Vaults, Flow Control Vault and Flow Meter Vault shall have high sump levels alarmed.

B. Loop 200-212 – Existing Gas Detection System

1. A gas detection system shall be provided to monitor hazardous conditions in all the major structures, with a controller in the Electrical Room of the Screening Facility. For reliability, each sensor shall have its own transmitter and be hardwired to the controller as individual analog signals. Combustibles, Hydrogen Sulfide, and Oxygen shall be monitored in the valve vaults, screenings and dumpster rooms. Ethernet communications shall be provided to the PLC-EHPS allowing full access to all data that is available at the controller.

2. The local HMI for the PLC shall have pages created that display a graphic of the various structures with sensors, showing the status and current analog values for each one, as well as monitoring, alarm and fault.

3. The equipment manufacturer shall be responsible for calibrating and programming the controller and all sensors. The System Integrator shall be responsible for programming the communications to this device and upstream monitoring in PLC. The vendor shall cooperate and coordinate with the System Integrator to accomplish all monitoring and control.

C. Loop 300-302 – New Channel Grinder System

1. There are two Channel Grinders with Screens inside Facility. The vendor provided Grinder Control Panel for each Grinder contains the vendor hardwired controls, Operator Interface, and PLC to monitor and control each Channel Grinder and associated Channel Screen.

2. The local HMI for the PLC-EHPS shall have a page created that displays a graphic of this system, showing the two (2) Channel Grinder and the two (2) Screens. The PLC-EHPS HMI shall be similar to the display on the vendor Operator Interface, OI (manufacturer furnished). General status indicators for the system, as well as monitoring and fault conditions shall be indicated at the PLC-EHPS (See Contract

Drawing I-10). Detailed setpoints, alarms, and monitoring of the associated Channel Screens appears at the Vendor OI. Also, include gates referenced in Loop 900-903.

3. In addition, provide analog signal to PLC-EHPS for continuous level monitoring in the upstream channel. Provide graphical indication of channel level (El. 928.50-948.50) with an alarm set for elevation 934.00.

4. The equipment manufacturer shall be responsible for programming the vendor furnished PLC, as applicable, and the System Integrator shall be responsible for programming the monitoring of hardwired points from this device and upstream monitoring in PLC-EHPS. The vendor shall cooperate and coordinate with the System Integrator to accomplish all monitoring.

D. Loop 400-409 – Revised Dry Weather Pumps

1. The local HMI for the PLC shall have pages created that display a graphic of the Pump Station, including a symbol for each of the four dry weather pumps and their respective tag. Run status of each pump shall be indicated by either a virtual indicator lamp or by a change in color of the pump symbol (or as mutually agreed with LFUCG staff). Alarm conditions shall also be indicated for VFD fault. Also, include levels and Safety stop status described in Loops 700-703.

2. The pumps shall be controlled via adjustable frequency drives (VFD's). All four pumps shall be monitored and controlled at the supervisory level by PLC-EHPS in the Electrical Room. The PLC shall include an Ethernet Switch, which shall be cabled to each VFD. The VFD manufacturer shall be responsible for programming the VFD's themselves and the System Integrator shall be responsible for implementing communications with the PLC-EHPS.

3. The VFD's shall be setup with local HMI for local control and display of status and alarm conditions, and shall connect to the Ethernet network through a communication module. The VFD's shall include Hand--Off-Automatic selector switches in the HMI. In Hand, control of the pump shall be from start/stop pushbuttons in the HMI of the VFD with speed adjustment locally by virtual potentiometer in the VFD HMI. In Automatic, the pump shall be started and controlled remotely through the PLC. When the switch is placed in Automatic, the PLC shall be signaled that it is in control. The PLC shall provide for manual starting and stopping of each pump. The PLC shall also allow for remote resetting of the VFD, in case of a controller fault. A virtual potentiometer in the PLC shall allow for remote speed adjustment when in manual control from the PLC.

4. The PLC shall also include an automatic sequence of control in addition to the remote manual sequence. In automatic, each pump speed shall be automatically controlled directly proportional to the wetwell level, based on plant influent flow conditions. The PLC and HMI shall provide for operator selection of control modes.

5. The PLC shall allow operators to set lead-lag-lag lag-standby pump assignments manually or automatically based on total runtime (with the pump with the least runtime set to lead pump). The PLC and HMI shall indicate the pump operating speed based on an analog signal from the VFD.

6. Dry Weather Pump and Wet Weather Pump typical automatic operation is with a combined wet well. An overall sequence description herein shall define how all the various equipment items shall operate together. Refer to level controls listed under loop 700-703 descriptions.

7. Float sensors in each wetwell (A & B) shall be hardwired to the VFD to lockout the associated pumps on low level, intended as a backup emergency shutoff system in case the pressure transducer level device fails to shutoff the pumps,

8. Run status for each dry weather pump shall be sent to the Chemical Feed System.

9. For the dry weather pumps, a separate pump monitoring panel will be utilized for monitoring pump alarm conditions. Indication for Pump Seal Leak, Motor Seal Leak, Bearing Overtemperature and Motor Overtemperature for each pump will be provided via Modbus TCP/IP (Modbus over Ethernet) communications to PLC-EHPS. Alarm conditions shall be indicated for dry weather pump lockout.

E. Loop 500-511 Revised Wet Weather Pumps

1. The local HMI for the PLC shall have pages created that display a graphic of the Pump Station, including a symbol for each of the four wet weather pumps and their respective tag. Run status of each pump shall be indicated by either a virtual indicator lamp or by a change in color of the pump symbol (or as mutually agreed with LFUCG staff). Alarm conditions shall also be indicated for seal leak, motor overtemperature and VFD fault. Also, include levels and Safety stop status described in Loops 700-703.

2. The pumps shall be controlled via adjustable frequency drives (VFD's). All four pumps shall be monitored and controlled at the supervisory level by PLC-EHPS in the Electrical Room. The PLC shall include an Ethernet Switch, which shall be cabled to each VFD. The VFD manufacturer shall be responsible for programming the VFD's themselves and the System Integrator shall be responsible for implementing communications with the PLC-EHPS.

3. The VFD's shall be setup with local HMI for local control and display of status and alarm conditions, and shall connect to the Ethernet network through a communication module. The VFD's shall include Hand--Off-Automatic selector switches in the HMI. In Hand, control of the pump shall be from start/stop pushbuttons in the HMI of the VFD with speed adjustment locally by virtual potentiometer in the VFD HMI. In Automatic, the pump shall be started and controlled remotely through the PLC. When the switch is placed in Automatic, the PLC shall be signaled that it is in control. The PLC shall provide for manual

starting and stopping of each pump. The PLC shall also allow for remote resetting of the VFD, in case of a controller fault. A virtual potentiometer in the PLC shall allow for remote speed adjustment when in manual control from the PLC.

4. The PLC shall also include an automatic sequence of control in addition to the remote manual sequence. In automatic, each pump speed shall be automatically controlled directly proportional to the wetwell level, based on plant influent flow conditions. The PLC HMI shall provide for operator selection of control modes.

5. The PLC shall allow operators to set lead-lag-lag lag-standby pump assignments manually or automatically based on total runtime (with the pump with the least runtime set to lead pump). The PLC and HMI shall indicate the pump operating speed based on an analog signal from the VFD.

6. Dry Weather Pump and Wet Weather Pump typical automatic operation is with a combined wet well. An overall sequence description herein shall define how all the various equipment items shall operate together. Refer to level controls listed under loop 700-703 descriptions.

7. Float sensors in the pump wetwell shall be hardwired to each VFD to lockout the pumps on low level, intended as a backup emergency shutoff system in case the pressure transducer level device fails to shutoff the pumps. Alarm condition shall be indicated for wet weather pump lockout.

F. Loop 600-617 Revised Dewatering Pumps

1. The local HMI for the PLC shall have a page created that displays a graphic of the Pump Station, including a symbol for each of the two dewatering pumps and their respective tag. Run status of each pump shall be indicated by either a virtual indicator lamp or by a change in color of the pump symbol (or as mutually agreed with LFUCG staff). Alarm conditions shall also be indicated for overload, seal leak, and motor overtemperature. Also, include levels described in Loops 700-703.

2. The pumps shall be controlled via full voltage non-reversing motor starters. Both pumps shall be monitored and controlled at the supervisory level by the PLC in the Electrical Room.

3. The starters shall be setup with switches and indicator lamps for local control and display of status and alarm conditions, and shall connect to the PLC via hardwired connections from each starter. The starters shall include Hand--Off-Automatic selector switches in the door. In Hand, the pump shall run continuously. In Automatic, the pump shall be started and controlled remotely through the PLC. When the switch is placed in Automatic, the PLC shall be signaled that it is in control. The PLC shall provide for manual starting and stopping of each pump. The PLC shall also monitor when the Hand-Off-Automatic selector switch is in Hand position.

4. The PLC shall no longer include an automatic sequence of control in addition to the remote manual sequence.

5. The PLC HMI shall provide for operator manual starting and stopping of each pump.

6. Float sensors in the pump wetwell shall be hardwired to each motor starter to lockout the pumps on low level, intended as a backup emergency shutoff. Alarm condition shall be indicated for dewatering pump lockout.

1.04 LOOP 700-703 EXISTING SAFETY STOP SYSTEM

A. a. The pump station wetwells shall have four different low level lockout float systems, two (2) levels for the dry weather pumps (same elevation), one (1) level for the wet weather pumps, and one (1) level for the dewatering pumps. The floats shall be wired through a relay panel and intrinsic safety barriers, with relay outputs connected to each associated pump motor controller. The relay panel shall be powered from the PLC UPS system. These low level signals shall also independently alarm into the PLC.

B. Loop 700, 701 **Revised Dry Weather Pump Wetwell Level Operation**

1. Common (Combined Dry Weather and Wet Weather) Wetwell Mode: When slide gate (G-5) is open, follow the Combined Mode. The operation of the pumps when in Common Mode shall be as follows:

   a. All pumps shall be set to alternate. Whichever pump has the Lead position will start running when the liquid level in either wetwell has reached the Lead "ON" start point for the common well. If the Lead pump cannot maintain the desired liquid level in the wetwell, then the first Lag pump will start once on the "ON" set point is reached for Lag pump. When two or more pumps are running, VFD speed equalization shall occur and the pumps shall run at the same speed while maintaining the desired liquid level in the wetwell. If the Lead pump and Lag pump cannot maintain the desired liquid level in the wetwell, then the Lag-Lag pump shall start once the "ON" set point is reached for Lag-Lag pump. When an energized "running" pump reaches the liquid level "OFF" set point in the Lead / Lag / Lag-Lag sequence, the pump shall be turned "OFF" until it is called for again based on the level in the common wetwell.

   b. All pumps shall be able to be grouped into different operational sequences if required.

   c. **Rising Water Level**: As the level in the wetwell rises and the Lead pump start level is reached, and the lead pump starts. The 4-20 mADC speed reference output from the controller to the VFD shall run at the low limit of the operating range and be adjusted over the operating speed range, initially set at 85-100% of full speed, based on the measured level, to try to match

incoming flow. The final Dry Weather Pump Operating speed range will be determined to avoid cavitation, with each pump delivering approximately 5000-6700 gpm. If level continues to rise, the speed output shall continue to increase until the pump is operating at full speed. If the level continues to rise and the Lag pump start level is reached, the Lag pump shall start and both pumps shall run at the low limit of the operating range and be adjusted over the operating speed range, initially set at 85-100% of full speed, based on the measured level. The Lead and Lag pump speed outputs shall be adjusted based on the measured level, to try to match incoming flow. If the level continues to rise, the speed output shall continue to increase until the pumps are operating at full speed. If the level continues to rise and the Lag-Lag pump start level is reached, the Lag-Lag pump shall start. Speed outputs shall be adjusted to operate all pumps at 100% of full speed. Alternatively, if the storage tank reaches full capacity as indicated by a High Level Setpoint, the operation of the Lag-Lag pump shall begin as indicated above. The station is not designed for simultaneous operation of all four pumps; therefore, the backup pump is not part of the sequence.

d. **Falling Water Level**: If all pumps are operating at full speed, and the wetwell level begins to fall, all pumps shall continue to operate at full speed until wet well level falls below the Maintain Level Setpoint. Below the Maintain Level Setpoint pumps speeds shall be reduced until low limit of the operating range. If one or more pumps is operating at reduced speed, and the wetwell level begins to fall, each pump shall stop when its respective OFF level has been reached.

e. **Pump Operating Setpoints**: Pump Operating setpoints shall be as defined in the table below.

Dry Weather Pump Settings

Description	Dry Weather Pump Station		Pump Control Setting	
	> ON EL. (ft)	< OFF EL. (ft)	> ON (ft)	< OFF (ft)
Lag-Lag Pump* Alternative Start	Storage Tank 984.50			
High Level Alarm	933.00	932.00	22.0	21.0
Lag-Lag Pump*	933.00	923.00	22.0	12.0
Lag Pump	929.00	922.00	18.0	11.0
Lead Pump	928.00	921.00	17.0	10.0
Maintain Level	924.00	924.00	13.0	13.0

*LAG-LAG to only operate when tank is within 1' of full or inflow exceeds capacity of dry weather pumps and all wet well pumps.

2. Isolated (Individual Dry Weather) Wetwell Mode: When slide gate (G-5) is closed, the dry weather wetwell will form two (2) isolated wetwells and each wetwell will function with a separate set of pumps and controls. The operation of the pumps when the wetwells are in isolated wetwell mode shall be as follows:

    a. All pumps for each individual wetwell shall be set to alternate. Whichever pump has the lead position will start running when the liquid level in the wetwell has reached the lead "ON" start point for the individual well. If the lead pump cannot maintain the desired liquid level in the wetwell, then the first lag pump will start once the "ON" set point is reached for lag pump #1. When two or more pumps are running, VFD speed equalization shall occur and the pumps shall run at the same speed while maintaining the desired liquid level in the wetwell. When an energized "running" pump reaches the liquid level "OFF" set point in the lead/lag sequence, the pump shall be turned "OFF" until it is called for again based on the level in the individual wetwell.

    b. The station is not designed for simultaneous operation of all four pumps; therefore, only one of the Lag pumps may operate when the wet wells are isolated.

3. All pumps in each individual well shall be able to be grouped into different operational sequences if required.

    a. **Disabled Wetwell Mode:** If Wetwell A or Wetwell B should need to be out of operation, a manual selection shall be provided within PLC-EHPS to lockout the associated pumps and associated pressure transducer. The pumps in the "active" wetwell shall operate in Isolated Wetwell Mode.

    b. **Forcemain Flushing Mode:** The Forcemain Flushing Mode automatic sequence may be manually initiated by the operator when the following conditions have been met.

        1) There has been no precipitation recently and none is expected during the flushing operation.

        2) DWQ Operator shall determine if the Flushing Sequence is needed.

        3) Optimum time is 3-7 days after a Wet Weather (WW) event

    c. When the Forcemain Flushing mode is activated, the following sequence will occur:

        1) All four (4) Dry Weather Pumps will be locked out / disabled.

2) Dry weather flow will continue to enter the EH PS and fill the combined Dry and Wet well and be pumped into the WWST by the Wet Weather pumps.

3) Wet weather pumps will remain in operation until the storage tank elevation reaches El. 951.00 (approximately 11.5 ft) and approximately 1.6 MG of flow is diverted and stored in the WWST. (Note: the bottom cone of the WWST holds approximately 130,000 gallons) When the level setpoint is reached or an operator adjustable flushing cycle timer, initially set at 6 hours, has expired, the Wet Weather pumps will be stopped.

4) Two (2) DWPS pumps will be activated and 15-30 seconds later the Tank Drain Flow Control Vault valve will open to an initial position of 35% open, to drain flow into the dry weather wet well of the pump station. The valve will then modulate (over a range of approximately 35-50% open) to maintain a consistent flow rate of ~11,500 to 12,000 gpm into the dry weather wet well to keep the dry weather pumps in operation continuously.

5) The dry weather pumps will then operate with speed adjustments to deliver a minimum of ~11,500 gpm (flushing velocity to resuspend solids), with an initial programmable setpoint of 12,000 gpm as measure by the discharge flowmeter, until the WWST is empty and the forcemain is flushed.

6) The Dry Weather pumps draw the remaining dry weather flow down until both pumps reach the Lead Pump OFF elevation.

7) The WWST continues to drain until empty (El 939.42) and 15 minutes later the Tank Drain Flow Control Vault valve will close fully to position for the next wet weather event.

8) When the Dry Weather pumps have stopped or the Tank Drain Flow Control Vault valve has closed, the Dry Weather Pump and Wet Weather Pump systems will reset to normal pumping operation.

4. Wetwell level shall be measured by two (2) submersible pressure transducers (PE-700 and PE-701). A 4-20 mADC output from each pressure transducer shall be sent to the PLC. Generate high level alarm indication.

   a. In Common Wetwell Mode, wetwell level may be determined from Dry Weather pressure transducers (PE-700 and PE-701) or Wet Weather pressure transducers (PE-702 and PE-703). From the combined four (4) sensors the operator selects PRIMARY, SECONDARY, and STANDBY level sensors assignments. The pump stations are controlled from the PRIMARY

level sensors. If any sensor fails, the other sensors will automatically be reassigned to fill the open assignments.

b. If PRIMARY and SECONDARY level sensor measurements differ by more than a setpoint, a Level Differential Alarm shall alert the operator to the need to reassign sensors and perform maintenance.

c. In Isolated Wetwell Mode, pressure transducer that will be utilized shall be determined to which wetwell is active.

d. PE-700 will be active with slide gate (G-5) closed and slide gate (G-6) open.

e. PE-701 will be active with slide gate (G-5) closed and slide gate (G-7) open.

f. Manual selection of pressure transducers shall be provided for locking out either pressure transducer.

C. Loop 702, 703 Revised Wet Weather Wetwell Level Operation

1. Common (Combined Dry Weather and Wet Weather) Wetwell Mode: The operation of the pumps when in Common Mode shall be as follows:

a. All pumps shall be set to alternate. Whichever pump has the Lead position will start running when the liquid level in wetwell has reached the Lead "ON" start point. If the Lead pump cannot maintain the desired liquid level in the wetwell, then the first Lag pump will start once on the "ON" set point is reached for Lag pump. When two or more pumps are running, VFD speed equalization shall occur and the pumps shall run at the same speed while maintaining the desired liquid level in the wetwell. If the Lead pump and Lag pump cannot maintain the desired liquid level in the wetwell, then the Lag-Lag pump shall start once the "ON" set point is reached for Lag-Lag pump. When an energized "running" pump reaches the liquid level "OFF" set point in the /Lead / Lag / Lag Lag sequence, the pump shall be turned "OFF" until it is called for again based on level.

b. All pumps shall be able to be grouped into different operational sequences if required.

c. **Rising Water Level:** As the level in the wetwell rises and the Lead pump start level is reached, and the lead pump starts. The 4-20 mADC speed reference output from the controller to the VFD shall run at the low limit of the operating range and be adjusted over the operating speed range, initially set at 85-100% of full speed, based on the measured level, to try to match incoming flow. The final Wet Weather Pump Operating speed range will be determined to avoid cavitation, with each pump delivering approximately 2100-2830 gpm. If level continues to rise, the speed output shall continue to increase until the pump is operating at full speed. If the level continues to

rise and the Lag pump start level is reached, the Lag pump shall start and both pumps shall run at the low limit of the operating range and be adjusted over the operating speed range, initially set at 85-100% of full speed, based on the measured level. The Lead and Lag pump speed outputs shall be adjusted based on the measured level, to try to match incoming flow. If the level continues to rise, the speed output shall continue to increase until the pumps are operating at full speed. If the level continues to rise and the Lag-Lag pump start level is reached, the Lag-Lag pump shall start and all pumps shall run at the low limit of the operating range and be adjusted over the operating speed range, initially set at 85-100% of full speed, based on the measured level. Speed outputs shall be adjusted based on the measured level, to try to match incoming flow. If the level continues to rise, the speed output shall continue to increase until all pumps are operating at full speed. The station is not designed for simultaneous operation of all four pumps; therefore, the backup pump is not part of the sequence.

d. **Falling Water Level:** If all pumps are operating at full speed, and the wetwell level begins to fall, all pumps shall continue to operate at full speed until the lead pump stop level is reached. If one or more pumps is operating at reduced speed, and the wetwell level begins to fall, the pump which is operating at reduced speed shall stop when its respective stop level has been reached. Any remaining pumps operating at full speed shall continue to operate at full speed until the lead pump stop level is reached.

e. **Pump Operating Setpoints**: Pump Operating setpoints shall be as defined in the table below.

Wet Weather Pump Settings

Description	Wet Weather Pump Station		Pump Control Setting	
	> ON EL. (ft)	< OFF EL. (ft)	> ON (ft)	< OFF (ft)
High Level Alarm	933.00	932.00	22.0	21.0
Lag-Lag Pump	932.00	928.00	22.0	17.0
Lag Pump	931.00	926.50	20.0	15.5
Lead Pump	930.00	925.00	19.0	14.0
All Pump Flushing Mode OFF		Storage Tank 951.00		
Maintain Level	929.00	929.00	18.0	18.0

2. **Disable Wet Weather Pumps:** When the level in the wet weather storage tank (WWST) reaches Elevation 980.00, the wet weather pump shall be locked off.

3. **Forcemain Flushing Mode:** When the forcemain flushing mode is activated, the Wet Weather Pumps will start under the normal operating sequence ON commands, and will be issued an off command when the storage tank elevation reaches El. 951.00.

4. Wetwell level shall be measured by two (2) submersible pressure transducers (PE-702 and PE-703). A 4-20 mADC output from each pressure transducer shall be sent to the PLC. Generate high level alarm indication.

    a. In Common Wetwell Mode, wetwell level may be determined from Dry Weather pressure transducers (PE-700 and PE-701) or Wet Weather pressure transducers (PE-702 and PE-703). From the combined four (4) sensors the operator selects PRIMARY, SECONDARY, and STANDBY level sensors assignments. The pump stations are controlled from the PRIMARY level sensors. If any sensor fails, the other sensors will automatically be reassigned to fill the open assignments.

    b. If PRIMARY and SECONDARY level sensor measurements differ by more than a setpoint, a Level Differential Alarm shall alert the operator to the need to reassign sensors and perform maintenance.

    c. Manual selection of pressure transducers shall be provided for locking out either pressure transducer.

D. Loop 800 4MG Existing Wet Weather Storage Tank (WWST)

1. The local HMI for the PLC shall have a page created that displays a graphic of the Wet Weather Storage Tank, showing the water level. The WWST level is critical to proper control of this process and shall be monitored by two (2) level devices (pressure transmitter in Flow Control Vault and pressure transducer at the WWST). The pressure transmitter shall be the primary indicator, while the pressure transducer shall be secondary indicator. The storage tank level devices shall be inputs to the PLC and levels displayed at the PLC. A high level alarm shall be provided. High water level shall be alarmed for the WWS tank. Manual selection of either level device shall be provided.

2. Should high level alarm be initiated for the WWST, then the Wet Weather pumps shall shutoff.

E. Loop 800-802 Revised Flow Control Vault

1. The local HMI for the PLC shall have a page created that displays a graphic of the Flow Control Vault, including a symbol for the modulating valve (V-1), high sump level float (see P&ID 100), and their respective tags. Valve position shall be

indicated on the HMI as well as whether the valve actuator is in local or remote control mode. Valve shall be capable of being manually or automatically positioned by the PLC.

2. Control Valve V-1 shall be normally closed. This valve shall remain closed until the level within the Dry Weather Wetwell drops to below Elevation 927.00, the valve shall open to

3. 100% at Elevation 926.00, and modulate proportionately between these two (2) levels. After a programmable time, initially set for 60 minutes, after achieving a low tank level within the Wet Weather Storage Tank (Elevation 943.00), the valve shall close and remain closed until the process starts over. The valve shall be forced closed upon Wet Weather pump operation.

4. **Forcemain Flushing Mode:** When the forcemain flushing mode is activated, the Tank Drain Flow Control Vault valve will open to an initial position of 35% open, to drain flow into the dry weather wet well 15-30 seconds after the two Dry Weather Pumps have been started. The valve will then modulate (over a range of approximately 35-50% open) to maintain a consistent flow rate of ~11,500 to 12,000 gpm into the dry weather wet well to keep the dry weather pumps in operation continuously.

F. Loop 800 Existing Flow Meter Vault

1. The pump station effluent flow shall be monitored using an electromagnetic flow meter.

2. The local transmitter (located in Electrical Room) shall produce a continuous 4-20mAdc signal, linear with flow which shall be output to the PLC.

3. The measured flow signal shall be indicated, totalized and trended at the PLC.

4. The local HMI for the PLC shall have a page created that displays a graphic of the Flow Meter Vault, including a symbol for the flow meter, high sump level float (see P&ID 100), and their respective tags. Show the real time flow rate, as well as the total flow accumulated since the last reset.

5. An EDCO SLAC Series or equal, combination AC/Signal Suppressor shall be provided located at the flow meter.

G. Loop 900-907 Existing Gate Control at Screening Room

1. The local HMI for the PLC shall have a page created that displays a graphic of the Bar Screen & Compactor System (as previously described in P&ID 300), including a symbol for each of the four (4) channel gates and their respective tag. Gate position shall be indicated on the HMI as well as whether the gate actuator is in

local or remote control mode. Each gate shall be capable of being manually positioned by the PLC.

H. Loop 1000-1007 Existing Gate Control at Pump Station

1. The local HMI for the PLC shall have a page created that displays a graphic of the Pump Station (as previously described above), including a symbol for each of the four (4) slide gates and their respective tag. Gate position shall be indicated on the HMI as well as whether the gate actuator is in local or remote control mode. Each gate shall be capable of being manually positioned by the PLC.

I. Loop 1004-1009 Existing Valve Control at Wet Weather Valve Vault

1. The local HMI for the PLC shall have a page created that displays a graphic of the Pump Station (as previously described above), including a symbol for the modulating valve (V-

a. 2) and its respective tag. Valve position shall be indicated on the HMI as well as whether the valve actuator is in local or remote control mode. Valve shall be capable of being manually or automatically positioned by the PLC.

2. Control Valve V-2 shall be normally closed. This valve shall open when either dewatering pump runs. Valve V-2 shall remain open for a programmable time (initially set at 60 minutes), then shall close back. Valve V-2 shall open and close automatically one time each 7 day period to exercise the mechanism; this automatic sequence shall never occur while a Wet Weather Pump is operating.

J. Loop 1100-1106 Existing Chemical Feed System

1. The local HMI for the PLC shall have a page created that displays a graphic of the Screening Facility (as previously described above), including a graphical representation of the high, low, empty status for each tank and a common alarm indication. Digital monitoring signals shall be output to the PLC from the Chemical Feed System Control Panel (furnished under Division 11). In addition, an analog input shall be provided to Chemical Feed System Control Panel from the PLC for effluent flow rate (P&ID 1200).

K. Loop 1108-1109 Existing Odor Control System

1. The local HMI for the PLC shall have a page created that displays a graphic of the Screening Facility (as previously described above), including a graphical representation of the fan status, as well as record running time of the fan. A digital monitoring signal shall be output to the PLC from the Odor Control Panel (furnished under Division 11).

L. Loop 1107 Existing Emergency Shower and Eye Wash Flow Monitoring

1. The emergency shower and eye wash station shall be furnished with an alarm package which includes a flow switch. The flow switch shall be an input to the PLC for monitoring operation of the emergency shower and eye wash station.

2. The local HMI for the PLC shall have a page created that displays a graphic of the Screening Facility (as previously described above), including a graphical representation of the flow switch alarm.

M. Loop 1108-1109 Existing Odor Control Fan Failure

1. An air flow switch shall be provided and installed within the ductwork of the exhaust fan serving the Odor Control room. This flow switch shall be monitored by a ventilation alarm panel (furnished under Division 16). Upon low air flow this room will be considered a Class I, Division 2 space, this alarm condition will be sent via the ventilation alarm panel to both the PLC and a building mounted light fixture (for local visualization).

2. The local HMI for the PLC shall have a page created that displays a graphic of the Screening Facility (as previously described above), including a graphical representation of the fan failure alarm.

1.05 EXISTING GAUGE SCHEDULE

Location Required	Range					Accessories
	Combination			Compound		
	Size	PSI	Feet	Vacuum (ft)	Altitude (ft)	
Pump Discharge	4-1/2"	0-100	0-230			A, B, C
Wet Weather Storage Tank	4-1/2"	0-30	0-70			A, B, C

Pressure Gauge Accessory Code:

A - Gauge Liquid Filled

B - Diaphragm Seal, Liquid Filled

C - Ball Valves for Shutoff and Vent

* - Viton Diaphragm

PART 2 – PRODUCTS (NOT USED)

PART 3 – PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 17490
MEASUREMENT AND CONTROL COMMISSIONING

PART 1 – GENERAL

1.01 WORK INCLUDED

A. The Contractor shall furnish and install all instrumentation equipment and accessory items as shown on the Contract Drawings and as specified herein.

1.02 RELATED WORK

A. The following Sections of this Specification Division contain requirements on instrumentation and control equipment and software which are considered to be covered by applicable requirements of this section (and shall be included in the bid by a single Instrumentation Supplier for this Project):

1. Section 17311 - PLC Hardware and Software
2. Section 17410 - Basic Measurement and Control Instrumentation Materials and Methods
3. Section 17420 - Instruments
4. Section 17430 - Boxes, Panels and Control Centers
5. Section 17480 - Instrument Lists and Reports

B. The following Divisions of these Specifications contain requirements on equipment furnished by other suppliers that must interface with the instrument system, or on methods and materials to be performed/used in the installation and/or wiring of the instrumentation system.

1. Division 1 - General Requirements
2. Division 11 - Equipment
3. Division 16 - Electrical

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 SEQUENCE OF CONSTRUCTION

A. Installation and startup of the pump station RTU revisions shall be coordinated with the Owner, as the equipment will communicate over an existing trunked radio system.

B. Delivery, startup, and programming of new equipment furnished under this Division shall be coordinated with process equipment installation. A qualified technician shall be present on site during pump startup.

3.02 INSTALLATION/APPLICATION/ERECTION

A. Instrumentation and accessory equipment shall be installed in accordance with the manufacturer's instructions. The locations of equipment, transmitters, alarms and similar devices shown on the Drawings are approximate only. Exact locations shall be as accepted by the Engineer during construction. Obtain in the field all information relevant to the placing of process control work, proceed as directed by the manufacturer and furnish all labor and materials necessary to complete the work in an acceptable manner.

B. The instrumentation installation details on the Drawings indicate the designed installation for the instruments specified. Where specific installation details are not specified or shown on the Drawings, the manufacturer's recommended practice shall be followed.

C. All work shall be executed in full accordance with codes. Should any work be performed contrary to said codes and/or regulations, the Contractor shall bear full responsibility for such violations and assume all costs arising therefrom. All equipment used in areas designated as hazardous shall be designed for the Class, Division, and Group as required on the Drawings for the locations.

D. Unless specifically shown in the Contract Documents, direct reading or electrical transmitting instrumentation shall not be mounted on process piping. Instrumentation shall be mounted on instrument racks or stands. All instrumentation connections shall be provided with shutoff and drain valves.

E. All piping to and from field instrumentation shall be provided with necessary unions, test tees, couplings, adaptors, and shut-off valves.

F. Field instruments requiring power supplies shall be provided with local electrical shut-offs and fuses as required.

G. Brackets and hangers required for mounting of equipment shall be provided. They shall be installed in a workmanlike manner and not interfere with any other equipment.

H. The system supplier shall investigate each space in the building through which equipment must pass to reach its final location. If necessary, the system supplier shall be required to ship his material in sections sized to permit passing through restricted areas in the building. The system supplier shall also investigate, and make any field modifications to the allocated space for each cabinet, enclosure and panel to assure proper space and access (front, rear, side).

I. The shield on each process instrumentation cable shall be continuous from source to destination and be grounded as directed by the manufacturer of the instrumentation equipment but in no case shall more than one ground point be employed for each shield.

J. Lifting rings shall be removed from cabinets/assemblies. Hole plugs shall be provided for the holes of the same color as the cabinet.

K. The system supplier, acting through the Contractor, shall coordinate the installation, the placing and location of system components, their connections to the process equipment panels, cabinets and devices, subject to the Engineer's acceptance. The system supplier shall be responsible to ensure that all field wiring for power and signal circuits are correctly done in accordance with best industry practice and provide for all necessary system grounding to ensure a satisfactory functioning installation. The Contractor hereunder shall schedule and coordinate his work under this Section with that of the electrical work specified under applicable Sections of Division 16.

3.03 FIELD QUALITY CONTROL

A. After equipment and materials have been shipped to the job site, the Supplier shall furnish the services of a factory-trained service technician or engineer to assist and advise the Contractor during installation and to provide programming/calibration/ adjustment at initial startup. A minimum period of 2 calendar days on the job site is required, and expenses associated with additional days necessary shall be at no cost to the Owner.

B. Following installation, checkout, and final adjustment of all panels, instruments, meters, monitoring, and control devices, the Contractor shall schedule a performance test in the presence of the Engineer on all equipment. The Contractor shall furnish the services of the system supplier's servicemen, all special tools, calibration equipment, and labor to perform the tests.

C. Meters shall be tested at 0 percent, 25 percent, 50 percent, 75 percent, and 100 percent of scale, if possible. All status and alarm switches as well as all monitoring and control functions shall also be checked, including logging at printers and change of state on graphics. Testing shall be done from the signal source to the final element or device including all field wiring. Results of all testing shall be submitted to the Engineer in writing.

D. As much as possible, points shall be checked "end-to-end". For example, valve status inputs shall be checked by stroking the valve, and a pump start output shall be checked

by using it to start to start the pump. Simulated testing shall be allowed only when no practical alternative exists. Workstation displays shall be verified for correctness at the same time. An I/O checklist shall be used to record test results and a copy provided to the Engineer upon completion. During system testing, the Contractor shall have a representative onsite continuously who is capable of troubleshooting and modifying system configuration programming.

E. If, during running of the tests, one or more points appear to be out by more than the system accuracy statement, or fails to perform in accordance with agreed strategies, the system supplier's servicemen shall make such adjustment or alterations as are necessary to bring equipment/programming up to specification performance. Following such adjustment, the tests shall be repeated for all specified points to ensure compliance.

3.04 PERFORMANCE TEST

A. Subsequent to the full system implementation, the Contractor shall conduct a successful 30 day final acceptance test for the system furnished and installed under this Contract. In this test, the entire system must operate continuously for 24 hours per day, 7 days per week during the test period, with zero downtime resulting from system failures. If a system failure occurs, the 30-day test period will be repeated, starting over at time zero, from the time that the system failure is repaired. The Contractor shall repeat the test until it is satisfactorily completed. The system will only be acceptable to the Owner after all equipment and software has satisfied the performance test requirements.

B. The Contractor shall submit a final acceptance test completion report which shall state that all Contract requirements have been met and which shall include a summary of maintenance/repair efforts that were required during the test period. Final acceptance of the system by the Owner until this has occurred.

3.05 ADJUSTING AND CLEANING

A. All equipment furnished under this Section of the Specifications shall be adjusted/calibrated as defined elsewhere this Section/Division.

B. All instruments and equipment shall be left free from shipping stickers, paint splatter, dirt, grease, etc., and shall be clean and in like new condition at final acceptance. Touch-up paint shall be furnished as needed to repair blemishes and scratches in finish paint on panels and enclosures, which shall be corrected by the Contractor.

3.06 EXTRA STOCK/SPARE PARTS

A. The following supplies and spare parts shall be furnished:

1. Ten fuses for each type/size in the system.

2. Four Cutler-Hammer C799L2 oxidation inhibitors; install one in each cabinet.

3. One relay of every size and type provided in the project

4. One pump control module

5. One (1) Fiber Optic Media Converter

6. One (1) Modbus TCP/IP communication module

B. Other spare parts are listed in specific instrument technical specifications in the appropriate Division 17 Specification Section herein. All spare parts shall be packaged in an acceptable manner for long-term storage and adequately protected against corrosion, humidity and temperature extremes. All items shall be tagged externally with what they are; both a written description and a manufacturer brand/part number.

END OF SECTION

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APPENDIX 1
EXISTING VFD SHOP DRAWINGS

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Submittal Stamp Page

GRW Project No. 4509-01

Project:	**Contractor:**
East Hickman Wet Weather Storage Facilities LFUCG, Lexington, KY	Judy Construction Company P.O. Box 457 Cynthiana, KY 41031

Copies	Submittal Number	Submittal Description
1	16446-01	VFDs

Contractor Certification Statement

By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with the contract drawings, specifications, other applicable approved shop drawings and all contract requirements.

Paul Lawrence
Signature

2/8/19
Date

Contractor Stamp

Specification Section 16446
Shop Drawing # 16446-01
JUDY CONSTRUCTION COMPANY
By: PL **Date:** 2/8/19

☐ **Reviewed**
☐ **Reviewed As Noted**

GRW Engineering Stamp

☐ REVIEWED ■ FURNISH AS CORRECTED
☐ REJECTED ☐ REVISE AND RESUBMIT
☐ SUBMIT SPECIFIED ITEM

This review is only for general conformance with the design concept and the information given in the Construction Documents. Corrections or comments made on the shop drawings during this review do not relieve the Contractor from compliance with the requirements of the plans and specifications. Review of a specific item shall not include review of an assembly of which the item is a component. The Contractor is responsible for: dimensions to be confirmed and correlated at the job site; information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences and procedures of construction; coordination of the Work with that of all other trades and performing all Work in a safe and satisfactory manner.

GRW engineering | architecture | geospatial

Date: 3/8/19
By: PJB

Comments:

1. Contractor to coordinate with submitted wiring diagrams (Wet and Dry Weather VFDs) and VFD manufacturer to incorporate/modify control options as required to reflect the control options shown on Sheet E-00-701.

2. Please note: the Dry Weather VFDs are slight larger than shown on Construction Documents. Adjust equipment on plan east wall of Electrical Room 105 to accommodate.

APPROVED FOR SUBMITTAL

February 1, 2019

J. L. DAVIS ELECTRICAL CONTRACTOR, INC.

By: _____

J. L. DAVIS ELECTRICAL CONTRACTOR, INC.
P. O. BOX 1028 / 235 KNOX STREET
BARBOURVILLE, KY. 40906
JLDECI@HOTMAIL.COM
PHONE (606) 546-8491
FAX (606) 546-8561

SUBMITTAL DRAWINGS

DIVISION 16 ELECTRICAL

SECTION 16446
VARIABLE FREQUENCY DRIVES

PROJECT:
EAST HICKMAN WET WEATHER STORAGE FACILITY
AND PUMP STATIONS
LEXINGTON, KENTUCKY

Q2C Number: 40982332	**Quote Number:** 1	**Revision Number:** 0
Project Name: East Hickman Wet Weather Storage T		**Quote Name:**

Item No.	Qty.	Catalog Number / Details

ENCLOSED DRIVES

007-00	4	**Designation:** 300HP ATV680 AFE ATV680C25T4N2ANWABGLEP266EP269EP2+ Altivar 680 ATV680C25T4N2ANWABGLEP266EP269EP278EP279 Designation: 300HP ATV680 AFE Main circuit breaker disconnect 100k AIC rated Selected for 460 Vac 3 phase motor 400 Horsepower Sized for Normal duty. Type 12 Enclosure UL508A Label RAL7035 (Gray) Power Circuit W: Drive combination package Control options: Hand-Off-Auto selector switch Speed Potentiometer Pilot light options: Power on pilot light (red) Run PTT pilot light (green) Trip PTT pilot light (yellow) Auxiliary contacts: 1 NO/NC run contact 1 NO/NC trip contact 1 NO auto mode contact Ethernet IP Communications Card EP266- Basin Low Level Alarm EP269- Seal water solenoid w/ pressure feedback EP278- Motor over temperature logic input EP279- Motor Over Temperature Logic input with Pilot Light This device contains selected features that require factory engineered configurations. Standard published lead times no longer apply. Enclosure dimensions are subject to change.

SQUARE D
by Schneider Electric

Job Name: EAST HICKMAN WWSF
Job Location: LEXINGTON, KY

Square D Quotation #: 40982332
Quotation Revision #:
Sales Contact: SCOTT RICE
Sales Contact Location: LEXINGTON FO

Purchaser: EUBANKS ELECTRICAL SUP INC
Purchaser PO #: 100810

Customer:
Customer PO #:

User:
User Location:

Architect:
Cons. Engineer:

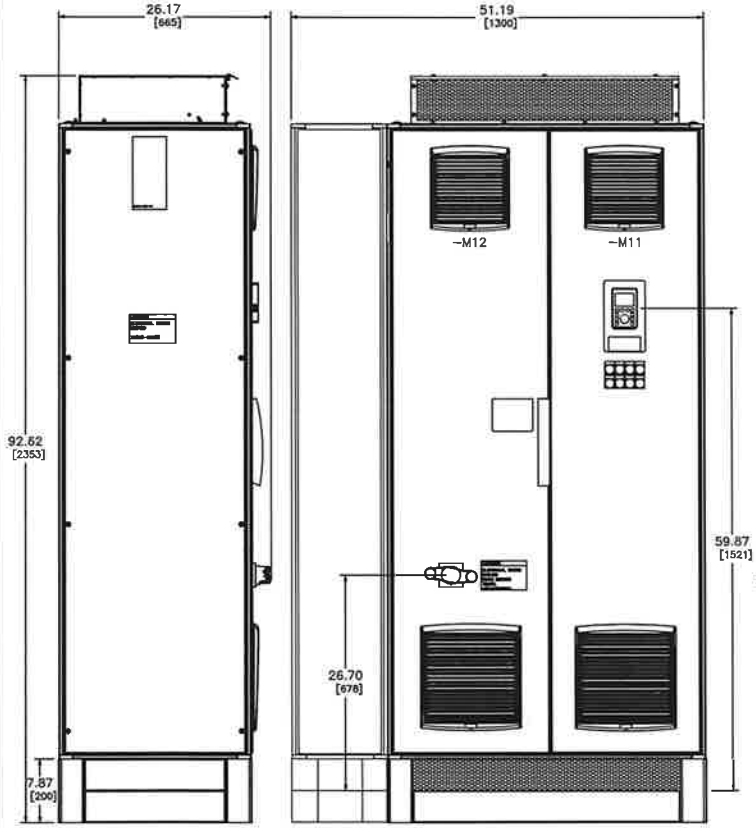
Drawing Status: APPROVAL

TABLE OF CONTENTS

SQUARE D FACTORY ORDER NUMBER: 40982332–007

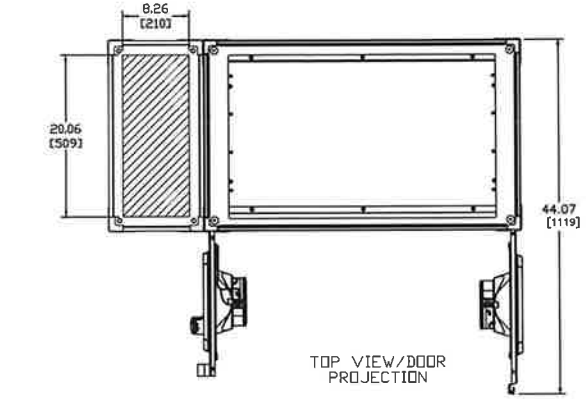
Equipment Designation	Equipment Type	Drawing Type	Drawing Number	Page	Revision Level
ATV680C25T4N2ANWABGL EP266EP269EP278EP279	ALTIVAR PROCESS DRIVE	ELEVATION	F40982332–007–01	1	–
		WIRING DIAGRAM	E40982332–007–01	1	–
			E40982332–007–01	2	–
			E40982332–007–01	3	–
			E40982332–007–01	4	–
			E40982332–007–01	5	–
		GENERAL ARRANGEMENT	R40982332–007–01	1	–
			R40982332–007–01	2	–
			R40982332–007–01	3	–

REV	DESCRIPTION	BY	DATE
–	----	--	--/--/--

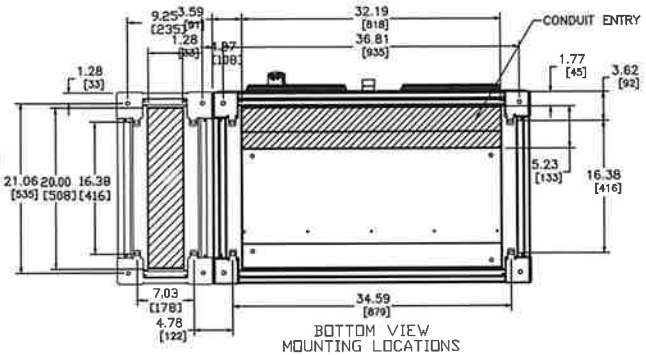


LEFT VIEW

FRONT VIEW

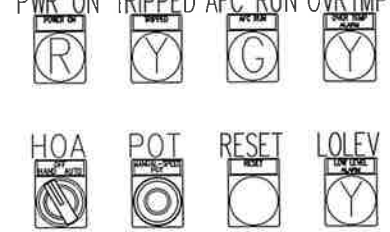


TOP VIEW/DOOR PROJECTION



BOTTOM VIEW
MOUNTING LOCATIONS

PILOT DEVICE DETAIL



ENCLOSURE OUTLINE & GENERAL ARRANGEMENT FOR CONTROLLER P/N

⚠ ATV680 C25 T4 N A N W

MAX FLA	KILOWATTS/HP	VOLTAGE/PH	DUTY TYPE	ENCLOSURE TYPE	HARMONIC MITIGATION	POWER CIRCUIT TYPE
477 AMPS	300KW/400HP	460V/3 PH	NORMAL	TYPE 12	AFE	W/BYPASS

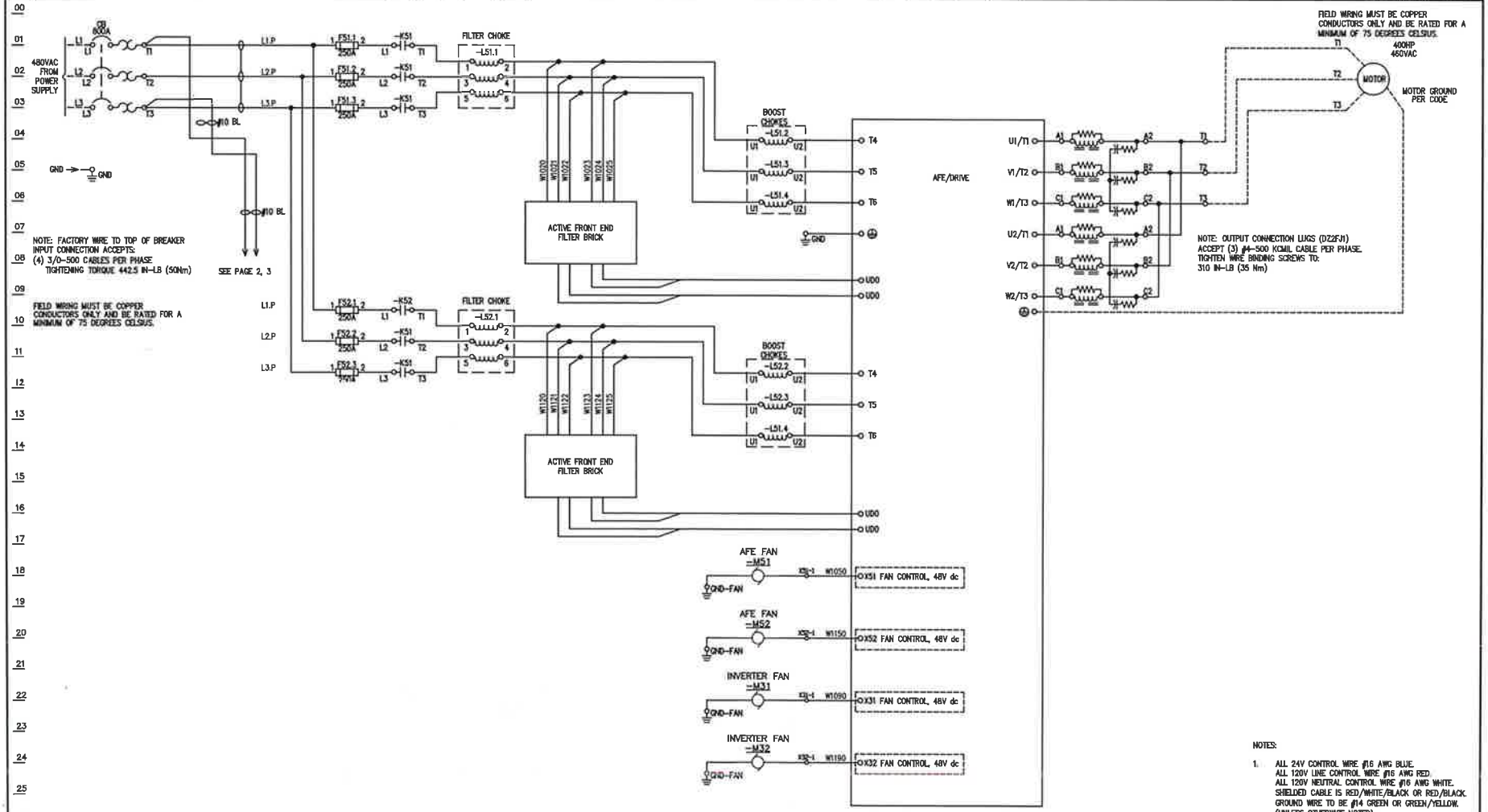
NOTES:

⚠ REFER TO CONTROLLER NAMEPLATE TO COMPLETE P/N.

JOB NAME:	EAST HICKMAN WWSF	EQUIPMENT DESIGNATION:	ATV680C25T4N2ANWABGLEP266EP269EP278EP279
JOB LOCATION:	LEXINGTON, KY	EQUIPMENT TYPE:	ALTIVAR PROCESS DRIVE
DRAWN BY:	T. SMITH	DRAWING TYPE:	ELEVATION
ENGR:	T. SMITH		
DATE:	3/7/18		
DRAWING STATUS:	APPROVAL	DWG#	F40982332-007-01-2

PG 1 OF 1 REV –

REV	DESCRIPTION	BY	DATE
–	-----	--	--/--/--



NOTES:

1. ALL 24V CONTROL WIRE #16 AWG BLUE.
   ALL 120V LINE CONTROL WIRE #16 AWG RED.
   ALL 120V NEUTRAL CONTROL WIRE #16 AWG WHITE.
   SHIELDED CABLE IS RED/WHITE/BLACK OR RED/BLACK.
   GROUND WIRE TO BE #14 GREEN OR GREEN/YELLOW.
   (UNLESS OTHERWISE NOTED)

TABLE FOR POWER WIRING		
POWER WIRING	WIRES/PHASE	EQUIPMENT GROUND
WIRE, 70mm, YELLOW	1	WIRE, 1 AWG, GRN/YEL

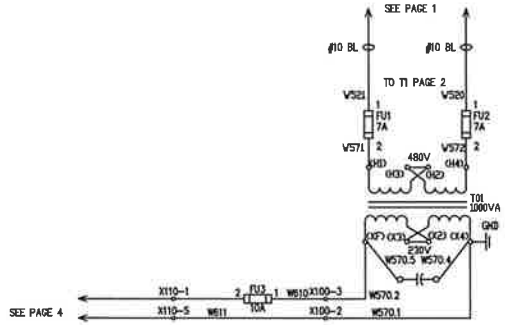
UNLESS OTHERWISE NOTED

JOB NAME:	EAST HICKMAN WWSF
JOB LOCATION:	LEXINGTON, KY
DRAWN BY:	T. SMITH
ENGR:	T. SMITH
DATE:	3/7/18
DRAWING STATUS:	APPROVAL

EQUIPMENT DESIGNATION:	ATV680C25T4N2ANWABGLEP266EP269EP278EP279
EQUIPMENT TYPE:	ALTIVAR PROCESS DRIVE
DRAWING TYPE:	WIRING DIAGRAM
DWG#	E40982332-007-01-1

REV	DESCRIPTION	BY	DATE
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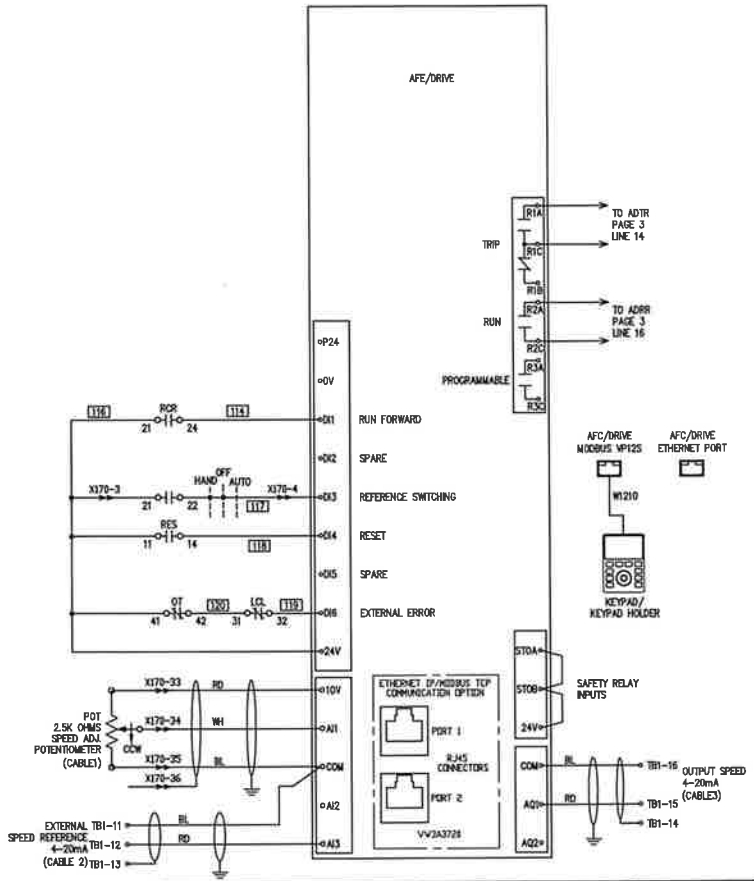
FIELD WIRING MUST BE COPPER CONDUCTORS ONLY AND BE RATED FOR A MINIMUM OF 75 DEGREES CELSIUS.



ATV680/980 FACTORY CONFIGURATION- VARIATIONS FROM DEFAULT						
MENU	TAB	SUBMENU	DESCRIPTION	SETTING	CODE	ADJ
1	S. START	----------	2/3 WIRE CONTROL	2C	TCC	2C
1	S. START	----------	BASIC FREQUENCY	60HZ NEMA	BFR	60
1	S. START	----------	MAX FREQUENCY	60	TFR	60
1	S. START	----------	LOW SPEED	3	LSP	3
1	S. START	----------	ACCELERATION	10	ACC	10
1	S. START	----------	DECELERATION	10	DEC	10
5.2	----------	SWITCHING FREQUENCY	SWITCHING FREQUENCY	2.5	SFR	2.5
5.5	----------	----------	REF. FREQ 1 CONFIG	AI3	FR1	AI3
5.5	----------	----------	FREQ SWITCH ASSIGN	DI3	RFC	DI3
5.5	----------	----------	2-WIRE TYPE	LEVEL	TCT	LEL
5.5	----------	----------	REF. FREQ 2 CONFIG	AI1	FR2	AI1
5.5	----------	CONTROL MODE	MIXED MODE CONFIG	CONTROL MODE 1/O PROFILE	CHCF	IO
5.5	----------	COMMAND SWITCHING	COMMAND SWITCHING	DI3	CCS	DI3
5.5	----------	CMD CHANNEL 1	CMD CHANNEL 1	TERMINAL	CD1	TER
5.5	----------	CMD CHANNEL 2	CMD CHANNEL 2	TERMINAL	CD2	TER
5.11	AI/AQ	AI3 CONFIGURATION	AI3 TYPE	CURRENT	AI3T	0A
5.11	AI/AQ	AI3 CONFIGURATION	AI3 MIN VALUE	4	CRL3	4
5.11	AI/AQ	AQ1 CONFIGURATION	AQ1 ASSIGNMENT	MOTOR FREQUENCY	AO1	OFR
5.11	AI/AQ	AQ1 CONFIGURATION	AQ1 MIN OUTPUT	4	AOL1	4
5.11	RELAY	R1 CONFIGURATION	R1 ASSIGNMENT	OPERATING STATE	R1	FLT
5.11	RELAY	R2 CONFIGURATION	R2 ASSIGNMENT	DRIVE RUNNING	R2	RUN
5.12	----------	CATCH ON THE FLY	CATCH ON THE FLY	YES	FLR	YES
5.12	----------	FAULT (TRIP) RESET	FAULT (TRIP) RESET	DI4	RSF	DI4
5.12	----------	EXTERNAL ERROR	EXTERNAL ERROR	DI6	ETF	DI6

TABLE FOR POWER WIRING		
POWER WIRING	WIRES/PHASE	EQUIPMENT GROUND
WIRE, 70mm, YELLOW	1	WIRE, 1 AWG, GRN/YEL

UNLESS OTHERWISE NOTED

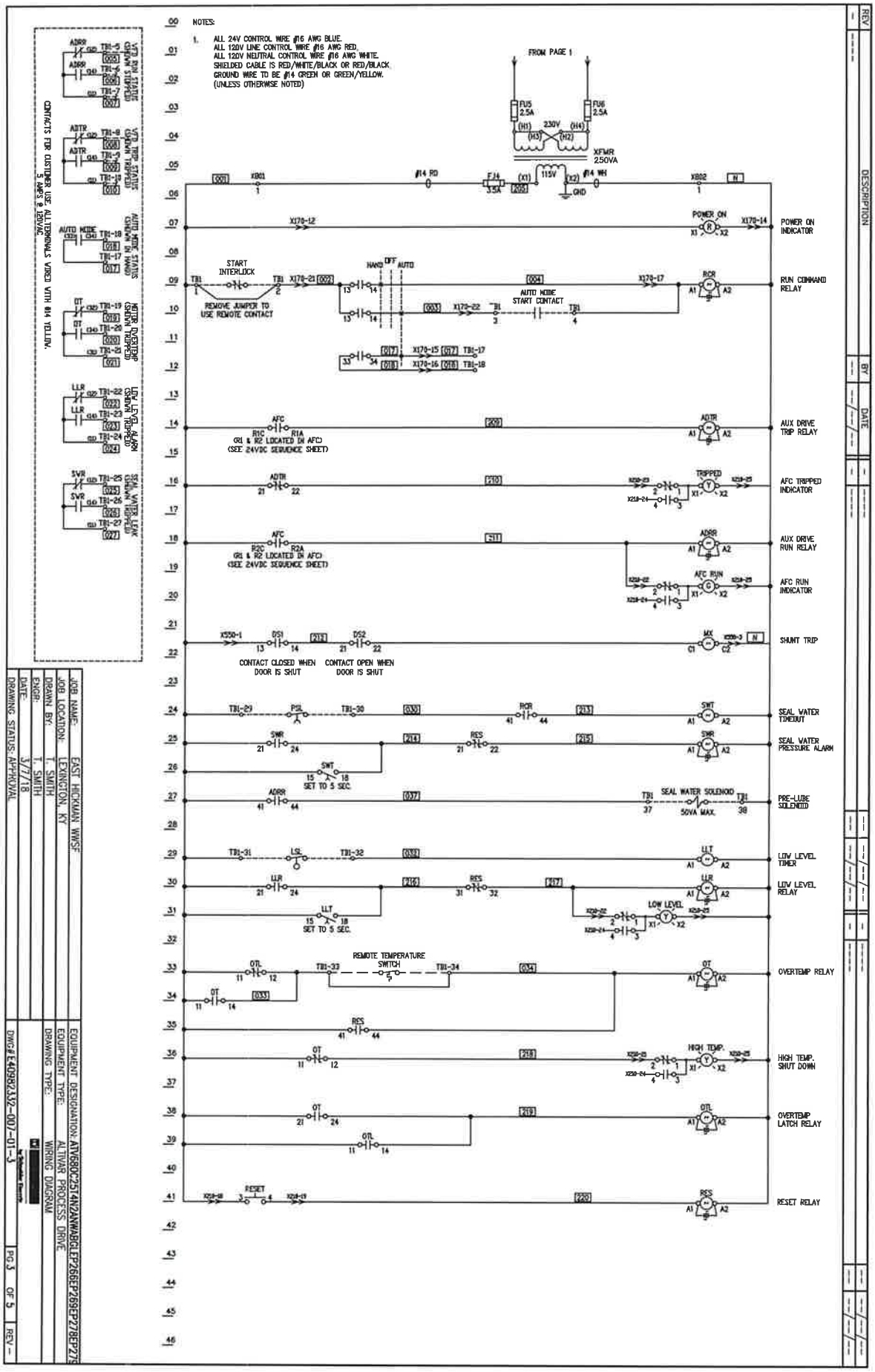


NOTES:

1. ALL 24V CONTROL WIRE #16 AWG BLUE.
   ALL 120V LINE CONTROL WIRE #16 AWG RED.
   ALL 120V NEUTRAL CONTROL WIRE #16 AWG WHITE.
   SHIELDED CABLE IS RED/WHITE/BLACK OR RED/BLACK.
   GROUND WIRE TO BE #14 GREEN OR GREEN/YELLOW.
   (UNLESS OTHERWISE NOTED)

JOB NAME:	EAST HICKMAN WWSF	EQUIPMENT DESIGNATION:	ATV680C25T4N2ANWABGLEP266EP269EP278EP279
JOB LOCATION:	LEXINGTON, KY	EQUIPMENT TYPE:	ALTIVAR PROCESS DRIVE
DRAWN BY:	T. SMITH	DRAWING TYPE:	WIRING DIAGRAM
ENGR:	T. SMITH		
DATE:	3/7/18		
DRAWING STATUS:	APPROVAL	DWG#	E40982332-007-01-2

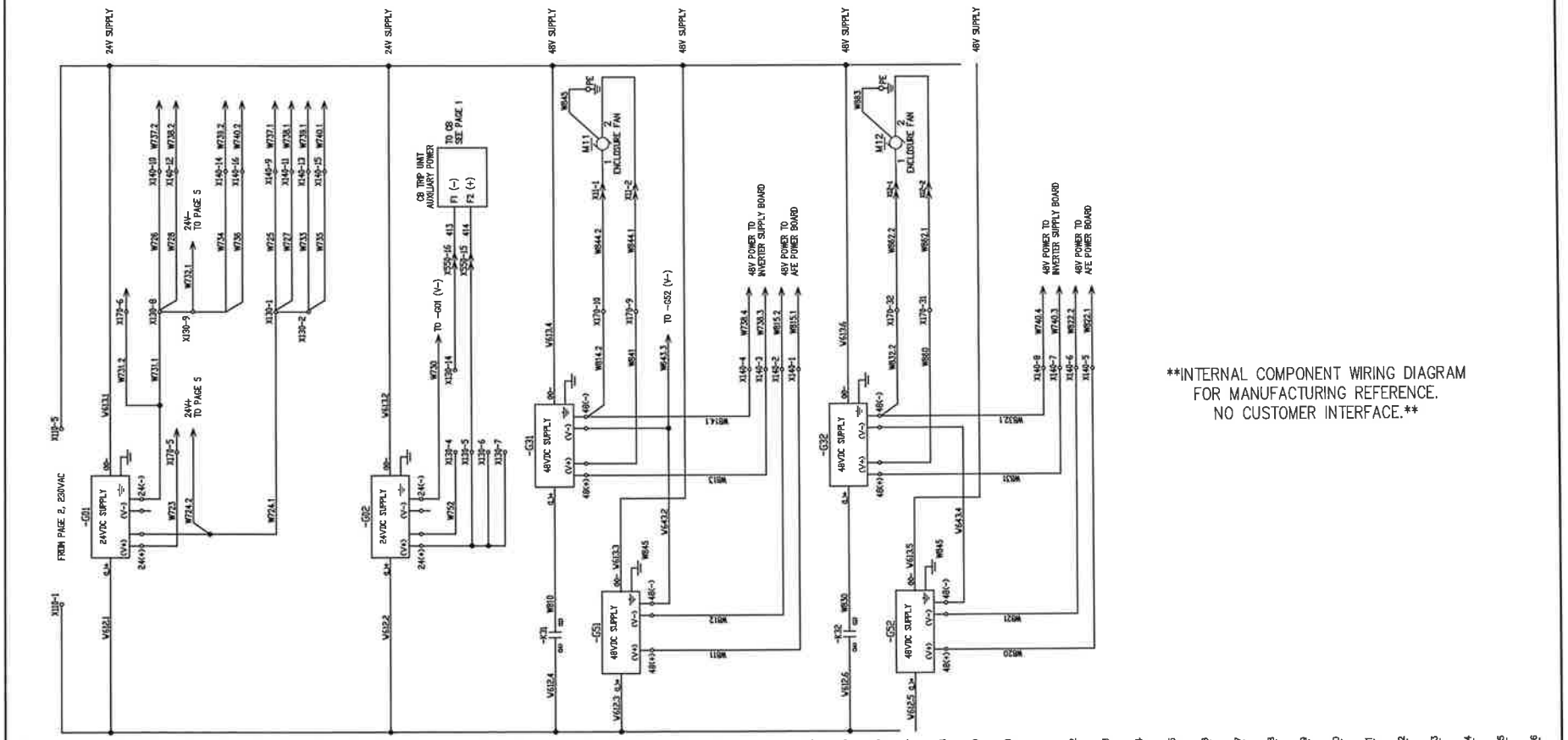
PG 2 OF 5 REV --



JOB NAME:	EAST HICKMAN WWSF
JOB LOCATION:	LEXINGTON, KY
DRAWN BY:	T. SMITH
ENGR:	T. SMITH
DATE:	3/7/18
DRAWING STATUS: APPROVAL	
EQUIPMENT DESIGNATION:	ATV680C25T4N2ANWABCLEP266EP269EP278EP279
EQUIPMENT TYPE:	ALTIVAR PROCESS DRIVE
DRAWING TYPE:	WIRING DIAGRAM
DWG#	E40998X32-007-01-3
PG	3 OF 5
REV	-

REV	DESCRIPTION	BY	DATE
-	----	---	--/--/--

REV	DESCRIPTION	BY	DATE
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**INTERNAL COMPONENT WIRING DIAGRAM
FOR MANUFACTURING REFERENCE.
NO CUSTOMER INTERFACE.**

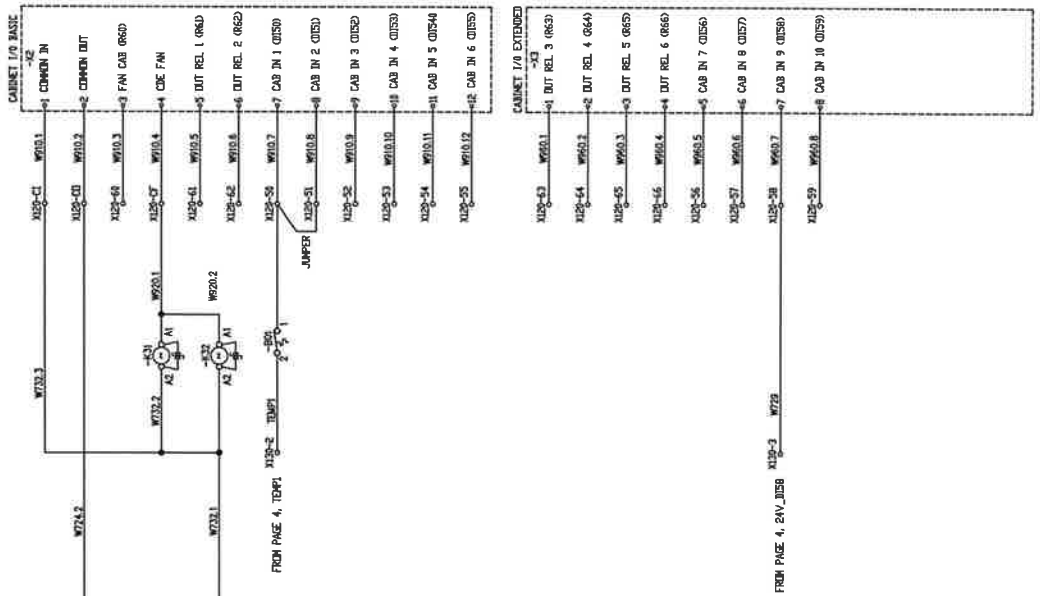
NOTES:

1. ALL 24V CONTROL WIRE #18 AWG BLUE.
   ALL 120V LINE CONTROL WIRE #18 AWG RED.
   ALL 120V NEUTRAL CONTROL WIRE #16 AWG WHITE.
   SHIELDED CABLE IS RED/WHITE/BLACK OR RED/BLACK.
   GROUND WIRE TO BE #14 GREEN OR GREEN/YELLOW.
   (UNLESS OTHERWISE NOTED)

JOB NAME:	EAST HICKMAN WWSF
JOB LOCATION:	LEXINGTON, KY
DRAWN BY:	T. SMITH
ENGR:	T. SMITH
DATE:	3/7/18
DRAWING STATUS:	APPROVAL

EQUIPMENT DESIGNATION:	ATV680C25T4N2ANWABGLEP266EP269EP278EP279
EQUIPMENT TYPE:	ALTIVAR PROCESS DRIVE
DRAWING TYPE:	WIRING DIAGRAM
DWG#	E40982332-007-01-14

REV	DESCRIPTION	BY	DATE
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**INTERNAL COMPONENT WIRING DIAGRAM
FOR MANUFACTURING REFERENCE.
SHOWN FOR REFERENCE.**

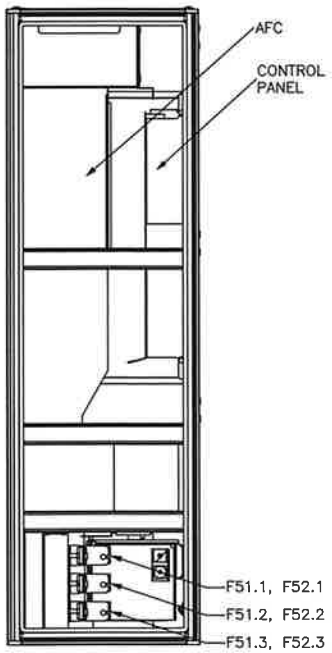
NOTES:

1. ALL 24V CONTROL WIRE #18 AWG BLUE.
ALL 120V LINE CONTROL WIRE #18 AWG RED.
ALL 120V NEUTRAL CONTROL WIRE #18 AWG WHITE.
SHIELDED CABLE IS RED/WHITE/BLACK OR RED/BLACK.
GROUND WIRE TO BE #14 GREEN OR GREEN/YELLOW.
(UNLESS OTHERWISE NOTED)

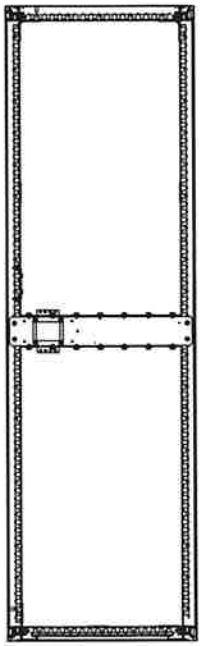
JOB NAME:	EAST HICKMAN WWSF
JOB LOCATION:	LEXINGTON, KY
DRAWN BY:	T. SMITH
ENGR:	T. SMITH
DATE:	3/7/18
DRAWING STATUS:	APPROVAL

EQUIPMENT DESIGNATION:	ATV680C25T4N2ANWABGLEP266EP269EP278EP279
EQUIPMENT TYPE:	ALTIVAR PROCESS DRIVE
DRAWING TYPE:	WIRING DIAGRAM
DWG#	E40982332-007-01-5

REV	DESCRIPTION	BY	DATE
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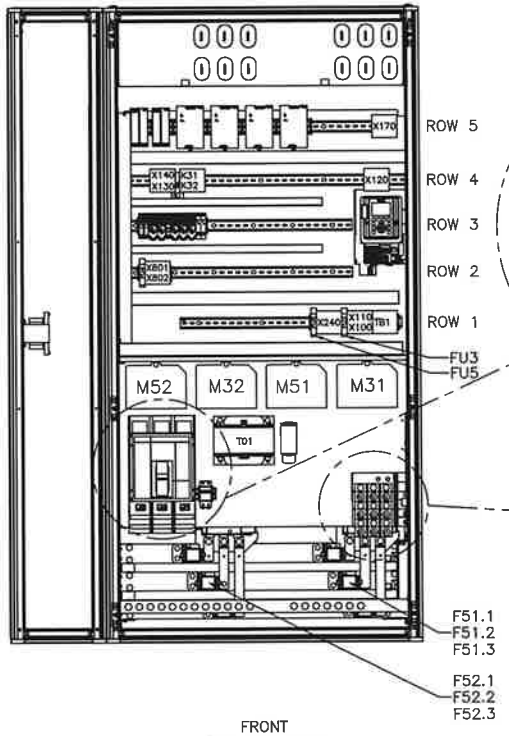


LEFT SIDE
INTERNAL VIEW

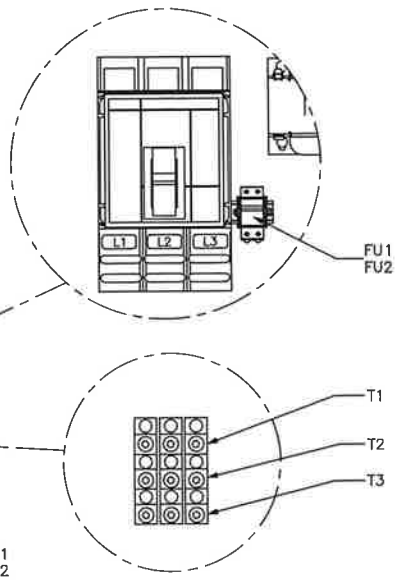


SECTION
B-B

COMPONENT DETAIL SEE
PAGE 2,3



FRONT
INTERNAL VIEW

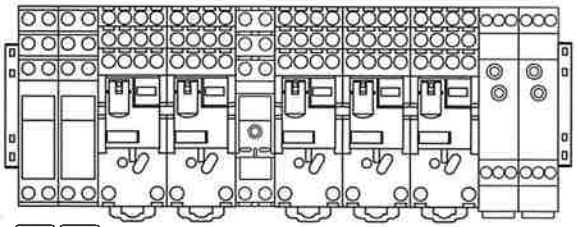


ENLARGED VIEW
CUSTOMER MOTOR CONNECTIONS

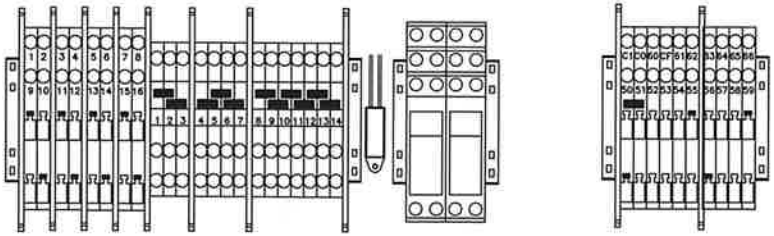
JOB NAME:	EAST HICKMAN WWSF	EQUIPMENT DESIGNATION:	ATV680C25T4N2ANWABGLEP266EP269EP278EP279
JOB LOCATION:	LEXINGTON, KY	EQUIPMENT TYPE:	ALTIVAR PROCESS DRIVE
DRAWN BY:	T. SMITH	DRAWING TYPE:	GENERAL ARRANGEMENT
ENGR:	T. SMITH		
DATE:	3/7/18		
DRAWING STATUS:	APPROVAL	DWG#	R40982332-007-01-1

REV	DESCRIPTION	BY	DATE
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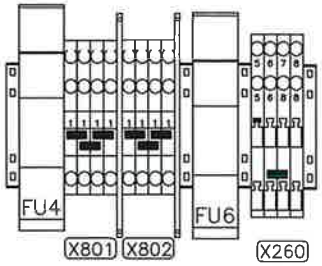
ROW 3



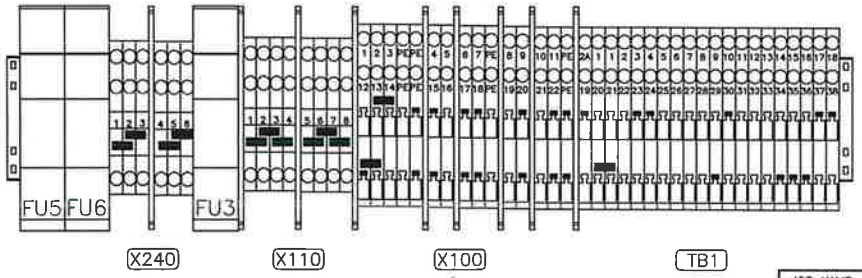
ROW 4



ROW 2



ROW 1



TB1 CONNECTOR LAYOUT

FACTORY JUMPERS (#16 RED)

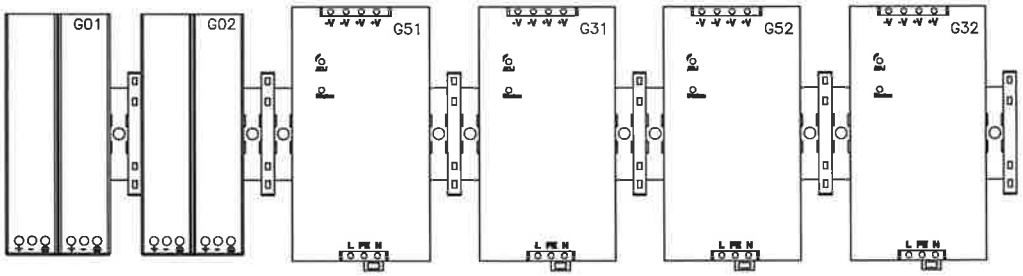
5 PIN PLUG					10 PIN PLUG					7 PIN PLUG					6 PIN PLUG					8 PIN PLUG					4 PIN PLUG				
2A	1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
						(NC)	(NO)	(C)		(NC)	(NO)	(C)																											
		CUSTOMER REMOTE START LOCKOUT (DRY CONTACT – N.C.)				AFC RUN STATUS (SHOWN NOT RUNNING)				AFC TRIP STATUS (SHOWN TRIPPED)		EXTERNAL SPEED REFERENCE 4-20 MA (INPUT)				SPEED FEEDBACK 4-20 MA (OUTPUT)				AUTO MODE STATUS																			
																				MOTOR OVER TEMP (SHOWN TRIPPED)			LOW LEVEL ALARM (SHOWN TRIPPED)			SEAL WATER LEAK (SHOWN TRIPPED)				SEAL WATER PRESSURE FEEDBACK			LOW LEVEL SWITCH FEEDBACK			MOTOR TEMPERATURE SWITCH				SEAL WATER SOLENOID 50VA MAX		

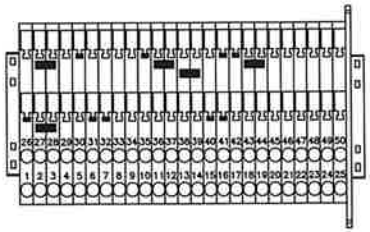
TB1

JOB NAME:	EAST HICKMAN WWSF	EQUIPMENT DESIGNATION:	ATV680C25T4N2ANWABGLEP266EP269EP278EP279
JOB LOCATION:	LEXINGTON, KY	EQUIPMENT TYPE:	ALTIVAR PROCESS DRIVE
DRAWN BY:	T. SMITH	DRAWING TYPE:	GENERAL ARRANGEMENT
ENGR:	T. SMITH		
DATE:	3/7/18		
DRAWING STATUS:	APPROVAL	DWG#	R40982332-007-01-2

REV	DESCRIPTION	BY	DATE
–	-----	--	--/--/--

ROW 5





X170

X170 CONNECTOR LAYOUT

26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
5 PIN PLUG					2 PIN		8 PIN PLUG								10 PIN PLUG									
4 PIN PLUG				2 PIN		2 PIN		2 PIN		6 PIN PLUG					9 PIN PLUG									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

JOB NAME:	EAST HICKMAN WWSF	EQUIPMENT DESIGNATION:	ATV680C25T4N2ANWABGLEP266EP269EP278EP279
JOB LOCATION:	LEXINGTON, KY	EQUIPMENT TYPE:	ALTIVAR PROCESS DRIVE
DRAWN BY:	T. SMITH	DRAWING TYPE:	GENERAL ARRANGEMENT
ENGR:	T. SMITH		
DATE:	3/7/18		
DRAWING STATUS:	APPROVAL	DWG#	R40982332-007-01-3

Q2C Number: 40982332	Quote Number: 1	Revision Number: 0
Project Name: East Hickman Wet Weather Storage T		Quote Name:

Item No.	Qty.	Catalog Number / Details
008-00	4	**Designation:** 75HP ATV660 ATV660D75T4N2AAWABGKLEP260EP263EP+ Altivar 660 ATV660D75T4N2AAWABGKLEP260EP263EP266EP278EP279-SPL Designation: 75HP ATV660 Main circuit breaker disconnect 100k AIC rated Selected for 460 Vac 3 phase motor 100 Horsepower Sized for Normal duty. Drive controller rated for 145 Max Output Amps Type 12 Enclosure UL508A Label RAL7035 (Gray) Power Circuit W: Drive combination package Control options: Hand-Off-Auto selector switch Speed Potentiometer Pilot light options: Power on pilot light (red) Run PTT pilot light (green) Trip PTT pilot light (yellow) Auxiliary contacts: 1 NO/NC run contact 1 NO/NC trip contact Ethernet IP Communications Card A09 - 5% Line Impedance EP260- Mount and wire customer supplied pump protection relay or Mini Cas compatible. EP263 - Provide pilot alarms and aux contacts for light moisture and pump over temperature from pump protection relay / meter EP266- Basin Low Level Alarm EP278- Motor over temperature logic input EP279- Motor Over Temperature Logic input with Pilot Light K14 - Additional 150VA control power This device contains selected features that require factory engineered configurations. Standard published lead times no longer apply. Enclosure dimensions are subject to change. Revision - 1/26/2018 - (20180126/20180126) 1/31/2018 1:41:58 PM Custom engineered features as identified by TAG number T100. Customer Supplied ABS Temperature/Leakage Relay CA462

SQUARE D
by Schneider Electric

Job Name: EAST HICKMAN WWSF
Job Location: LEXINGTON, KY

Square D Quotation #: 40982332
Quotation Revision #:
Sales Contact: SCOTT RICE
Sales Contact Location: LEXINGTON FO

Purchaser: EUBANKS ELECTRICAL SUP INC
Purchaser PO #: 100810

Customer:
Customer PO #:

User:
User Location:

Architect:
Cons. Engineer:

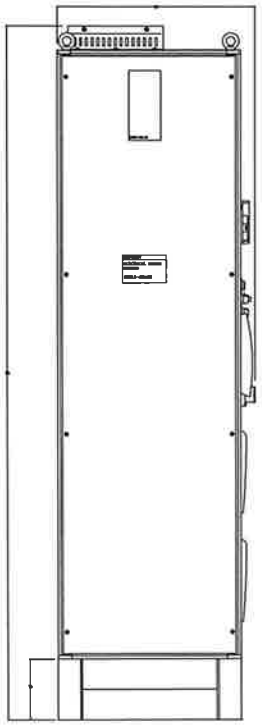
Drawing Status: APPROVAL

TABLE OF CONTENTS

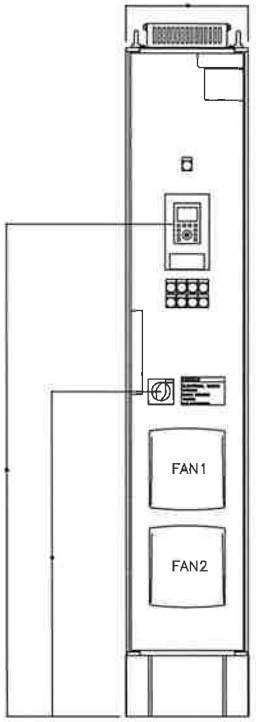
SQUARE D FACTORY ORDER NUMBER: 40982332-008

Equipment Designation	Equipment Type	Drawing Type	Drawing Number	Page	Revision Level
ATV660D75T4N2AAWABGK L-SPL	ALTIVAR PROCESS DRIVE	ELEVATION	F40982332-008-01	1	-
		ELEMENTARY	E40982332-008-01	1	-
			E40982332-008-01	2	-
		LAYOUT	R40982332-008-01	1	-
			R40982332-008-01	2	-

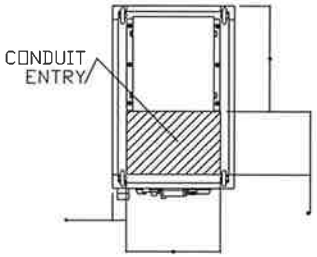
REV	DESCRIPTION	BY	DATE
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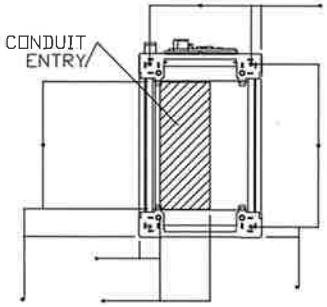
LEFT VIEW



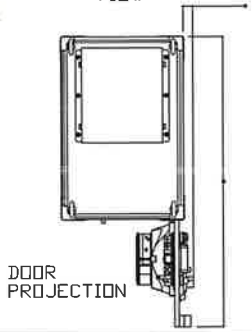
FRONT VIEW



TOP VIEW

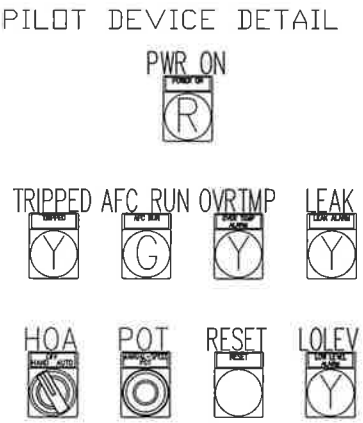


BOTTOM VIEW MOUNTING LOCATIONS



DOOR PROJECTION

PILOT DEVICE DETAIL



NOTES:

⚠ REFER TO CONTROLLER NAMEPLATE TO COMPLETE P/N.

ENCLOSURE OUTLINE & GENERAL ARRANGEMENT FOR CONTROLLER P/N

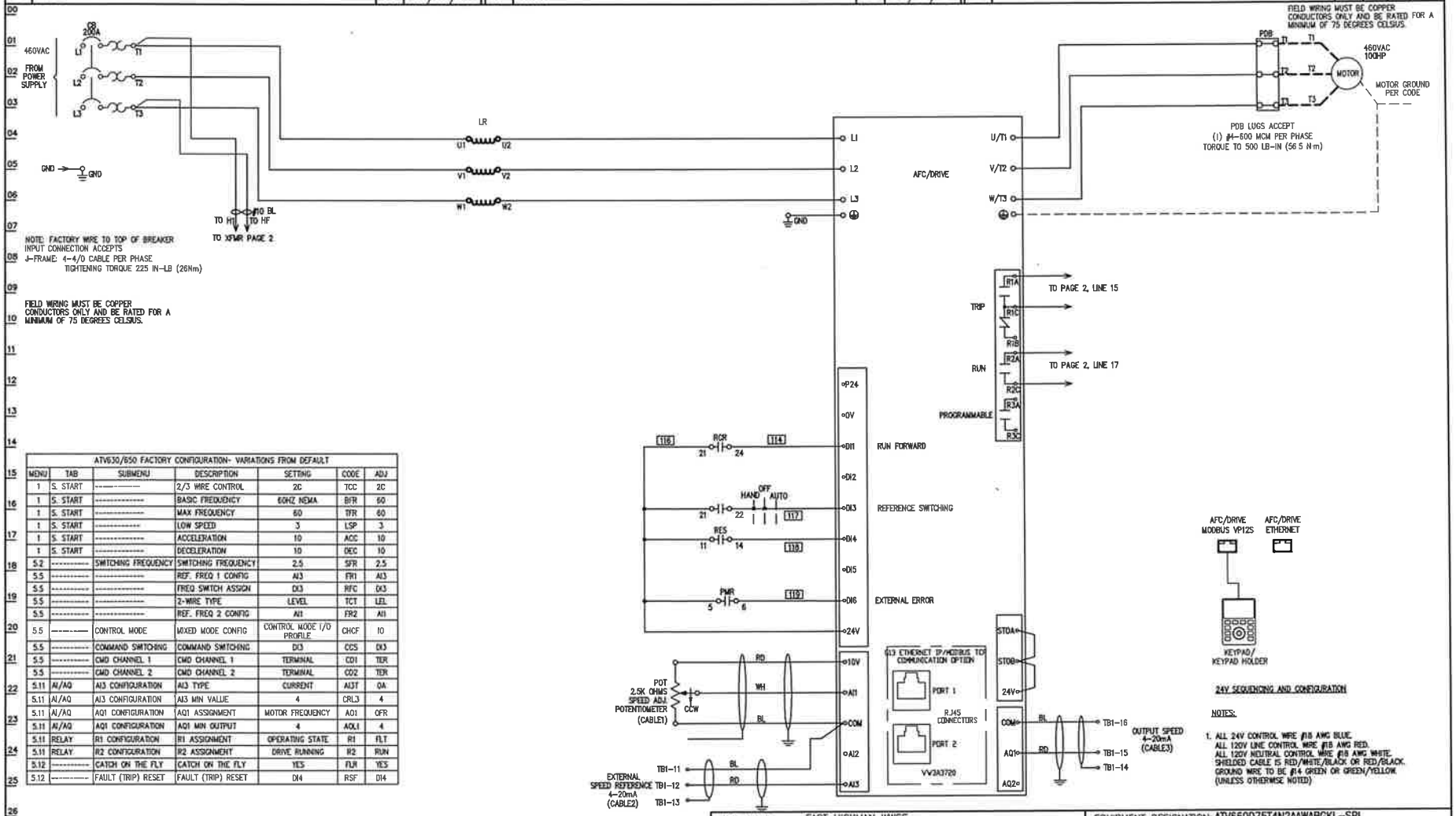
⚠ ATV660 D75 T4 N A A W

MAX FLA	KILOWATTS/HP	VOLTAGE/PH	DUTY TYPE	ENCLOSURE TYPE	HARMONIC MITIGATION	POWER CIRCUIT TYPE
145 AMPS	75KW/100HP	460V/3 PH	NORMAL	TYPE 12	5% REACTOR	WO/BYPASS

THIS ASSEMBLY MUST MEET UNDERWRITERS LABORATORIES STANDARD UL 508A.

JOB NAME:	EAST HICKMAN WWSF	EQUIPMENT DESIGNATION:	ATV660D75T4N2AAWABGKL-SPL
JOB LOCATION:	LEXINGTON, KY	EQUIPMENT TYPE:	ALTIVAR PROCESS DRIVE
DRAWN BY:	T. SMITH	DRAWING TYPE:	ELEVATION
ENGR:	T. SMITH		
DATE:	3/7/18		
DRAWING STATUS:	APPROVAL	DWG#	F40982332-008-01-1

REV	DESCRIPTION	BY	DATE
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ATV630/650 FACTORY CONFIGURATION- VARIATIONS FROM DEFAULT

MENU	TAB	SUBMENU	DESCRIPTION	SETTING	CODE	ADJ
1	S. START	----------	2/3 WIRE CONTROL	2C	TCC	2C
1	S. START	----------	BASIC FREQUENCY	60HZ NEMA	BFR	60
1	S. START	----------	MAX FREQUENCY	60	TFR	60
1	S. START	----------	LOW SPEED	3	LSP	3
1	S. START	----------	ACCELERATION	10	ACC	10
1	S. START	----------	DECELERATION	10	DEC	10
5.2	----------	SWITCHING FREQUENCY	SWITCHING FREQUENCY	2.5	SFR	2.5
5.5	----------	----------	REF. FREQ 1 CONFIG	AI3	FR1	AI3
5.5	----------	----------	FREQ SWITCH ASSIGN	DI3	RFC	DI3
5.5	----------	----------	2-WIRE TYPE	LEVEL	TCT	LEL
5.5	----------	----------	REF. FREQ 2 CONFIG	AII	FR2	AII
5.5	----------	CONTROL MODE	MIXED MODE CONFIG	CONTROL MODE I/O PROFILE	CHCF	IO
5.5	----------	COMMAND SWITCHING	COMMAND SWITCHING	DI3	CCS	DI3
5.5	----------	CMD CHANNEL 1	CMD CHANNEL 1	TERMINAL	CD1	TER
5.5	----------	CMD CHANNEL 2	CMD CHANNEL 2	TERMINAL	CD2	TER
5.11	AI/AQ	AI3 CONFIGURATION	AI3 TYPE	CURRENT	AI3T	0A
5.11	AI/AQ	AI3 CONFIGURATION	AI3 MIN VALUE	4	CRL3	4
5.11	AI/AQ	AQ1 CONFIGURATION	AQ1 ASSIGNMENT	MOTOR FREQUENCY	AO1	OFR
5.11	AI/AQ	AQ1 CONFIGURATION	AQ1 MIN OUTPUT	4	AOL1	4
5.11	RELAY	R1 CONFIGURATION	R1 ASSIGNMENT	OPERATING STATE	R1	FLT
5.11	RELAY	R2 CONFIGURATION	R2 ASSIGNMENT	DRIVE RUNNING	R2	RUN
5.12	----------	CATCH ON THE FLY	CATCH ON THE FLY	YES	FUN	YES
5.12	----------	FAULT (TRIP) RESET	FAULT (TRIP) RESET	DI4	RSF	DI4

TABLE FOR POWER WIRING

POWER WIRING	WIRES/PHASE	EQUIPMENT GROUND
WIRE, 2/0 AWG, BLACK	1	WIRE, 4 AWG

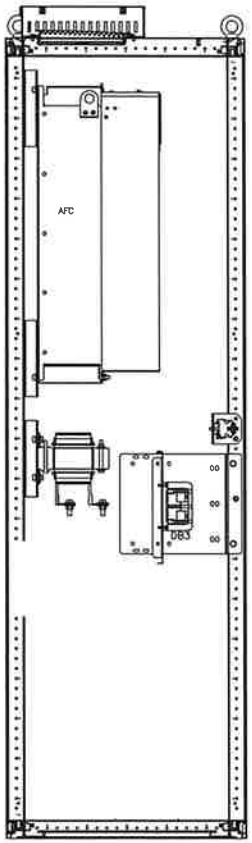
UNLESS OTHERWISE NOTED

JOB NAME:	EAST HICKMAN WWSF
JOB LOCATION:	LEXINGTON, KY
DRAWN BY:	T. SMITH
ENGR:	T. SMITH
DATE:	3/7/18
DRAWING STATUS:	APPROVAL

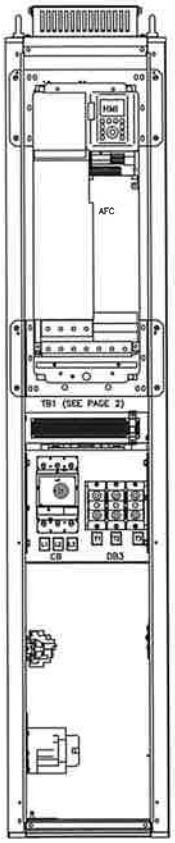
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EQUIPMENT TYPE:	ALTIVAR PROCESS DRIVE
DRAWING TYPE:	WIRING DIAGRAM
DWG#	E40982332-008-01-1
PG	1 OF 2
REV	–

JOB NAME: EAST HICKMAN WWSF
JOB LOCATION: LEXINGTON, KY
DRAWN BY: T. SMITH
ENGR: T. SMITH
DATE: 3/7/18
DRAWING STATUS: APPROVAL
EQUIPMENT DESIGNATION: ATV660D75T4N2AAWABGKL-SPL
EQUIPMENT TYPE: ALTIVAR PROCESS DRIVE
DRAWING TYPE: WIRING DIAGRAM
SQUARE D
DWG# E409923332-008-01-1
PG 1 OF 2
REV -
DESCRIPTION
DATE
BY
REV
NOTES:
1. ALL 24V CONTROL WIRE #18 AWG BLUE
ALL 120V LINE CONTROL WIRE #16 AWG RED
ALL 120V NEUTRAL CONTROL WIRE #16 AWG WHITE
SHIELDED CABLE IS RED/WHITE/BLACK OR RED/BLACK.
GROUND WIRE TO BE #4 GREEN OR GREEN/YELLOW.
(UNLESS OTHERWISE NOTED)
CONTACTS FOR CUSTOMER USE ALL TERMINALS WIRED WITH #14 YELLOW.
150VA OPTION
POWER ON
FAN 1
FAN 2
RESET RELAY
LOW LEVEL TIMER
AFC TRIPPED
MOTOR OVERTEMP RELAY
LEAK RELAY
AFC RUN
AUX DRIVE RUN RELAY
AUX DRIVE TRIP RELAY
RUN COMMAND RELAY
HIGH TEMP.
LEAK ALARM
LOW LEVEL RELAY
THERM. SW.
LEAK SENSOR
HIGH TEMP
LEAKAGE
CUSTOMER FUSE
150VA
REMOVE JUMPER IF USING INTERLOCK
START INTERLOCK
AUTO MODE START CONTACT
HAND
OFF
AUTO
FROM PAGE 1
TO PAGE 1
LINE 19
SET TO 5 SEC.
(SEE 24VDC SEQUENCE SHEET)
(SEE 24VDC SEQUENCE SHEET)
LEAKAGE ALARM (SHOWN TRIPPED)
LOW LEVEL ALARM (SHOWN TRIPPED)
MOTOR OVERTEMP (SHOWN TRIPPED)
AUTO MODE STATUS (SHOWN IN HAND)
VFD TRIP STATUS (SHOWN TRIPPED)
VFD RUN STATUS (SHOWN STOPPED)

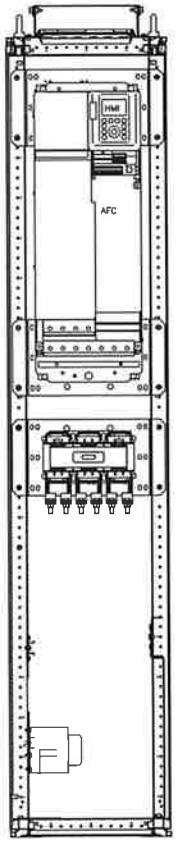
REV	DESCRIPTION	BY	DATE
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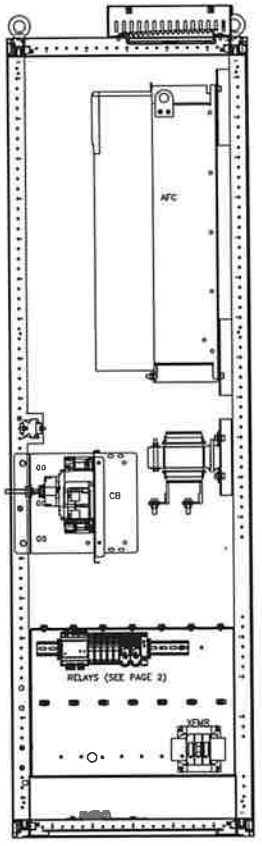
LEFT VIEW



FRONT VIEW



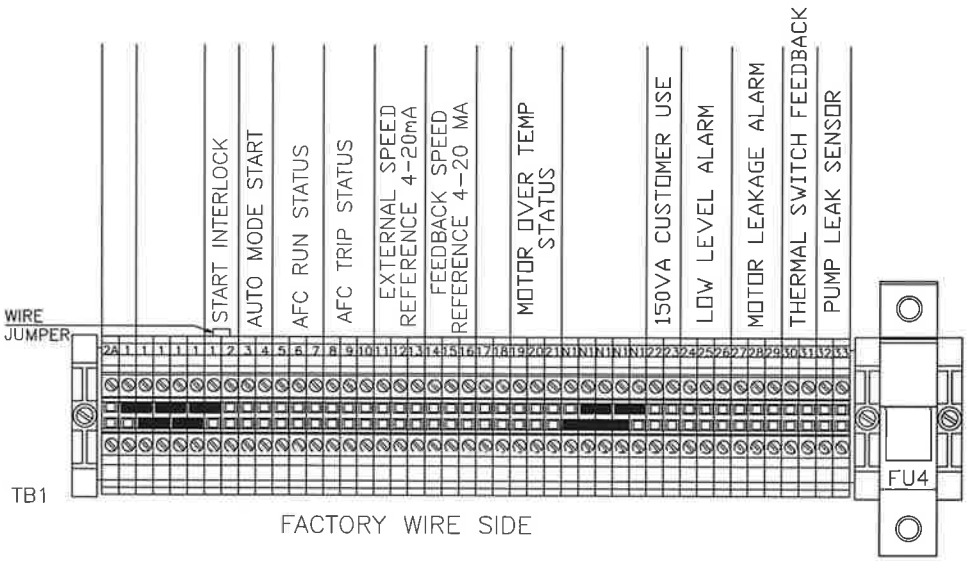
FRONT VIEW (BACK PANEL ONLY)



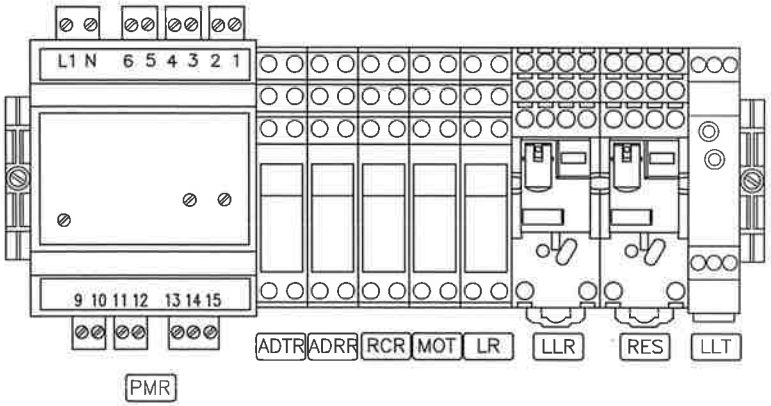
RIGHT VIEW

JOB NAME:	EAST HICKMAN WWSF	EQUIPMENT DESIGNATION:	ATV660D75T4N2AAWABGKL-SPL
JOB LOCATION:	LEXINGTON, KY	EQUIPMENT TYPE:	ALTIVAR PROCESS DRIVE
DRAWN BY:	T. SMITH	DRAWING TYPE:	GENERAL ARRANGEMENT
ENGR:	T. SMITH		SQUARE D by Schneider Electric
DATE:	3/7/18	DWG#	R40982332-008-01-1
DRAWING STATUS:	APPROVAL		PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE
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FACTORY WIRE SIDE

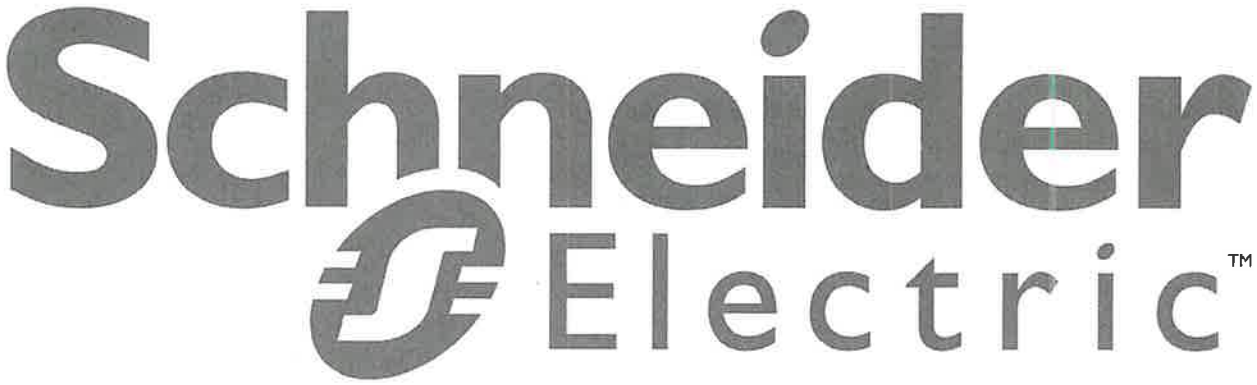


JOB NAME:	EAST HICKMAN WWSF	EQUIPMENT DESIGNATION:	ATV660D75T4N2AAWABGKL-SPL
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ENGR:	T. SMITH		SQUARE D
DATE:	3/7/18		
DRAWING STATUS:	APPROVAL	DWG#	R40982332-008-01-2 PG 2 OF 2 REV –

Q2C Number: 40982332 **Quote Number:** 1 **Revision Number:** 0

Project Name: East Hickman Wet Weather Storage T **Quote Name:**

Item No.	Qty.	Catalog Number / Details
010-00	10	**Designation**: Spare Fuses 2543020700 DRIVE PART 2543020700 DRIVE PART
013-00	10	**Designation:** Spare LED Lamp Red 2550100003 MINI_BAYONET_LED_120V_RED 2550100003 MINI_BAYONET_LED_120V_RED
014-00	10	**Designation:** Spare LED Lamp Yel 2550100004 MINI BAYONET LED 120V YEL 2550100004 MINI BAYONET LED 120V YEL
015-00	10	**Designation:** Spare LED Lamp Grn 2550100005 MINI_BAYONET_LED_120V_GRN_ 2550100005 MINI_BAYONET_LED_120V_GRN_



LITERATURE

Life Is On | Schneider Electric

Altivar AC Drives

Advanced energy management and performance in motor control



schneider-electric.us/drives



Schneider Electric

Segment focused. Customer centric.
Schneider Electric can help you meet the challenges of the trends impacting our world. With a long history of industry-leading motor control solutions and a global footprint, we offer the right choices for motor controls from simple local applications to large global enterprise solutions.

5 Key trends shaping our world

1 Urbanization
Greater demand for water and waste water solutions

2 Industrialization
Greater need for connectivity and automation

3 Digitization
Big data capability provides new avenues for efficiencies

4 Scarcity of resources
Demand for efficient use of resources

5 Climate change
Demand for sustainable development

INNOVATIVE	SUPPORTIVE	EXPERIENCED
359	1,000+	1.5M
active patents	drives application specialists annually	drives sold annually

The Altivar Drives family: The most advanced and user-friendly variable-speed AC Drives and Drive Systems offering on the market.

Featuring proprietary motor control algorithms to achieve optimal motor performance and complete scalability to match your application speed, size, and protection requirements, the complete line of Altivar™ products and solutions delivers the flexibility and performance to:

- Optimize a broad range of utility and industrial applications including pumps, fans, compressors, material handling, hoisting, packaging, and material working.
- Reduce your energy costs by using proprietary energy saving technologies available only from Schneider Electric.
- Improve your uptime by simplifying installation, commissioning, and maintenance by providing advanced diagnostics, industry-leading voltage ride-through capability, and seismic-qualified products and solutions.

Improve your business operations with Altivar AC Drives

Schneider Electric offers a portfolio of AC Drives designed to provide value in your business operations.

Machine builders



- Space savings
- Certified safety connectability
- Complementary product offers
- Automation network integration
- Process performance improvement

Building managers



- Energy savings
- Energy management
- Green building compliance
- Building network integration
- Ready to install enclosed offer

Industrial process owners



- Energy management
- Process optimization
- Predictive maintenance
- Remote network access
- Packaged drive systems

Utility site operators



- Process monitoring
- Energy management
- Sitewide network control
- Coordinated drive systems
- Chemical and air particle pollution resistance

For more than 30 years, Schneider Electric has supplied AC Drives to energy-intensive industries across the world. We are a global leading supplier of reliable, high-performance AC Drives, built for a wide range of applications across diverse and demanding segments.

Altivar AC Drives for machines

Designed to assist OEMs, panel builders, and system integrators build tailored, high-performance equipment.

- Material handling
- Material working equipment
- Material forming and embossing
- Gappers, palletizing
- Packaging machinery
- Metal process machinery
- Hoisting
- Extruding
- PM motor control






	Altivar 12	Altivar 312	Altivar 32	Altivar 71
Voltage	115 208/230	208/230 480 600	208/230 480	208/230 480 600
HP	¼ – 1 ¼ – 5	¼ – 20 ½ – 20 1 – 20	¼ – 3 ½ – 20	½ – 100 1 – 700 1 – 700
kW	0.18 – 0.75 0.18 – 4	0.18 – 15 0.37 – 15 0.75 – 15	0.18 – 0.75 0.37 – 15	0.75 – 75 0.75 – 500 0.75 – 500
Enclosure	IP20	IP20, UL Type 1 with kit	IP20	IP20, UL Type 1 with kit
Performance	compact size	general purpose	programmable logic safety inputs	high torque capacity encoder options

Altivar AC Drives for buildings

Providing economical choices for OEMs and energy management capabilities for building managers.

- Ventilation fans
- Air conditioning fans
- Recovery wheel control
- Heating and cooling pumps
- Cooling tower pumps and fans
- Building water pressure pumps






	Altivar 212	Altivar 61	S-Flex	ATV660
Voltage	208/230 480	208/230 480 600	208/230 480	208/230 480
HP	1 – 40 1 – 100	1 – 125 1 – 900 1 – 800	1 – 40 1 – 100	1 – 40 1 – 1100
kW	0.75 – 30 0.75 – 75	0.75 – 90 0.75 – 630 0.75 – 630		
Enclosure	IP 20, UL Type 1 with kit, UL Type 12	IP 20, UL Type 1 with kit, UL Type 12	UL Type 1	UL Type 1,12, 3R (1 – 125hp)
Communication	Built in: modbus, N2 BACnet™ & P1 Lonworks option	Built in: modbus, Optional: N2, P1 BACnet™, & Lonworks	Built in: modbus, N2 BACnet & P1 Lonworks option	Built in: Ethernet

Altivar AC Drives for industrial utility process

Altivar process drives deliver added value services to enable business and process optimization through improved life cycle asset management and optimized energy consumption. Designed to assist OEMs, system integrators, and industrial process owners, Altivar process drives improve process performance by enabling full information and operational technology convergence.

Embedded PlantStruxure™ and Foxboro™ Evo architectures simplify system integration.

Water applications

- Booster pumps
- Lift station pumps
- Desalination pumps
- Water supply pumps
- Water suction pumps
- Progressing cavity pumps
- Influent and effluent pumps
- Secondary clean water pumps

Oil & Gas applications

- Rod pumps
- Feed pumps
- Pipeline, booster, and unloading pumps
- Water injection pumps
- Reciprocating and centrifugal compressors
- Progressing cavity pumps
- Electric submersible pumps

Mining & Metals applications

- Hoisting
- Crushers
- Extruding
- Conveyors
- Slurry pumps
- Induced draft fans
- Quenching pumps
- Dust collection fans
- Mine ventilation fans
- Hydro-transport pumps






	Altivar 630	Altivar 650*	Altivar 930*	Altivar 950*
Voltage	208/230 480	480	208/230 480	208/230 480
HP	1 – 125 1 – 250	1 – 125	1 – 125 1 – 250	1 – 125
kW	0.75 – 90 0.75 – 160	0.75 – 90	0.75 – 90 0.75 – 160	0.75 – 90
Enclosure	UL Type 1 Heatsink Kit option: 125 – 250 hp	UL Type 12	UL Type 1 Heatsink Kit option: 125 – 250 hp	UL Type 12
Application functions	>30 pump functions, fans, and simple material handling	>30 pump functions, fans, and simple material handling	Master slave, safety inputs, dynamic braking	Master slave, safety inputs, dynamic braking
Performance	Normal or heavy duty	Normal or heavy duty	High torque capacity encoder options, dual Ethernet ports	High torque capacity encoder options, dual Ethernet ports

*Available Q1 2016 *Available Q3 2016

Altivar Drive Systems for industrial process utility

Schneider Electric configurable packages and systems that deliver high performance across multiple segments.



Water

It is estimated that 15% of worldwide water use is industrial. All industries rely on the unlimited availability of water required for processes that control flow and pressure through large pumps.



Power

Market pressure and rising costs require producers to convert a larger share of fuel into sustainable kilowatt hours. Operating optimization is key to cost-effective production.



Oil & Gas

Complex operations and harsh environments put high demand on most chemical and oil and gas process equipment. Achieving high efficiency and availability is critical to increased output and improved product quality.



Mining, Minerals & Metals

Sustainable growth is a major challenge as demand exceeds supply and new deposits are in increasingly remote regions. Processes need to improve efficiency and safety while reducing environmental impact.

Benefits

- Energy savings
- Improved process reliability
- Accurate flow and pressure control
- Soft starting & stopping
- Reduced life cycle costs
- Extended equipment life

- Increased process efficiency
- Reduce emissions
- Improved heat rate
- Higher plant availability
- Improved process control
- Less energy consumption

- Helps keep costs under control
- Lower maintenance costs
- Simple and effective process control
- Operate equipment at optimum set point

- Better cost-control of energy intensive applications
- Improved heat rate
- Efficient control of large fans and pumps
- Replace older hydraulic and mechanical controls

Features

- Access to real time data
- QR codes to access support
- Innovative tools and diagnostics
- Powerful user interfaces
- Flexible communications
- Easy-to-maintain designs
- Full array of support services
- Built-in pump protection functions
- Multiple configurations and options

Altivar Drive Systems for industrial process and utility

AC drive platform packages configured, optimized, and engineered to order for your business.

Water applications

- Influent and effluent pumps
- Booster pumps
- Secondary clean water pumps
- Desalination pumps
- High-service pumps
- Water supply pumps
- Water suction pumps

Oil & Gas applications

- Rod pumps
- Feed pumps
- Electric submersible pumps
- Pipeline, booster, and unloading pumps
- Reciprocating and centrifugal compressors
- Water injection pumps
- Progressing cavity pumps

Mining & Metals

- Conveyors
- Furnace fans
- Slurry pumps
- Induced draft fans*
- Quenching pumps
- Dust collection fans
- Mine ventilation fans
- Hydro-transport pumps

Power Generation applications

- Dust collection fans
- Induced and forced-draft boiler fans
- Feed water, cooling, circulation, and condensate pumps
- Reactor recirculation pumps







	Altivar plus	Altivar outdoor	Altivar 660 compact*	Altivar 680 low harmonic*	Altivar 1260 medium voltage
Voltage	460 575	460	208/230 460	460	4,160, 3-phase
HP	460 V (VT) 125 – 2000 hp 460 V (CT) 125 – 1800 hp 575 V (VT) 125 – 2500 hp 575 V (CT) 125 – 2100 hp	460 V (VT) 20 – 350 hp 460 V (CT) 20 – 250 hp	1 – 1100	125 – 900	700 – 6,500
Enclosure	UL Type 12	UL Type 3R	UL Type 1,12, 3R (1 – 125hp)	UL Type 1, 12	UL Type 1
Performance	Variable torque or constant torque	Variable torque or constant torque (-10 to 50 °C)	Normal or heavy duty	Low harmonic drive systems with active mains rectifier to reduce the current harmonics THDi < 5 %	CT, VT synchronous or induction
Features	Populated with the Altivar 61 or Altivar 71 drive	Outdoor rating to withstand blowing dust, driving rain, and heat	Modular concept with functionality of the Altivar Process 630	System approach to managing harmonics	3-Level NPC, 24 pulse DFE, sine wave filter, HMI, Web App, UPS, PLC, MV-IGBT's

*Available Q4 2015 *Available Q1 2016

Solutions for every stage of your equipment's life cycle

Life Is On | Schneider Electric

At Schneider Electric, we take a long-term, holistic approach to determine your facility and operational needs, then develop strategies to improve the performance of your people, systems, and processes.

Our expertise enables you to cut costs, reduce energy consumption, and keep your systems up and running through routine maintenance, process enhancements, and migrations to new, state-of-the-art functionality.

Start-up and commissioning

- Expert instillation support service, comprehensive power-up, and diagnostic check on system components

Technical training

- Training offered on-site, off-site, and online for Schneider Electric™ drives products taught by professional instructors

Remote technical support

- Comprehensive online and phone support from experts trained on Schneider Electric drives products

On-site technical support

- Regular maintenance, upgrades, and conversion assistance, small application/ programming assistance, troubleshooting, and repair — even in emergencies

Preventive maintenance

- Programs to proactively detect potential system issues to help avoid costly unscheduled downtime and reduced equipment life

Industrial repair services

- Repair capabilities for more than 400,000 part numbers from more than 2,500 manufacturers at our Greensboro, NC, facility

Spare parts management

- On-site assessment to determine parts/inventory needs to ensure proper system operation and reduce downtime/costs

Migration and modernization

- Process optimization through the identification/replacement of legacy products for new, innovative technology while maximizing existing hardware for cost-effective solutions

Software renewals

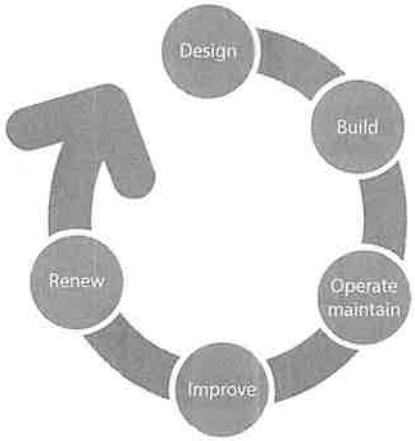
- Access to the latest software available to ensure optional functionality for your system

Extended warranty

- Protection plans tailored to your needs to reduce costs and out-of-service time

When it comes to your process equipment, we can help at each point

- Personalized assessment, system design, and consulting
- Expert instillation and new system start-up assistance
- Regular maintenance, repair, support, and troubleshooting
- Cost-effective modernization of legacy equipment
- Timely upgrades and conversion assistance to new equipment



More information

For more detailed information, including product specifications, please view our eCatalogs:
schneider-electric.dirxion.com/app.php?ReIId=6.2.3.3

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