E. All work improperly done or not done at all as required by the Mechanical Trades in this section, will be performed by the Contractor at the direction of the trade whose work is affected.

3.2 SLEEVES

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.

2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

F. Pipes Passing Through Waterproofing Membranes: Pipes passing through floor waterproofing membrane shall be installed through a 4-pound lead-flashing sleeve, or a 0.032-inch thick aluminum sleeve, each with an integral skirt or flange. Flashing sleeve shall be suitably formed, and the skirt of flange shall extend not less than 8 inches from the pipe and shall set over the floor membrane in a troweled coating of bituminous cement. The flashing sleeve shall extend up the pipe a minimum of 1 inch above the floor. The annular space between the flashing sleeve and the metal-jacket-covered insulation shall be sealed. At the Contractor's option, pipes passing through floor waterproofing membrane may be installed through a cast iron sleeve with caulking recess, anchor lugs, flashing clamp device, and a pressure ring with brass bolts. Waterproofing membrane shall be clamped into space and sealant shall be placed in the caulking recess.

G. Pipes Passing Through Roof: Pipes passing through the roof shall be installed where shown on the drawings. Any penetration in roof shall be approved by the Roofing Manufacturer.

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 ESCUTCHEONS

A. Escutcheons shall be provided at all finished surfaces where exposed piping, bare or insulated, passes through floors, walls, or ceilings. Escutcheons shall be fastened securely to pipe sleeves or to extensions of sleeves without any part of sleeves being visible. Where sleeves project slightly from floors, special deep-type escutcheons shall be used.

3.5 CUTTING

A. All trades shall coordinate all openings in masonry walls with the General Contractor, and, unless otherwise indicated on the Architectural drawings, shall provide lintels for all openings required for the plumbing work (piping, wall boxes, etc.).

B. No cutting is to be done at points or in a manner that will weaken the structure and unnecessary cutting must be avoided. If in doubt, contact the engineer.

C. Pipe openings in slabs and walls shall be cut with core drill. Hammer devices will not be permitted. Edges of trenches and large openings shall be scribe cut with a masonry saw.

D. Openings in metal building walls shall be made in strict accord with building suppliers recommendations.

3.6 PATCHING AND REPAIRING

A. Patching and repairing made necessary by work performed under this division shall be included as part of the work and shall be done by skilled mechanics of the trade or trades for work cut or damaged, in strict accordance with the provisions herein before specified for work of like type to match adjacent surfaces and in a manner acceptable to the engineer.

B. Where portions of existing lawns, shrubs, paving, etc. are disturbed for installation or work of this Division, such items shall be repaired and/or replaced to the satisfaction of the engineer.

C. Where the installation or removal of piping, etc. requires or creates the penetration of fire or smoked rated walls, ceilings or floors, the space around such pipe, etc., shall be tightly filled with an approved non-combustible fire insulating material satisfactory to maintain the rating integrity of the wall, floor or ceilings affected.

D. Piping passing through floors, ceilings and walls in finished areas, unless otherwise specified, shall be fitted with chrome plated brass escutcheons of sufficient outside diameter to amply cover the sleeved openings and an inside diameter to closely fit the pipe around which it is installed.

E. Where pipes pass through exterior walls, the wall openings shall be sealed air and water tight. This shall include sealing on both sides of the wall to insure air and water does not enter or exit the wall cavity. This is especially critical on exterior walls where the wall cavity may be vented to the exterior.

END OF SECTION 22 05 17

SECTION 21 05 29 – HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Pipe and Equipment Hangers, Supports, and Associated Anchors

1.2 RELATED DOCUMENTS

A. The General and Special Conditions and all other Contract Documents (ESPECIALLY DIVISIONS 21, AND 26) are applicable to work under this section of the specifications. All the work under this section of the specifications shall be governed by any alternates and unit prices called for in the FORM OF PROPOSAL insofar as they affect this portion of the work.

B. Section 210100 – WATER BASED FIRE SUPRESSION SYSTEM

C. Section 211010 – NITROGEN GENERATING CORROSION INHIBITING SYSTEM

D. Section 210517 - SLEEVING, CUTTING, PATCHING AND REPAIRING

E. Section 210529 – HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT –

F. Section 211119 – FIRE PROTECTION SPECIALTIES

G. Section 219996 – FLOW TEST

H. Section 219997 – FIRE WATCH

I. Section 219998 – SUPPLEMENTAL INSTRUCTIONS

J. Section 219999 – MAINTENANCE AND SERVICE CONTRACT

1.3 SCOPE

A. This specification shall apply for the design and fabrication of all hangers, supports, anchors and guides. Where piping design is such that exceptions to this specification are necessary, the particular system shall be identified, and the exceptions approved by Engineer prior to installation. See drawings.

1.4 STRUCTURE

A. This section is intended to cover the structural requirements of the piping and equipment. It is not intended to imply that the building structure will support the loads imposed. The contractor shall review the structural drawings for where loads can be applied, what load can be supported and what structural reinforcing is required. Specific questions can be directed to the structural engineer.

1.5 DESIGN

A. All supports and parts shall conform to the latest requirements of the ANSI Code for Pressure Piping B31.1.0, and MSS Standard Practice SP-58, SP-69 and SP-89 except as supplemented or modified by the requirements of this specification.

B. Designs generally accepted as exemplifying good engineering practice, using stock or production parts, shall be utilized wherever possible.

C. Accurate weight balance calculations shall be made to determine the required supporting force at each hanger location and the pipe weight load at each equipment connection.

D. Pipe hangers shall be capable of supporting the pipe in all conditions of operation. They shall allow free expansion and contraction of the piping, and prevent excessive stress resulting from transferred weight being induced into the pipe or connected equipment.

E. Where possible, steel structural attachments shall be beam clamps. Other attachments shall be as scheduled.

F. All rigid hangers shall provide a means of vertical adjustment after erection.

G. Hanger rods shall be subject to tensile loading only. At hanger locations where lateral or axial movement is anticipated, suitable linkage shall be provided to permit swing.

H. Where horizontal piping movements are greater than ½ inch, or where the hanger load angularity from the vertical is greater than 4 degrees from the cold to hot position of the pipe, the hanger rod to structural attachment shall be by use of Anvil Fig. 47 and Fig. 299 or the hanger rod and structural attachments shall be offset in such manner that the rod is vertical in the hot position.

I. Hangers shall be designed so that they cannot become disengaged by movements of the supported pipe.

J. Hangers shall be spaced in accordance with ANSI B31.1.0

K. Where practical, riser piping shall be supported independently of the connected horizontal piping.

1. Pipe support attachments to the riser piping shall be riser clamp lugs. Welded attachments shall be of material comparable to that of the pipe, and designed in accordance with ANSI B31.1 codes.

L. Supports, guides and anchors shall be so designed that excessive heat will not be transmitted to the building steel. The temperature of support parts shall be based on a temperature gradient of 100 degrees F per inch distance from the outside surface of the pipe.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Anvil, B-Line, Elcen, Mason Industries, Advanced Thermal, Fee & Mason, Piping Specialties, MIRO Industries.

2.2 SHIELDS

A. Shield for Insulated Piping 2 Inches and Smaller: galvanized steel shield over insulation in 180-degree segments, minimum 12 inches long at pipe support. See schedule for thickness.

B. Shield for Insulated Piping 2 ½ Inches and Larger: Pipe covering protective saddles.

C. Shields for Insulated Cold Water Piping 2 ½ Inches and Larger: Hard block non-conducting saddles in 90-degree segments, 12-inch minimum length, block thickness same as insulation thickness.

D. Shields for Vertical Copper Pipe Risers: Sheet lead.

2.3 HANGER RODS

A. Threaded one end, threaded both ends, threaded continuously.

2.4 INSERTS

A. Inserts: Malleable iron case or galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.5 PIPE HANGERS, SUPPORTS AND ANCHORS

A. Beam Clamps

1. Beam clamps shall have malleable iron jaws, steel bolt or tie rod, nuts and jamb nuts.

2. C-clamps will not be permitted unless retainer is provided.

B. Finish

1. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 INSERTS

A. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

B. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.

3.2 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping indicated in schedule on drawings.

B. Install hangers to provide minimum ½ inch space between finished covering and adjacent work.

C. Place a hanger within 12 inches of each horizontal elbow.

D. Provide hangers with 1-1/2-inch minimum vertical adjustment.

E. Support riser piping independently of connected horizontal piping.

F. Support horizontal piping as follows:

Nominal Pipe Size	Single Rod Diameter	Maximum Spacing Piping
3/4" & Under	3/8"	6'
1"	3/8"	7'
1 1/4	3/8"	8'
1 ½"&2"	3/8"	9'
2 ½"&3"	½"	12'
4" & 5"	5/8"	14'
6"	3/4"	14'
8"	7/8"	14'

END OF SECTION 22 05 29

SUBMITTAL

In accordance with the requirements of the General Conditions and Supplementary General Conditions, the following information is required to be submitted for this Section. The Contractor shall submit the required information to Architect for approval within 30 days after notice to proceed.

ITEM DESCRIPTION	SHOP DRAWINGS	CATALOG DATA	PARTS LISTS	OPERATING MANUAL	WIRING DIAGRAM	CERTIFICATION	SAMPLES	OTHER
Pipe Hangers	X	X						
Supports	X	X						
Inserts		X						

SECTION 21 10 00 – WATER BASED FIRE SUPPRESSION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This section covers the complete installation of a full dry-pipe fire protection sprinkler system and related items.

B. Provide all items, articles, materials, operations and/or methods listed, mentioned or herein specified, including all labor, materials, equipment and incidentals necessary and required for their completion.

C. Design drawings for this project show the location of fire protection system work is required. Any additional system components or sprinkler heads that may be required to meet all NFPA 13 requirements is the responsibility of the contractor. Any areas not shown to be sprinkled but required to be sprinkled by NFPA 13 requirements shall be sprinkled by the contractor and include any and all equipment required.

D. Contractor shall submit design drawings and calculations to engineer for approval prior to submission to LFUCG.

E. Remove two dry pipe risers and replace with four dry pipe risers.

F. Install Nitrogen Generating System on dry pipe system.

G. Rezone building into four zones.

H. Replace existing fire protection system on material recycling sorting machine. Field visit to survey machine.

1.2 RELATED DOCUMENTS

A. The General and Special Conditions and all other Contract Documents (ESPECIALLY DIVISIONS 21, AND 26) are applicable to work under this section of the specifications. All the work under this section of the specifications shall be governed by any alternates and unit prices called for in the FORM OF PROPOSAL insofar as they affect this portion of the work.

B. Section 210100 – WATER BASED FIRE SUPRESSION SYSTEM

C. Section 211010 – NITROGEN GENERATING CORROSION INHIBITING SYSTEM

D. Section 210517 - SLEEVING, CUTTING, PATCHING AND REPAIRING

E. Section 210529 – HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT –

F. Section 211119 – FIRE PROTECTION SPECIALTIES

G. Section 219996 – FLOW TEST

H. Section 219997 – FIRE WATCH

I. Section 219998 – SUPPLEMENTAL INSTRUCTIONS

J. Section 219999 – MAINTENANCE AND SERVICE CONTRACT

1.3 WORK INCLUDED

A. The work covered by this section of the specifications consists of the furnishing of all materials, labor, equipment and appurtenances and the performance of all operations required for the installation of a system of automatic sprinklers.

B. Work shall commence at a point where shown and shall include all necessary parts, accessories and items of work required for a complete and finished installation including all normally closed flow switches for use by the fire alarm system.

C. All piping including all valves, sprinkler heads, alarm valve, control valves, etc.

D. Any apparatus, machinery, material small items or incidentals not mentioned herein, which may be found necessary to complete or perfect any portion of the installation in a substantial manner and in compliance with the requirements stated, implied or intended in these specifications, shall be furnished without extra cost to the owner. This shall include fire department connections, post indicator valve, water motor gong, ALARM BELL, backflow checks, all electrical power and control wiring and interlock which is not shown on the Electrical Drawings, etc. to provide a complete system and approved fire protection system.

E. The building areas in general are based on light hazard occupancy with storage rooms and mechanical rooms on ordinary hazard; head spacing as required. A system based on hydraulic calculation, as approved by NFPA 13, is acceptable, and as required by the insuring company. Occupancy hazard shall be confirmed by the local Fire Marshal and/or the authority having jurisdiction before calculations are performed.

1.4 SPECIAL REQUIREMENTS

A. No Contractor other than those regularly engaged in the installation of approved and franchised automatic sprinkler systems will be considered or approved for the work under this Section of the specifications. Bidders must have had not less than five years' experience in the fabrication and erection of such systems and shall have completed installations similar and equal in scope to this system under approval by one or more of the recognized underwriting associations in the insurance field.

B. Before submitting bid, examine all mechanical, electrical, architectural and structural drawings, visit the site and become acquainted with all conditions that may, in any way whatsoever, affect the execution of this work.

C. The Contractor shall take his own measurements and be responsible for exact size and location of all openings required for installation of this work. Figured dimensions where indicated are reasonably accurate and should govern in setting out work. Detailed method of installation is not indicated. Sprinkler Contractor shall coordinate exact ceiling grid location and install sprinkler heads centered in the 2' x 2' and 2' x 4' ceiling panels. Location of sprinkler head must be carefully coordinated with the Architect.

D. It shall be this Contractor's responsibility to verify all existing water line sizes and to conduct water flow tests and report to the Architect and Engineer the results of water flow test. Existing water flow test listed within the bidding documents is for bidding purposes only. The Contractor shall conduct/obtain his own water flow test information for use in shop drawing/hydraulic calculations. Water flow test shall be done in accordance with NFPA 291 and use a minimum of two (2) fire hydrants. The test shall be fully coordinated with the utility company, fire department and owner and witnessed by the Architect/Engineer's representative.

E. It is not the intent of these Plans and Specifications to provide a complete detailed description of the apparatus, materials, equipment, etc., which is required to make a complete installation of a specified fire protection system. Include all required sprinkler heads, tamper switches, material and equipment and perform all work required to install a complete and approved installation.

F. All materials and methods shall be in accordance with applicable codes, regulations and/or ordinances and meet approval of local inspection authority and insuring agency having jurisdiction. The latest edition of the National Board of Fire Underwriters Bulletins shall be the minimum requirement for all work. All materials under this Contract shall be listed by the Underwriter's Laboratories, Inc., as approved for fire protection installation. The installation shall comply with the NFPA, and the Kentucky Building Code and Local Fire Marshal in every respect.

G. Perform work under this section in close harmony with other sections so completed work shall present a neat and workmanlike installation.

H. Any paving, floors, or other improvements disturbed or destroyed as a result of installation of sprinkler system, shall be restored or replace to Owner's satisfaction.

1.5 SHOP DRAWINGS

A. Prepare detailed shop drawings for the complete sprinkler system, showing the location of the heads, piping and other installation details and submit plans to the Architect. Drawings shall bear the stamp of a certified sprinkler technician and shall be complete with all calculations and equipment drawings for approval of Architect, Engineer and the Department of Housing, Building and Construction and/or the authority having jurisdiction.

B. Sprinklers shall be shown on drawings, submittals and project information and shall be identified by the manufacturer's style or series designation as published in the appropriate agency listing or approval. Trade names and abbreviations are not permitted.

C. Shop drawings and descriptive literature shall be submitted as a minimum, but not limited to the following:

1. Sprinkler Heads
2. O. S. & Y Valve
3. Alarm Control
4. Back Flow Preventer Detector Check
5. Pipe Hanger and Support
6. Nitrogen Generator

1.6 PERMITS, CODES AND INSTALLATIONS

A. All construction permits and inspections for the automatic sprinkler system shall be paid for and furnished under this section. The work shall be installed in a manner to comply with all state and local codes applicable and with all requirements of NFPA Standard 13 latest revision for the installation of sprinkler systems. The entire installation, all materials, etc., shall meet their requirements.

B. Contact the serving Water Company to determine their cost for any tap on fees, vault, values, piping, equipment required to complete the fire protection tie in. These costs shall be included in this Contract.

C. Pay for all fees and costs arising from this installation and for any and all destruction to property, both public and private, which may arise from this service tap on.

D. No work is to be started by the Contractor until Contractor's drawings are approved by the local Authority Having Jurisdiction and the local Fire Marshal's offices, and one copy delivered to the Architect. Entire installation is to be approved by the local Authority Having Jurisdiction, and the local Fire Marshal and/or the authority having jurisdiction. Final payment will not be made until these approvals are received.

1.7 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Deliver to the architect three (3) copies of the complete operating and maintenance instructions for the equipment furnished and installed under this contract. Provide the aforementioned parties with parts lists for all new equipment items. Each set shall be provided in a plastic or hard back binder with notations of contents.

B. The Contractor shall adequately instruct the Owner's maintenance personnel in the proper operation of all sprinkler devices installed.

1.8 RECORD DRAWINGS

A. After all work has been completed, provide for the Architect's records one (1) complete set of as built "Record Drawings" showing final installation of the work.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. All equipment and materials shall be new and approved by the UL and/or NFPA. System design shall be 175 PSIG.

B. Trade name and manufacturers mentioned herein are intended only to indicate design, quality and size. Other manufacturers products equal in all respects may be substituted, provided they meet with the prior approval of the architect and are found by him to be equal in every way to the items specified herein.

C. All devices shall be in accordance with the rules and regulations of the state fire marshal's office in all cases and shall bear the approval of Factory Mutual Global (FM) and/or NFPA.

2.2 ACCEPTABLE MANUFACTURERS

A. Allied Piping, Firematic, Grinnell, Reliable, Star, Victualic, Viking, Potter Electric Signal, System Sensor.

2.3 INTERIOR DRY SYSTEM FIRE PROTECTION PIPING AND FITTINGS

A. Schedule 40, Black Steel Pipe: ASTM A135. Pipe ends may be factory or field formed to match joining method. NPS 1 to NPS 2.

2.4 SPRINKLER HEADS

A. All sprinkler heads shall be FM approved automatic spray semi-recessed sprinklers and/or exposed upright sprinklers of the correct temperature and type for each location unless otherwise noted. Provide a spare head cabinet with one sprinkler wrench. Quantity of extra heads as indicated in NFPA #13.

B. Stainless steel flexible sprinkler drops may be used to properly locate sprinkler heads. The flexible tube shall be braided (FM-1637) of unbraided/corrugated (UL 2443) type 304 stainless steel. The drops shall be FM approved with one-piece open gate bracket for sprinkler installation before or after the bracket is secured to the ceiling gird. Any flexible drop 36-inches or longer must be listed for a minimum of three 90-degree bends to insure proper installation.

C. Sprinkler heads shall be provided with wire guards.

D. Sprinkler heads 7' 0" or less above floor and other heads where subject to mechanical injury shall be provided with wire guards.

2.5 SPRINKLER HEAD CABINET

A. Steel Cabinet with hinged cover designed for wall mounting and having a finished appearance. Cabinet shall hold a minimum of six spare sprinklers plus a sprinkler wrench. Provide number of sprinkler heads required by NFPA 13.

2.6 CONTROL VALVES

A. All valves 2" and smaller shall be bronze, solid bronze solid ball or wedge disc, screwed or grooved end pattern, ball type or outside rising stem and yoke, designed for 150 psi working pressure and approved by FM.

B. All gate valves 2-1/2" and larger shall be iron body, bronze mounted, double disc, parallel seats outside screw and yoke and grooved end, screwed or flanged pattern designed for 160 psi working pressure and approved by FM.

C. All butterfly valves 2-1/2" and larger shall be ductile iron body, elastomer encapsulated ductile iron disc with integrally cast stem, grooved pattern designed for 300 psi maximum working pressure and approved by FM.

D. Valve Operators: Where indicated on drawings, provide FM approved indicator parts.

2.7 CHECK VALVES

A. Check valves shall be ductile iron body, bronze or stainless steel mounted, flanged or grooved and Factory Mutual approved for 250 psi or 175 lbs. working pressure.

2.8 ALARM VALVES

A. Standard: UL 193. Design: For horizontal or vertical installation. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.

2.9 NITROGEN GENERATOR

A. Refer to Specification Section 211010 – NITROGEN GENERATING CORROSION INHIBITING SYSTEM

2.10 DRAINS

A. Install auxiliary drains at all drain down locations.

1. All drains shall be drum drip style with 2 lockable valves.

2. Basis of design: CollectAndDrain M5300B

3. Contractor to supply locks and keys.

B. Where drains, flushing connections, etc., are necessary to comply with local code or NBFU requirements, they shall be considered a part of this Contract and furnished and installed accordingly, whether shown specifically on the Drawings or covered in these Specifications.

C. All sprinkler branch piping shall be installed to drain at main riser wherever possible.

D. Where sprinkler piping is trapped, an approved auxiliary draw-off shall be provided and installed. Provide all test drains as required. All exposed piping on the exterior of the building shall be rust proofed and painted, color as selected by Architect. Provide splash blocks at all exterior drains.

2.11 INSPECTOR'S TEST STATIONS

A. Install 1" inspection test connection. Discharge from test connection shall run to open air. All locations must comply with NFPA requirements and local Fire Marshall requirements.

B. Inspection test connection shall have an attached metal tag bearing the words "Test Connection".

2.12 PRESSURE GAGES

A. Standard: UL 393. Dial Size: 3-1/2- to 4-1/2-inch diameter. Pressure Gage Range: [0- to 250-psig minimum. Label: Include "WATER" label on dial face.

2.13 ALARMS

A. Provide the following alarms where required or indicated:

1. Water-Motor Operated Alarms

2. Electronically Operated Alarm
3. Water-Flow Indicator
4. Pressure Switch
5. Valve Supervisory Switch
6. Indicator Post Supervisory Switch

2.14 WALL AND CEILING ESCUTCHEONS

A. This contractor shall furnish and install on all lines passing through the floor, ceiling or wall in finished areas, an approved escutcheon as specified in Section 220517 – SLEEVING, CUTTING, PATCHING AND REPAIRING - PLUMBING. Escutcheons shall be submitted for approval before installation. Standard plates used in the industry may not be acceptable.

2.15 HANGERS

A. Furnish and install all hangers of approved pattern and size to support all pipes in a substantial manner.

B. See Section 210529 - SUPPORTS AND ANCHORS FOR PIPING AND EQUIPMENT of these specifications for pipe hangers and brackets.

C. Hangers for overhead piping shall comply with NBFU requirements as to size and spacing. Special and improvised supports and hangers shall meet with the approval of the Underwriters Laboratories and the Architect

PART 3 - EXECUTION

3.1 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building.

B. Install shutoff valve, check valve, pressure gage, and drain and other accessories indicated at connection to water service.

3.2 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
3. It shall be the responsibility of the contractor to examine the building and the drawings, confirming all dimensions before any pipe is cut, to determine if any offsets, etc., are necessary. Where additional offsets are required, they shall be made without any additional cost to the architect.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions adjacent to each valve in pipes NPS 2 and smaller.

E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

G. Install sprinkler piping with drains for complete system drainage.

H. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

I. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

J. Install alarm devices in piping systems.

K. Drain dry-pipe sprinkler piping.

L. Connect nitrogen generator supply to dry-pipe sprinkler piping.

M. Connect nitrogen generator to the following piping and wiring:

1. Pressure gages and controls.
2. Electrical power system.
3. Fire-alarm devices, including low-pressure alarm.

N. Pressurize and check dry-pipe sprinkler system piping and air-pressure maintenance devices and nitrogen generator.

O. Purge system to 98% nitrogen concentration.

P. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

Q. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal and install where they are not subject to freezing.

R. Be responsible for locating all openings required in walls, floors, ceilings or roof, for all materials and equipment furnished under this section of the specifications.

S. Sleeves or openings shall be provided for passage of pipes. Where openings or sleeves have been omitted, they shall be drilled or sawed as required by the architect. All cutting and patching shall be done by the trades whose work is affected. All expenses incurred shall be a responsibility of this section of the specifications.

T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 2120517 SLEEVING, CUTTING, PATCHING AND REPAIRING.

U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 SLEEVING, CUTTING, PATCHING AND REPAIRING.

V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210517 SLEEVING, CUTTING, PATCHING AND REPAIRING.

3.3 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

J. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

K. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

L. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

M. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

N. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. Install valves in vertical position for proper direction of flow, in main supply to system.

2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.

3. Install dry-pipe valves with trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

   a. Install nitrogen generator and compressed-air-supply piping.

   b. Install air-pressure maintenance device with shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig adjustable range; and 175-psig maximum inlet pressure.

3.5 SPRINKLER INSTALLATION

A. All heads must "line up" and work in with the ceiling pattern of the lights and heating equipment. All heads located in lay-in ceiling tile shall be centered along the centerline of the tile. Heads may be located at the center and quarter points of the tile. Avoid ducts, lights, hangers, etc. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

B. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.6 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13. Piping shall be marked on 20' centers. Where pipe extends through walls, identify pipe on both sides of wall.

B. Identify system components, wiring, cabling, and terminals.

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

   1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.

   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

   3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.

   4. Energize circuits to electrical equipment and devices.

   5. Coordinate with fire-alarm tests. Operate as required.

   6. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.8 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

END OF SECTION 21 10 00

SUBMITTALS

In accordance with the requirements of the General Conditions and Supplementary General Conditions, the following information is required to be submitted for this Section. The Contractor shall submit the required information to Architect for approval within 30 days after notice to proceed.

ITEM DESCRIPTION	SHOP DRAWINGS	CATALOG DATA	PARTS LISTS	OPERATING MANUAL	WIRING DIAGRAM	CERTIFICATION	SAMPLES	OTHER
Fire Suppression System	X	X	X	X		X	X	

SECTION 21 10 10 - NITROGEN-GENERATING SPRINKLER CORROSION INHIBITING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This section outlines the requirements for the nitrogen-generating sprinkler corrosion inhibiting system. The work described in this section includes all engineering, labor, materials, equipment, and service required to design, supply, install, test, and commission the nitrogen generating corrosion inhibiting system.

B. Section includes:

1. Sprinkler corrosion inhibiting system.

1.2 RELATED DOCUMENTS

A. The General and Special Conditions and all other Contract Documents (ESPECIALLY DIVISIONS 21, AND 26) are applicable to work under this section of the specifications. All the work under this section of the specifications shall be governed by any alternates and unit prices called for in the FORM OF PROPOSAL insofar as they affect this portion of the work.

B. Section 210100 – WATER BASED FIRE SUPRESSION SYSTEM

C. Section 211010 – NITROGEN GENERATING CORROSION INHIBITING SYSTEM

D. Section 210517 - SLEEVING, CUTTING, PATCHING AND REPAIRING

E. Section 210529 – HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT –

F. Section 211119 – FIRE PROTECTION SPECIALTIES

G. Section 219996 – FLOW TEST

H. Section 219997 – FIRE WATCH

I. Section 219998 – SUPPLEMENTAL INSTRUCTIONS

J. Section 219999 – MAINTENANCE AND SERVICE CONTRACT

1.3 SYSTEM BASIS OF DESIGN

A. Potter INS Series Nitrogen generating corrosion inhibiting system

1.4 PERFORMANCE REQUIREMENTS

A. General.

1. Design and performance of systems, components, and methods specified herein shall comply with all applicable referenced codes and standards.

2. Contract drawings indicate the general arrangement of the system and are a guide for intent only. Contractor is responsible for providing and installing all equipment necessary to complete the installation in compliance with all applicable requirements.

3. Contractor shall design, furnish, and install the sprinkler corrosion inhibiting system(s) per this specification, and shall provide Professional Engineering services needed to assume Engineering responsibility.

4. Pipe sizing indicated on contract drawings is based on preliminary hydraulic estimates for routing indicated. Contractor is responsible for final hydraulic calculations and pipe sizing based on as-installed locations.

5. Contractor is responsible for all approved expansion devices where required.

6. All piping system components shall be approved for at least 175 PSIG (1200 kPa gage) working pressure.

7. All equipment and materials shall be new and unused.

1.5 QUALITY ASSURANCE

A. Pipe shall bear label, stamp, or other markings indicating material specification.

B. Shop drawings and design calculations shall include a seal and signature by a qualified Licensed Professional Engineer, registered in the State where jobsite is located.

1.6 SUBMITTALS

A. General Requirements. The Engineer shall review all submittals for conformance to the contract drawings and specifications. The contractor shall be required to resubmit any materials, with appropriate modifications, that are found to be in non-conformance with the requirements of the contract drawings and these specifications after review by the Engineer. Approval of the submittals by the Engineer shall not relieve the Contractor of their responsibility to meet the requirements of the drawings and specifications.

B. Action Submittals.

1. Product Data. For each type of product indicated, include, as applicable, product rated capacities, operational characteristics, electrical characteristics, materials of construction, standards of construction, and approvals.

a. Nitrogen generating sprinkler corrosion inhibiting system.

2. Shop Drawings. Include all pertinent information such as structural members, ceiling construction, partitions, lighting fixtures, air diffusers and registers, speakers, and piping runs.

a. Plan views of all rooms where nitrogen generating assemblies are located.

C. Delegated-Design Submittals. Include performance requirements and design criteria analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Commissioning Submittal: Field Test Plan.

PART 2 - PRODUCTS

2.1 SPRINKLER CORROSION INHIBITING SYSTEM. Furnish and install a nitrogen generating sprinkler corrosion inhibiting system size based on volume capacity and operating pressure. This system shall provide nitrogen for supervisory pressure of the preaction sprinkler system pipe instead of air.

A. General Requirements.

1. The nitrogen generating system shall provide a minimum of 98% purity nitrogen within the sprinkler pipe after a reasonable time allowed for purging.

2. Separate AC circuits, of the proper phase and current and voltage rating, shall be provided by the Electrical Contractor for the compressor / tank assembly and the refrigerated dryer.

3. Unit shall be 208 volt / 1 phase.

B. Specific Product Requirements.

1. Compressor / tank assembly, consisting of a DOT or ASME air storage tank, an air compressor mounted on top of the air storage tank, and an outlet regulator with ball valve.

2. Furnish and install a nitrogen generator system at each fire sprinkler riser room to service all dry/pre-action zones as required by the system size and pressure requirement stipulated in the drawings and installed per manufacturer's instructions.

3. The nitrogen generator shall have an air compressor that is sized appropriately for the application and capable of achieving system supervisory pressure within 30 minutes in accordance with requirements of NFPA 13.

4. The nitrogen generator shall provide a minimum of 98% purity nitrogen to the fire sprinkler system.

5. The nitrogen generator shall be equipped with a filtration system to remove residual water and all hydrocarbons form the air stream.

6. The nitrogen generator shall have a nitrogen control panel capable of monitoring compressor runtimes, nitrogen generator pressure, and operational mode locally and over the internet.

7. The nitrogen generator shall have a leak detection system capable of determining sprinkler system leak rates and give alerts if leaks develop within the sprinkler piping, nitrogen generator system or air compressor.

8. Alerts shall be capable of being e-mailed.

9. The nitrogen generator systems shall have the ability to automatically switch between air bypass mode and nitrogen generating mode based on the demands of the sprinkler system.

10. The nitrogen generator shall have an air storage tank and nitrogen storage tank air that confirm to ASME standard for pressure vessel.

11. The nitrogen generator is FM approved.

12. Steel pipe or approved tubing rated for a minimum of 175 PSI shall be used to connect the various system components.

13. Manual bypass valves shall permit the filling of the system with supervisory air pressure in a maximum of 30 minutes, per NFPA 13.

2.2 NITROGEN PURGE VALVES

A. General Requirements.

1. Furnish and install an automatic nitrogen purge valve at the furthest point from the fire sprinkler riser for each fire sprinkler riser.

2. Provide with 24VAC AC power transformer for each automatic purge valve

B. Specific Product Requirements.

1. The nitrogen purge valve be supplied with a restricted orifice which size is determined by the total system pressure requirements.

2. The nitrogen purge valve shall have a nitrogen sensor that can shut off the purge valve after 98% nitrogen has been achieved throughout the fire sprinkler system.

3. The nitrogen purge valve shall monitor the nitrogen level in the fire protection system periodically.

4. The nitrogen purge valve shall have a BMS alarm relay to indicate trouble if nitrogen purity drops below desired purity.

5. The nitrogen purge valve shall be able to connect to a nitrogen generator for remote monitoring.

6. The nitrogen purge valve shall be able to be networked with other purge valves.

7. The nitrogen purge valve shall be closed during hydrostatic and air pressure testing of the fire sprinkler system and then placed in the open position for the commissioning, treatment and operation of the system.

2.3 AIR MAINTENANCE DEVICE

A. General Requirements.

1. Furnish and install an Air Maintenance Device for each dry fire sprinkler system

B. Specific Product Requirements.

1. Air Maintenance Device shall be equipped with an adjustable pressure regulator that is capable of setting the required pressure for the fire sprinkler system.

2. The Air Maintenance Device shall be listed or approved for fire sprinkler application.

3. The Air Maintenance Device shall be installed per manufacturer's specifications

2.4 BLEEDER VALVE

A. General Requirements.

1. Furnish and install BVL bleed valve for testing purposes.

2.5 PORTABLE NITROGEN ANALYZER

A. General Requirements.

1. Furnish a Portable Nitrogen Analyzer

B. Specific Product Requirements.

1. Durable N2 analyzer

2. One-button operation

3. Auto-off

4. 3-digit display

5. Resolution 0.1% Nitrogen

PART 3– EXECUTION

3.1 MECHANICAL TESTING

A. Testing to be performed by the installing licensed sprinkler contractor in accordance with manufacturer's commissioning instructions.

B. Test Plan.

1. The Contractor shall submit a test plan that describes how the system shall be tested. This shall include a step-by-step description of all tests and shall indicate type and location of test apparatus to be used. At a minimum, the tests to be conducted shall be per the relevant referenced codes and any additional supplemental tests required by the authority having jurisdiction.

2. Tests shall not be scheduled or conducted until the Engineer approves the test plan.

C. Execution. All tests shall be performed in the presence of the Engineer and the authority having jurisdiction. The Contractor shall record all equipment, tests and system configurations in a format approved by the Engineer and the authority having jurisdiction.

A copy of the commissioning tests and results shall be provided to the Engineer, the authority having jurisdiction, and the end user.

3.2 WARRANTY

A. All equipment and installation to be warranted against defects for 12 months starting upon the date of system acceptance by all authorities having jurisdiction.

B. Contractor shall supply and change filter as required during warranty period.

END OF SECTION 21 10 10

SECTION 21 11 19 – FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Backflow Preventers

1.2 RELATED WORK

A. The General and Special Conditions and all other Contract Documents (ESPECIALLY DIVISIONS 21, AND 26) are applicable to work under this section of the specifications. All the work under this section of the specifications shall be governed by any alternates and unit prices called for in the FORM OF PROPOSAL insofar as they affect this portion of the work.

B. Section 210100 – WATER BASED FIRE SUPRESSION SYSTEM

C. Section 211010 – NITROGEN GENERATING CORROSION INHIBITING SYSTEM

D. Section 210517 - SLEEVING, CUTTING, PATCHING AND REPAIRING

E. Section 210529 – HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT –

F. Section 211119 – FIRE PROTECTION SPECIALTIES

G. Section 219996 – FLOW TEST

H. Section 219997 – FIRE WATCH

I. Section 219998 – SUPPLEMENTAL INSTRUCTIONS

J. Section 219999 – MAINTENANCE AND SERVICE CONTRACT

1.3 REFERENCES

A. ANSI/ASSE 1013 - Backflow Preventers, Reduced Pressure Principle

1.4 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by same manufacturer throughout.

B. All drinking water system components that convey or dispense water for human consumption through drinking or cooking shall be "lead-free" in accordance with NSF/ANSI 61 and/or NSF/ANSI 372 standards and any and all state and local requirements.

PART 2 - PRODUCTS

2.1 BACKFLOW PREVENTERS

A. Reduced Pressure Detector Backflow Preventers: ANSI/ASSE 1013; Horizontal installation, bronze body with bronze and plastic internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve which opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

B. Basis of Design : Zurn 475STDA

C. Manufactured by Ames, Apollo, Febco, Watts and Zurn.

2.2 INSTALLATION

A. General: Install plumbing specialty components, connections, and devices according to manufacturer's written instructions.

B. Install backflow preventers of type, size, and capacity indicated, at each water-supply connection to mechanical equipment and systems, and to other equipment and water systems as indicated. Comply with authorities having jurisdiction. Locate backflow preventers in same room as connected equipment. Install air-gap fitting on units with atmospheric-vent connection and pipe relief outlet drain to nearest floor drain. Do not install bypass around backflow preventer.

C. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

D. Fasten recessed, wall-mounting plumbing specialties to reinforcement built into walls.

E. Secure supplies to supports or substrate.

2.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 21 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

1. Install piping connections between plumbing specialties and piping specified in other Division 21 Sections.
2. Install piping connections indicated between appliances and equipment specified in other Sections; connect directly to plumbing piping systems.
3. Supply Runouts to Plumbing Specialties: Install hot- and cold-water-supply piping of sizes indicated, but not smaller than required by authorities having jurisdiction.

END OF SECTION 21 11 19

SUBMITTALS

In accordance with the requirements of the General Conditions and Supplementary General Conditions, the following information is required to be submitted for this Section. The Contractor shall submit the required information to Architect for approval within 30 days after notice to proceed.

ITEM DESCRIPTION	SHOP DRAWINGS	CATALOG DATA	PARTS LISTS	OPERATING MANUAL	WIRING DIAGRAM	CERTIFICATION	SAMPLES	OTHER
Backflow Preventers	X	X						

SECTION 21 99 96 – FLOW TEST

PART 1 - GENERAL

1.1 FLOW TEST

A. See following pages for flow test.

END OF SECTION 21 11 19

SECTION 21 99 96 – FLOW TEST

PART 1 - GENERAL

1.1 FLOW TEST

A. See following pages for flow test.

END OF SECTION 21 11 19

KENTUCKY AMERICAN WATER
Fire Flow Test Report

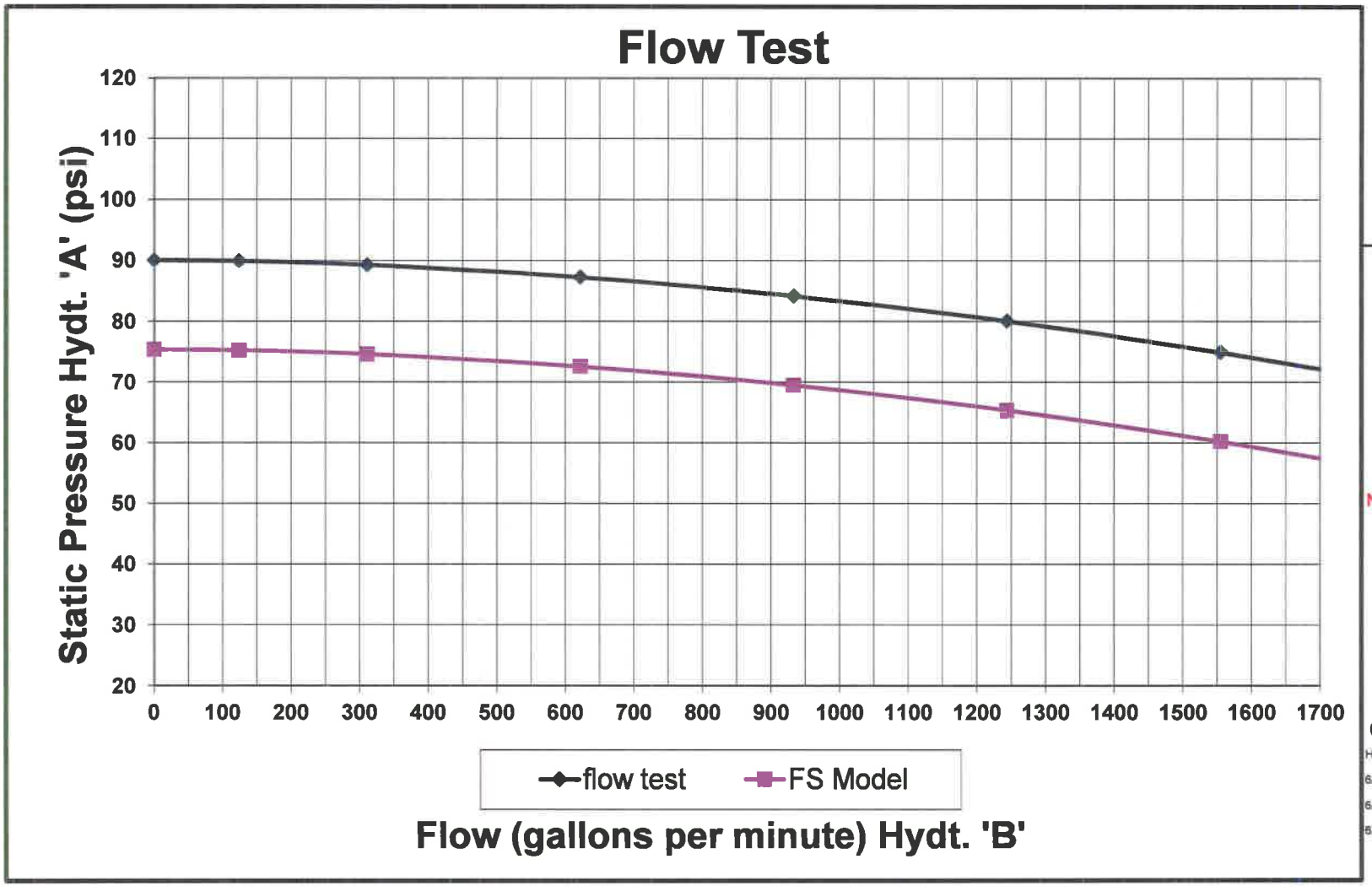
Location: 360 Thompson Rd
Date flowed: \ Time:
Requested By: Mike McGaughey
Name of Project:
Phone #:
Email: .mcgaughey@stweng
Contact:

$Q_r = Q_t * (h_r^{0.54} / h_t^{0.54})$

Flow Requirement: N/A GPM @ N/A PSI

Point 'A' Residual Meter Box: HLX-3504 Location: Thompson Rd
Static Pressure (psi): 90
Residual Pressure (psi): 80
Point 'A' Elevation (ft): 930.0

Point 'B' Flowing Hydrant No.: HLX-31 Location: Thompson Rd
Static Pressure (psi): 82 Nozzle size: 2.5
Pitot Pressure (psi): 55
Flow (gpm): 1244 Hydrant Elevation (ft): 945.0



Flow at 'B' (gpm)	Pressure at 'A' (psi)	Pressure for FS (psi)
0	90.0	75.3
124	89.9	75.1
311	89.2	74.5
622	87.2	72.5
933	84.1	69.4
1244	**80.0**	**65.3**
1555	74.9	60.2
1866	68.8	54.1
Enter desired flow:		
N/A	#VALUE!	#VALUE!

Node #: J-14943
(Model: 2012 Central Avg Day.p2k)

HGL used for Design of FS (MSL)*:	1103.9
6/13/00 Avg. HGL from Model (MSL):	1137.1
6/13/00 Min. HGL from Model (MSL):	1103.9
6/13/00 Max HGL from Model (MSL):	1170.2

KENTUCKY AMERICAN WATER

FIRE FLOW TEST

A flow test was made in the following manner for: 360 Thompson Rd (Address) ???

Hydrant # HLX-3504 on Thompson Street was selected as the residual hydrant (**POINT "A"**). < Elevation (ft) 930

Hydrant # HLX-3151 on Thompson Street was selected as the flow hydrant (**POINT "B"**) < Elevation (ft) 945

Static pressure at **POINT A** was 90 p.s.i. before the flow test.

Static pressure at **POINT B** was 82 p.s.i. before the flow test.

With hydrant at **POINT B** flowing, residual pressure at **POINT A** was 80 lbs. Pitot pressure at **POINT B** was 55 lbs.

Actual flow at **POINT B** was 1244 g.p.m. After a two minute flow from the hydrant at **POINT B**,

the static pressure at **POINT A** was 90 lbs and the static pressure at **POINT B** was 82 lbs.

This flow test was made using the 2 1/2 outlet at hydrant # HLX-3151 , with an Outlet Coefficient of: 0.90

FLOW TEST CONDUCTED BY: Allender/Branch

DATE: 22-Mar-19 TIME: 11:30 AM Total water used for test = 2,488 Gallons

DIAGRAM (not to scale)

MAP #(s)

Node #:

(Model: 2012 Central Avg Day.p2k)

HGL used for Design of FS (MSL)*:

6/13/00 Avg. HGL from Model (MSL):

6/13/00 Min. HGL from Model (MSL):

6/13/00 Max HGL from Model (MSL):

SECTION 21 99 97 – FIRE WATCH

PART 1 – GENERAL

A. Contractor is required to employ personal to conduct a fire watch at the following times:

1. Any time during 2nd or 3rd shift when the facility is not in operation, and the fire protection system is not 100%.

2. Owner to provide FIRE WATCH during 1st shift.

PART 2 - PRODUCTS

PART 3 - EXECUTION

A. All fire watch operation shall meet the requirements of Lexington Fire Department.

Notice of Hazard

Life Safety Fire Watch Procedure

Your fire alarm or fire sprinkler system is out of service and you are to take immediate steps to restore the system to service. Failure to comply with this written order shall subject you, your company, or your corporation to penalties as outlined in the LFUCG Codes of Ordinances and Kentucky Revised Statutes as they pertain to fire prevention and control.

A fire watch shall be established in a building when the fire alarm and/or sprinkler system is temporarily shut down more than **4 hours** for reasons including maintenance, periodic inspection, repair, renovation, or demolition work. The areas that are affected by the outage or malfunction will be covered until the system has been repaired, tested and placed back into service utilizing the following procedure

1. **The management of a business or property shall supervise the fire watch service or designate a responsible person to provide supervision of the fire watch.**
2. **Notify the alarm monitoring company if required.**
3. **Notify Fire Department when the system is not working and again when the system has been repaired.**
4. **Verify that a log is kept for all inspections.**
5. **Provide fire watchers access to all areas of the building(s)**
6. **Provide fire watchers reliable means of communicating with 9-1-1.**

If the fire watch personnel discover a fire their first response is to notify the fire department by calling 9-1-1. They will report the exact location of the fire and the extent of fire involvement. Fire watch personnel shall then notify the occupants of the facility of the need to evacuate. If the fire alarm horns are still functional they shall be utilized to assist.

A sufficient number of fire watch personnel shall be assigned to fire watch service throughout the structure or site as applicable. Fire watch personnel may perform other duties assigned by management as long as the fire watch duty is the primary function and the other duties do not interfere with the fire watch.

Fire watch personnel shall make rounds of the structure(s) and grounds at intervals determined by the Fire Department. Each site or building may require different timed rounds. Hourly rounds will be the minimum requirement. Special conditions such as areas with people sleeping, occupied assemblies, hazardous material storage, or hazardous materials processing may require additional rounds. A log of the rounds, times of rounds, and conditions noted for attention shall be kept by all fire watch personnel and faxed to the number below.

Should you require further information, please call the Fire Prevention Bureau at 859-231-5668 between the hours of 8:00-4:00 pm Monday-Friday.

END OF SECTION 21 99 97

SECTION 21 99 98 – SUPPLEMENTAL INSTRUCTIONS

PART 1 - GENERAL

1.1 MATERIAL RECYCLING CENTER OPERATIONS

A. Facility to be in operation 1st shift only.

B. Sprinkler system shall remain in operation as much as possible.

1. Contractor to employ a FIREWATCH in all areas of the building where the sprinkler system is not in operation during 2nd or 3rd shift until system in back in operation.

2. Owner to provide FIREWATCH during 1st shift, when facility is operating.

1.2 WORK HOURS

A. Contractors work hours to be limited to 2nd and 3rd shift, and weekends.

B. Any work to be performed at any other time must be approved by the owner.

1.3 SHUTDOWN

A. To help facility the installation, the owner will schedule a complete shutdown of the facility for a period not to exceed 2 weeks.

B. Anticipated work

1. Removal of existing backflow preventer, and installation of new.

2. Removal of existing dry pipe risers, and installation of new risers.

3. Reconnect existing fire protection systems where possible to remain in operation during construction.

4. Reconnect existing air compressor to new dry pipe risers.

5. Removal and replacement of heads and piping in areas not accessible while building in in operation.

1.4 SORTING MACHING

A. Contractor shall survey the sorting machine prior to design.

B. Coordinate surveying operations with the owner during facility operating hours.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 21 99 98

SECTION 21 99 99 – MAINTENANCE AND SERVICE CONTRACT

PART 1 - GENERAL

1.1 SUMMARY

A. The owner intends to enter into a 5-year maintenance and service contract with the successful bidding contractor.

B. Contract to begin when warranty period is complete.

1.2 WORK INCLUDED

A. Contractor to provide all tools, labor, and equipment to perform total maintenance, testing, and inspection of the entire fire sprinkler system and each of its components in accordance with the most current NFPA 25 and all other applicable codes.

1. Test dry pipe system and piping.
2. Set a schedule for all drain down locations to be checked and drained as necessary.

B. Test, inspect and perform maintenance on nitrogen generating system as required by manufacturer. Work to include, but not limited to:

1. Supply and replace filters as necessary.
2. Maintain membrane.
3. Maintain automatic nitrogen purge valves.
4. Via the Nitrogen Generator, review and/or record the following Nitrogen Generator status items:
   a. Compressor total run time (record on maintenance log)
   b. Average cycle time (record on maintenance log)
   c. Trouble status
   d. Maintenance status
5. Via the Nitrogen Generator, review and/or record the following Purge Valve status items. Where trouble found, record device number and error code:
   a. Trouble status
   b. Sensor status
6. Examine each purge valve for presence of power and trouble warning status.

C. Contractor to create contract for Owners approval.

1. Contract shall include at a minimum:
   a. Length of Contract
   b. Notification of test dates,
   c. Access procedures.

1.3 SPECIAL REQUIREMENTS

A. Contractor shall not subcontract work to any other contractor without express written permission by the Owner.

B. Contractor shall be licensed to perform work in the Commonwealth of Kentucky and the City of Lexington.

C. Contractor shall have been involved in maintenance, testing, and inspections of fire sprinkler systems as a contractor for a minimum period of five years.

D. Contractor must maintain adequate licensing by the Commonwealth of Kentucky during entire period of contract. Loss of license could be cause for termination of the contract.

E. Contractor shall maintain workforce of qualified technicians during the period of this contract.

F. Contractor shall have in his possession or shall have the capacity to procure all necessary tools and equipment to perform the work required by this contract such as, but not limited to, ladders, scaffolding, hand tools, power tools, and personal protective equipment.

1.4 CONTRACTOR EMPLOYEE QUALIFICATIONS

A. All contractor employees shall be clothed in recognizable uniforms plainly displaying the logo of the contractor and the name of the employee or, in absence of uniforms, have displayed plainly visible, a picture identification badge attached to employee's person.

B. All contractor employees shall provide picture identification, such as a valid driver's license, immediately upon request of Owner.

C. Contractor shall upon request provide legal documentation for any employee of national origin other than United States citizen.

D. Contractor shall have on site at least one employee to supervise, lead, or oversee the work crew at each job site. The name of the person in charge and the number of employees on each job site shall be communicated to the Owner or his representative prior to beginning work.

E. All contractor employees shall behave in a professional manner not to disturb and/or disrupt the work of any occupants of City-owned buildings any more than necessary.

F. All contractor employees shall adhere to all City of Lexington, Commonwealth of Kentucky, and United States Governmental Laws and Regulations at all times while on City of Lexington property. Contractor shall be held responsible for any such violations.

G. Contractor shall properly and safely contain any and all water discharged from the Fire Sprinkler System, during work, into proper devices and/or containers until water is emptied into proper drain. Water discharged to the exterior of buildings shall be piped or directed to closest proper drain or proper area designated by the Owner or his representative.

H. Contractor shall provide only properly and adequately trained employees. Contractor employees shall be properly and adequately trained in the operation and use of all tools, power tools, and equipment.

I. Contractor employees shall not leave any site unprotected by the Fire Sprinkler System without notification and permission of the Owner or his representative.

1.5 DISCHARGE EVENT COST

A. The contractor shall supply the owner with an individual lump sum price for the resetting of the fire protection system in the event of a sprinkler discharge, or any other episode that requires the piping to be drained and nitrogen to be re-purged.

1. Price shall include all labor and material necessary to include, but not limited to:

a. Drain all water from piping.

b. Replace heads if necessary.

c. Reset dry pipe valve.

d. Purge piping to nitrogen level recommended by manufacturer.

e. Additional cost for boom / lift to access remote heads and components.

2. Owner will give consideration for additional reimbursement if an item needs to be replaced in a hard to reach location where specialized equipment is needed to reach areas of work.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 LOG BOOK

A. Maintain a Maintenance Log Book with schedules of all regularly scheduled maintenance events and tests, including, but not limited to:

1. All tests and inspections as dictated by the current edition of NFPA 25.
2. Changing of filters on the nitrogen generating system.
3. Inspection and draining of all system drain down locations.
   a. Action to occur at a minimum every 2 weeks for the duration of the contract.
   b. If, after the first year, water is not observed on a regular basis at the drain down location, the frequency of the inspection may be altered.

END OF SECTION 21 99 99

SECTION 26 05 00 – GENERAL REQUIREMENTS

1.1 GENERAL REQUIREMENTS

A. All drawings and general provisions of the contract, including the General and Supplementary Conditions and Division 01 Specifications apply to all specifications in Divisions 26, 27 and 28. In addition, the general requirements described within this specification section, 260500 General Requirements, apply to all specifications in Division 26, 27, 28 and the Contract Drawings.

B. The contractor is responsible for obtaining and paying for all building permits, fees, licenses and inspections required by the governing agencies.

C. The drawings and specifications constitute the Contract Documents. They complement each other. All items shown on the drawings and/or listed in the specifications shall be provided and installed by the Contractor unless specifically noted that it will be provided and/or installed by others. In the event there is a conflict within the Contract Documents, the Contractor shall notify the Engineer immediately. If a clarification is not given, the Contractor shall bid the more stringent of the two requirements.

D. Any materials, labor, equipment or services not specifically mentioned herein which may be necessary to complete any part of the electrical systems described in the drawings and/or specifications shall be included as part of the Contract.

E. References in the Contract Documents to any specific manufacturer and/or catalog numbers are intended to establish a standard of quality and not to limit competition. Proposed equivalent manufacturers shall be provided to the Engineer a minimum of 14 days prior to bid.

F. All work performed in the Contract shall comply with all relevant codes adopted by the state and locality in which the project is located.

G. All electrical components, devices and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

H. The drawings are diagrammatic only. It is the responsibility of this Contractor to coordinate the installation of the specified components with all other trades to accomplish the following:

1. Allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

2. Provide for ease of disconnecting the equipment with minimum interference with other installations.

3. Allow right of way for piping and conduit installed at required slope, so connecting raceways, cables, wireways, cable trays and busways will be clear of obstructions and of the working and access space of other equipment.

I. All work shall be installed in a neat and workman like manner complying with standards in NECA1, Standard for Good Workmanship in Electrical Construction.

1.2 WARRANTY

A. At a minimum the Contractor shall warranty all defects in material and labor for one year starting from the date of substantial completion. In the event of a multi-phased renovation, all warranty periods shall start on the date of substantial completion of the final phase. Additional warranties may be required and will be described within the associated specification section.

1.3 SHOP DRAWINGS

A. The Contractor shall provide the Engineer with any and all product cutsheets, dimensioned drawings, wiring diagrams or any other documentation which may be required to describe the material to be provided as part of this Contract.

1.4 OPERATION AND MAINTENANCE MANUALS

A. Provide product information for all electrical components to be included in the operation and maintenance manuals. The information shall include at a minimum cutsheets for all equipment, requirements for routine maintenance and instructions for testing and adjusting equipment.

1.5 SMOKE AND FIREPROOFING

A. The Contractor shall provide fire and/or smoke stopping around/in any components which penetrate rated assemblies as required to maintain the rating of that assembly.

B. Refer to the related specifications under Division 07 for additional information.

1.6 DEMOLITION

A. All existing materials that will not be reused must be removed unless noted otherwise. All conduits shall be removed unless located in walls or slabs which do not get demolished. All conductors shall be removed.

B. All removed materials MUST be disposed of in a lawful manner. The contractor shall familiarize themselves with all local requirements.

C. The contractor shall keep all existing building systems functioning during construction.

D. The contractor is responsible for patching and repairing all areas where walls, slabs and materials have been cut, removed or modified as a result of demolition. Match existing materials, ratings and finishes. This includes, but not limited to, patching holes in walls with like materials where switches, receptacles and other devices have been removed.

1.7 TRENCHING AND BACKFILLING

A. All conduits located beyond the building perimeter must be buried a minimum of 30 inches below grade to the top of the conduit with the exception of conduits used for underground primary. Underground conduits used for primary electrical service shall be buried a minimum of 42 inches below grade unless otherwise noted.

B. Excavate utility trenches a minimum of 6 inches below the bottom of conduit and 6 inches on each side of the outer most conduit. When multiple conduits are installed within a common trench, 3 inches shall be maintained between the edges of all conduits. Install conduit spacers as required to maintain clearances between conduits.

C. Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduits. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

D. Place backfill on subgrades free of mud, frost, snow or ice. Install backfill as specified under Division 02.

E. Provide detectable warning tape above buried pipes and conduits. The warning tape shall be installed 12 inches below the top of grade except where located under pavements and slabs, and then it shall be buried 6 inches below subgrade. Install tape per manufacturers instructions.

F. Refer to the specifications under Division 02 for additional trenching and backfilling requirements.

END OF SECTION 26 05 00

SECTION 26 05 05 – PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Refer to the General Requirements Specifications, Section 260500.

B. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

1.2 SCOPE

A. Provide fire and/or smoke stopping around, or in, any components which penetrate rated assemblies as required to maintain the rating of that assembly.

1.3 SUBMITTALS

A. Product Data

1. Provide product data for each type of product to be utilized on this project.

B. Shop Drawings

1. Provide shop drawings detailing materials, installation methods, and relationships to adjoining construction for each through-penetration firestop system, and each kind of construction condition penetrated and kind of penetrating item.

C. Qualifications Data

1. Provide documentation from a qualified testing and inspecting agency indicating that each through-penetration firestop configuration submitted has been tested for the manner in which it is to be installed.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:

1. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:

a. Classification markings on penetration firestopping correspond to designations listed by the following:

i) UL in its "Fire Resistance Directory."

ii) Intertek ETL SEMKO in its "Directory of Listed Building Products."

iii) FM Global in its "Building Materials Approval Guide."

C. Single-source responsibility: Obtain through-penetration fire-stop systems for each kind of penetration and construction condition from a single-supplier.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. 3M

B. Dow Corning Corporation

C. Hilti Construction Chemicals

2.2 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.

2. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.

E. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.

F. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

G. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Sealants: 250 g/L.

2. Sealant Primers for Nonporous Substrates: 250 g/L.

3. Sealant Primers for Porous Substrates: 775 g/L.

H. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

1. Permanent forming/damming/backing materials, including the following:

a. Slag-wool-fiber or rock-wool-fiber insulation.

b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.

c. Fire-rated form board.

d. Fillers for sealants.

2. Temporary forming materials.

3. Substrate primers.

4. Collars.

5. Steel sleeves.

2.3 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

3.2 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.

2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form-release agents from concrete.

C. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

D. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

E. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

F. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

G. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

H. Install fill materials for firestopping by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.

2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

I. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

J. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration throughout the duration of this project.

END OF SECTION 26 05 05

SECTION 26 05 19 – ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.2 SUBMITTALS

A. Product Data: For each conductor type.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Acceptable Manufacturers:

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN and SO.

2.2 CONNECTORS AND SPLICES

A. Acceptable Manufacturers:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Conductors: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND WIRING METHODS

A. All locations unless otherwise noted: Conductors shall have THHN-THWN insulation and installed in raceway.

B. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

END OF SECTION 26 05 19

SECTION 26 05 26 – GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment:

1.2 SUBMITTALS

A. Product Data: For the grounding bus bar and grounding electrodes.

1.3 QUALITY ASSURANCE

A. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Bare Grounding Conductor:

1. No. 4 AWG minimum, soft-drawn copper.

D. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 4 inches in cross section, unless otherwise indicated; with insulators.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, 3/4 inch diameter by 10 feet length.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.

2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.

3. Connections to Ground Rods at Test Wells: Bolted connectors.

4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

C. Signal and Communication Equipment: For telephone, fire alarm, voice and data, security and other communication/low voltage equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-16-inch grounding bus.

2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

D. Signal and communications pathways: Pathways include cable tray, conduits and sleeves. Any path that signal or communications cabling is routed.

1. Install metal conduit sleeves entering the communication rooms with grounding bushings and connect with grounding conductor to grounding system.

2. Ground cable trays according to manufacturer's written instructions.

3. Conduit stub-ups and stub-outs do not need to be grounded.

4. Test the pathway to ensure electrical continuity of bonding and grounding connections, and to demonstrate compliance with the maximum grounding resistance. Adhere to the recommendations of the ANSI/TIA 607B standards. Install in accordance with best industry standards.

E. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.

2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes shall be at least 12 inches deep, with cover.

1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.

3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in EMT conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

G. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.

2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

3.4 FIELD QUALITY CONTROL

A. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

B. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

C. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Make tests at ground rods before any conductors are connected.

1. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

2. Perform tests by fall-of-potential method according to IEEE 81.

D. Ground resistances shall not exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.

2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.

3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.

4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

E. If resistance to ground exceeds specified values, take appropriate measures to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 29 – HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Acceptable Manufacturers:
   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.; a division of Cooper Industries.
   c. ERICO International Corporation.
   d. GS Metals Corp.
   e. Thomas & Betts Corporation.
   f. Unistrut; Tyco International, Ltd.
   g. Wesanco, Inc.
2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Acceptable Manufacturers:

1) Hilti Inc.

2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

3) MKT Fastening, LLC.

4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Acceptable Manufacturers:

1) Cooper B-Line, Inc.; a division of Cooper Industries.

2) Empire Tool and Manufacturing Co., Inc.

3) Hilti Inc.

4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

6. Toggle Bolts: All-steel springhead type.

7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.

2. To New Concrete: Bolt to concrete inserts.

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

4. To Existing Concrete: Expansion anchor fasteners.

5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.

6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.

7. To Light Steel: Sheet metal screws.

8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2. Install anchor bolts to elevations required for proper attachment to supported equipment.

3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 33 – RACEWAY AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. FMC: Flexible metal conduit.

D. LFMC: Liquid-tight flexible metal conduit.

E. LFNC: Liquid-tight flexible nonmetallic conduit.

F. RNC: Rigid nonmetallic conduit.

G. RSC: Rigid galvanized steel conduit.

1.3 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1. Custom enclosures and cabinets.
2. For handholes and boxes for underground wiring, including the following:
    a. Duct entry provisions, including locations and duct sizes.
    b. Frame and cover design.
    c. Grounding details.
    d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
    e. Joint details.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.

8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.

B. Rigid Galvanized Steel Conduit: ANSI C80.1.

C. Aluminum Rigid Conduit: ANSI C80.5.

D. EMT: ANSI C80.3.

E. FMC: Zinc-coated steel or aluminum.

F. LFMC: Flexible steel conduit with PVC jacket.

G. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Compression or set screw, steel type.

H. Joint Compound for Rigid Steel Conduit: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

A. Available Manufacturers:Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.; Pipe & Plastics Group.
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.

B. ENT: NEMA TC 13.

C. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

D. LFNC: UL 1660.

E. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

F. Fittings for LFNC: UL 514B.

2.3 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Arnco Corporation.
2. Endot Industries Inc.
3. IPEX Inc.
4. Lamson & Sessions; Carlon Electrical Products.

B. Description: Comply with UL 2024; flexible type, approved for plenum riser general-use installation as required by the environment.

2.4 METAL WIREWAYS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type.

E. Finish: Manufacturer's standard enamel finish.

2.5 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Thomas & Betts Corporation.
b. Walker Systems, Inc.; Wiremold Company (The).
c. Wiremold Company (The); Electrical Sales Division.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Butler Manufacturing Company; Walker Division.
b. Hubbell Incorporated; Wiring Device-Kellems Division.
c. Panduit Corp.
d. Walker Systems, Inc.; Wiremold Company (The).
e. Wiremold Company (The); Electrical Sales Division.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.

2. EGS/Appleton Electric.
3. Hoffman.
4. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
5. RACO; a Hubbell Company.
6. Robroy Industries, Inc.; Enclosure Division.
7. Thomas & Betts Corporation.
8. Walker Systems, Inc.; Wiremold Company (The).

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Metal Floor Boxes: Cast or sheet metal, fully adjustable, rectangular.

F. Nonmetallic Floor Boxes: Nonadjustable, round.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

I. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

J. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.

1. Color of Frame and Cover: Green.
2. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC" or "TELEPHONE." as applicable each service.
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

7. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. Armorcast Products Company.

b. Carson Industries LLC.

c. CDR Systems Corporation.

d. NewBasis.

C. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Basis-of-Design Product: Subject to compliance with requirements, provide [the product indicated on Drawings or a comparable product by one of the following:

a. Armorcast Products Company.

b. Carson Industries LLC.

c. Christy Concrete Products.

d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.

D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of fiberglass.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. Carson Industries LLC.

b. Christy Concrete Products.

c. Nordic Fiberglass, Inc.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. The use of metal clad (MC) cable is NOT permitted.

B. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid Galvanized Steel Conduit (RSC)

2. Concealed Conduit, Aboveground: RNC, Type EPC-40-PVC.

3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment):LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
6. Application of Handholes and Boxes for Underground Wiring:
   a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
   b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Heavy-duty fiberglass units with polymer-concrete frame and cover, SCTE 77, Tier 8 structural load rating.
   c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.

C. Comply with the following indoor applications, unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: RSC. Includes raceways in the following locations:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
4. Above Ceilings: EMT.
5. Concealed within concrete block and concrete walls: RNC. RNC shall transition to EMT above ceiling and all boxes shall be steel. No non-metallic boxes shall be permitted.
6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
7. Damp or Wet Locations: Rigid Steel Conduit.
8. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
9. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.
10. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT.
11. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.
12. Exposed not Subject to Severe Damage, Below Ceiling, Finished Space: Surface Raceway

D. Minimum Raceway Size: 3/4-inch trade size.

E. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB2.10.

F. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

G. Do not install aluminum conduits in contact with concrete.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

E. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

F. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

G. Surface Raceways: Coordinate installation with architectural drawings including windows, furniture, etc.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Change from ENT to rigid steel conduit or EMT, as applicable, before rising above the floor.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches of slack at each end of pull wire.

L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet .
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull

or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

2. Where otherwise required by NFPA 70.

N. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.

2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

O. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

P. Set metal floor boxes level and flush with finished floor surface.

Q. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in architectural and/or civil engineering specifications for pipe less than 6 inches in nominal diameter.

2. Install backfill as specified in architectural and/or civil engineering specifications.

3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in architectural and/or civil engineering specifications.

4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.

5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.

b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

6. Warning Tape: Bury warning tape approximately 12 inches above direct buried conduits.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes and boxes with bottom below the frost line.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

SECTION 26 05 53 – IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Equipment identification labels.
7. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.

2. Legend: Indicate voltage.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 FLOOR MARKING TAPE

A. 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.5 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.

2. Printing on tape shall be permanent and shall not be damaged by burial operations.

3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.

2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.

3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE,.

2.6 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.

2. 1/4-inch grommets in corners for mounting.

3. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.

2. 1/4-inch grommets in corners for mounting.

3. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.7 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a black background. Minimum letter height shall be 3/8 inch.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

F. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

G. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.

2. In Spaces Handling Environmental Air: Plenum rated.

H. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

I. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.

2. Power.

3. UPS.

B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.

b. Colors for 208/120-V Circuits:

i) Phase A: Black.

ii) Phase B: Red.

iii) Phase C: Blue.

c. Colors for 480/277-V Circuits:

i) Phase A: Brown.

ii) Phase B: Orange.

iii) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

C. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

D. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Install underground-line warning tape for both direct-buried cables and cables in raceway.

E. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

F. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.

b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.

c. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.

b. Enclosures and electrical cabinets.

c. Access doors and panels for concealed electrical items.

d. Switchgear.

e. Switchboards.

f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.

g. Emergency system boxes and enclosures.

h. Motor-control centers.

i. Enclosed switches.

j. Enclosed circuit breakers.

k. Enclosed controllers.

l. Variable-speed controllers.

m. Push-button stations.

n. Power transfer equipment.

o. Contactors.

p. Remote-controlled switches, dimmer modules, and control devices.

q. Battery-inverter units.

r. Battery racks.

s. Power-generating units.

t. Monitoring and control equipment.

u. UPS equipment.

END OF SECTION 26 05 53

SECTION 26 28 16 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Shunt trip switches.
4. Molded-case circuit breakers (MCCBs).
5. Molded-case switches.
6. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

B. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

C. Manufacturer's field service report.

D. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.

2. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect and Owner no fewer than seven days in advance of proposed interruption of electric service.

2. Indicate method of providing temporary electric service.

3. Do not proceed with interruption of electric service without Architect's and Owner's written permission.

4. Comply with NFPA 70E.

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 230 or 600V ac as indicated, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.

4. Lugs: Mechanical type, suitable for number, size, and conductor material.

5. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

3. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Alternate Maintenance Setting (AMS) Switch. Switch shall be provided for the temporary arc-flash incident energy reduction during maintenance activities. Provide for circuit breakers where the actual overcurrent device installed in the circuit breakers are rated or can be adjusted to 1,200 amps or higher.

1. Provide a manual switch on the compartment door to switch the circuit breaker's short-time tripping characteristics to instantaneous with minimum pick-up setting in order to reduce the danger from a potential arc-flash at downstream equipment.
2. Provide a lock feature for the AMS switch so that it may be locked in either the off or on maintenance mode position.
3. Provide a blue LED indicating light to indicate the AMS switch is in the maintenance mode.

D. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

E. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

F. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I2t response.

G. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

H. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

I. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.

2.4 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen or Wash-Down Areas: NEMA 250, Type 4X, stainless steel .
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 3R.

5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.3 IDENTIFICATION

A. Label each enclosure with engraved metal or laminated-plastic nameplate.

END OF SECTION 26 28 16

SECTION 27 15 00 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pathways.
2. UTP cabling.
3. Cable connecting hardware, patch panels, and cross-connects.
4. Telecommunications outlet/connectors.
5. Cabling system identification products.
6. Cable management system.

1.2 HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.

1. Bridged taps and splices shall not be installed in the horizontal cabling. Horizontal cabling shall be continuous.

B. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet in the horizontal cross-connect.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, including:

1. UTP cabling.
2. Telecommunications outlets.
3. Patch panels.
4. Patch cords.

B. Qualification Data: provide copy of certifications for installer and installation supervisor.

C. Maintenance Data: For splices and connectors to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff or certified by the material manufacturer to install their products.

1. Installation Supervision: Installation shall be under the direct supervision of certified installer, who shall be present at all times when Work of this Section is performed at Project site.

B. General Performance: Horizontal cabling system shall comply with transmission standards in ANSI/TIA-568-C.1, when tested according to test procedures of this standard.

C. Telecommunications Pathways and Spaces: Comply with ANSI/TIA-569-C.

D. Grounding: Comply with ANSI/TIA-607-B.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test each pair of UTP cable for open and short circuits.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. Cable Support: NRTL labeled for support of Category 5E/6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Comply with NFPA 70 and UL 2043 for fire resistant and low smoke producing characteristics.

2. Straps and other devices. All cable straps shall be reusable black Velcro cable wraps. No zip ties will be permitted.

2.2 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. TE Connectivity
2. General Cable
3. Berk-tek
4. Hitachi
5. Mohawk
6. Leviton
7. Superior Essex
8. Belden

B. Description: 100-ohm, 4-pair UTP, with a thermoplastic, non-plenum rated jacket. Acceptable Category 6 cable shall have a divider or separator between pairs. Color as selected by the owner/engineer during shop drawing reviews.

1. Comply with ICEA S-90-661 for mechanical properties where applicable. Comply with ANSI/TIA-568-C.1 for performance specifications.

2. Comply with ANSI/TIA-568-C.2 where applicable.

3. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

a. Communications, General Purpose: Type CM or CMG.

b. Communications, Riser Rated: Type CMR, complying with UL 1666.

2.3 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Panduit Corp.
2. Hubbell Premise Wiring
3. TE Connectivity
4. Leviton Voice & Data Division
5. Ortronics
6. Belden

B. General Requirements for Cable Connecting Hardware: Comply with ANSI/TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Connecting Blocks: 110-style IDC for Category 5E/6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

1. Number of Terminals per Field: One for each conductor in assigned cables.

E. Patch Panel: Modular patch panels with molded rear snap-in faceplates to accept modular jacks. Provide with labels.

1. Number of Ports: One for each four-pair cable, plus 25 percent spare spaces.

F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

G. Patch Cords: Factory-made, four-pair cables; terminated with eight-position modular plug at each end.

1. Provide equipment room patch cords for 100% of the voice and data cables. Cord lengths shall be 4 feet.
2. Provide workstation patch cords for 100% of the voice and data cables. Cord lengths shall be 10 feet.
3. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 5E/6 performance. Patch cords shall have latch guards to protect against snagging.
4. Patch cords shall have color-coded boots for circuit identification.
5. Color to be selected by Engineer during submittal review.

2.4 TELECOMMUNICATIONS OUTLET/CONNECTORS

A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular.

B. Workstation Outlets: Four-port-connector modular assemblies mounted in single or multigang faceplate.

1. Faceplate: Coordinate color and material type with Division 26 Section "Wiring Devices."

a. Provide Decora style faceplates to cover Decora style inserts.

2. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords.
   a. Flush mounting jacks installed in Decora style inserts.
   b. Decora style inserts shall be thermoplastic.
3. Label: Machine generated, self-laminating, adhesive label.

2.5 IDENTIFICATION PRODUCTS

A. Comply with ANSI/TIA-606-B and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
   1. Install plenum cable in environmental air spaces, including plenum ceilings.
   2. All communications cabling shall be installed above grade, with the exception of where they are installed to floor boxes or island furnishings. Where cabling is installed below grade, the cable must be rated for wet location installation.

B. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:
   1. Comply with ANSI/TIA-568-C.1.
   2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
   3. Install 110-style IDC termination hardware unless otherwise indicated.
   4. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
   5. Cables may not be spliced. Secure and support cables at intervals not exceeding 5 feet and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
   6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
   7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
   8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
   9. Cold-Weather Installation: Bring cable to room temperature before unreeling. Heat lamps shall not be used for heating.

10. Service Loops: In the communications equipment room, install a 10-foot-long service loop. Install a one-foot long service loop at the workstation. This loop shall be coiled and attached to the conduit stub-up or stub-out above ceiling. The coil shall be a minimum of 12 inches in diameter.

11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with ANSI/TIA-568-C.2.

2. Maintain a 1/2 inch (or less) untwist on UTP cables from the point of termination to maintain cable geometry.

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches above ceilings by J-hooks not more than 60 inches apart.

3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.

2. Install cabling after the flooring system has been installed in raised floor areas.

3. Coil cable 6 feet long not less than 12 inches in diameter below each feed point.

F. Group connecting hardware for cables into separate logical fields.

G. Separation from EMI Sources:

1. Comply with BICSI TDMM 13th edition and ANSI/TIA-569-C for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.

2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.

b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.

b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.3 FIRESTOPPING

A. Comply with ANSI/TIA-569-C, Annex A, "Firestopping."

B. Comply with BICSI TDMM 13th edition, "Firestopping Systems" Chapter 7.

3.4 GROUNDING

A. Install grounding according to BICSI TDMM 13th edition, Grounding, Bonding (Earthing) Chapter 8.

B. Comply with ANSI/TIA-607-B.

C. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.5 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with ANSI/TIA-606-B.
1. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.

B. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation.
1. Example Label – 121-A-1-D1, D2
    a. 121 – Room number
    b. A – Distribution frame identifier. IDF-A. Where cable originates.
    c. 1 – Patch panel identifier. Where cable originates.
    d. D1, D2 – Data jacks 1 and 2 in this outlet and room.

C. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

D. Paint and label colors for equipment identification shall comply with ANSI/TIA-606-A.

E. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

F. Cable and Wire Identification:
1. Label each cable at each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated. Provide three labels at

each end, spaced 12 inches apart. The first label shall be installed within four inches of the termination. Labels shall be visible from all sides of cable.

2. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

   a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.

   b. Label each unit and field within distribution racks and frames.

3. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in ANSI/TIA-606-B.

1. Use flexible vinyl or polyester, self-laminating, adhesive labels that flex as cables are bent.

3.6 FIELD QUALITY CONTROL

A. Perform Tests and Inspections:

1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with ANSI/TIA-568-C.1.

2. Visually confirm Category 5E/6, marking of outlets, cover plates, outlet/connectors, and patch panels.

3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

   a. Test instruments shall meet or exceed applicable requirements in ANSI/TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

4. UTP Cable Tests:

   a. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance.

   b. UTP performance test using a level IIe tester for Category 5e, level III tester for Category 6 and level IIIe for Category test cable. Test for each outlet and MUTOA. Perform the following tests according to ANSI/TIA-568-C.1 and ANSI/TIA-568-C.2:

      1) Wire map.

      2) Length (physical vs. electrical, and length requirements).

      3) Insertion loss.

      4) Near-end crosstalk (NEXT) loss.

      5) Power sum near-end crosstalk (PSNEXT) loss.

6) Equal-level far-end crosstalk (ELFEXT).

7) Power sum equal-level far-end crosstalk (PSELFEXT).

8) Return loss.

9) Propagation delay.

10) Delay skew.

5. Continuity: Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.

6. Length: Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA 568-C Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.

7. Final Verification Tests: Perform verification tests for UTP systems after the complete communications cabling and workstation outlet/connectors are installed.

   a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.

   b. Data Tests: Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

B. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

C. End-to-end cabling will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

1. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Engineer for approval. Documentation shall include the items detailed in the sub-sections below.

2. Documentation shall be submitted within ten (10) working days of the completion of each testing phase (e.g. subsystem, cable type, area, floor, etc.). This is inclusive of all test result and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase. At the request of the Engineer, the telecommunications contractor shall provide copies of the original test results.

3. The Engineer may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be

a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be required to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets.

3.8 WARRANTY

A. A warranty shall be provided for all internal infrastructure wiring as it pertains to voice and data networking for both copper and fiber systems. All installations must be performed according to the manufacturer's System Warranty and Performance Application.

B. The warranty will combine an extended product and applications assurance warranty for a minimum of 25 years.

C. An Extended Product Warranty shall be provided which warrants functionality of all components used in the system from the date of registration. The Extended Product Warranty shall warrant the installed horizontal and/or backbone copper, and both the horizontal and the backbone optical fiber portions of the cabling system.

D. The Application Assurance Warranty shall cover the failure of the wiring system to support the applications that are designed for the link/channel specifications of ANSI/TIA-568-B-1. These applications include, but are not limited to, 10BASE-T, 100BASE-T, 1000BASE-T and 155 Mb/s ATM.

E. The contractor shall provide a warranty on the physical installation.

3.9 FINAL ACCEPTANCE & SYSTEM CERTIFICATION

A. Completion of the installation, in-progress and final inspections, receipt of the tst and as-built documentation, and successful performance of the cabling system for a two week period will constitute acceptance of the system. Upon successful completion of the installation and subsequent inspection, the end user shall be provided with a certificate, from the manufacturer, registering the installation.

END OF SECTION 27 51 00

SECTION 28 31 11 – DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes .
3. System smoke detectors.
4. Nonsystem smoke detectors.
5. Heat detectors.
6. Notification appliances.
7. Firefighters' two-way telephone communication service.
8. Magnetic door holders.
9. Remote annunciator.
10. Addressable interface device.
11. Digital alarm communicator transmitter.
12. Radio alarm transmitter.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

A. Noncoded, UL-certified addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

1.5 SUBMITTALS

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
   a. Trained and certified by manufacturer in fire-alarm system design.
   b. NICET-certified fire-alarm technician, Level III minimum.
   c. Licensed or certified by authorities having jurisdiction.

B. Product Data: For each type of product indicated.

C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.

2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

D. Delegated-Design Submittal: For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.

E. Qualification Data: For qualified Installer.

F. Field quality-control reports.

G. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
   a. Frequency of testing of installed components.
   b. Frequency of inspection of installed components.
   c. Requirements and recommendations related to results of maintenance.
   d. Manufacturer's user training manuals.
5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.
7. Copy of NFPA 25.

H. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.

C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL.

F. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

G. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FMG-approved alarm company.

1.7 RENOVATIONS

A. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Construction Manager and Owner no fewer than two days in advance of proposed interruption of fire-alarm service.
2. Do not proceed with interruption of fire-alarm service without Construction Manager's and Owner's permission.

B. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.

C. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.8 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. NOTIFIER; a Honeywell company.
2. SimplexGrinnell LP; a Tyco International company.
3. Edwards/EST.
4. Siemens.
5. Silent Knight.
6. Fike

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Verified automatic alarm operation of smoke detectors.
6. Automatic sprinkler system water flow.
7. Fire-extinguishing system operation.
8. Fire standpipe system.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
7. Close smoke dampers in air ducts of designated air-conditioning duct systems.
8. Recall elevators to primary or alternate recall floors.
9. Activate emergency shutoffs for gas and fuel supplies.
10. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Elevator shunt-trip supervision.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
   a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
   b. Include a real-time clock for time annotation of events on the event recorder and printer.
2. Addressable initiation devices that communicate device identity and status.
   a. Smoke sensors shall additionally communicate sensitivity setting.
   b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
3. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.
   a. Initiating Device Circuits: Style D.
   b. Notification Appliance Circuits: Style Z.

c. Signaling Line Circuits: Style 5.

d. Install no more than 50 addressable devices on each signaling line circuit.

2. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.

a. Initiating Device Circuits: Style B.

b. Notification Appliance Circuits: Style X .

c. Signaling Line Circuits: Style 3.

d. Install no more than 50 addressable devices on each signaling line circuit.

3. Serial Interfaces: Two RS-232 ports for printers.

D. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.

2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire-alarm control unit and detector.

3. Record events by the system printer.

4. Sound general alarm if the alarm is verified.

5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

E. Elevator Recall:

1. Smoke detectors at the following locations shall initiate automatic elevator recall.

a. Elevator lobby detectors except the lobby detector on the designated floor.

b. Smoke detector in elevator machine room.

2. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.

3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.

a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

F. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.

G. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

H. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

I. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals,supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

J. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Vented, wet-cell pocket, plate nickel cadmium.

K. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.

2. Station Reset: Key- or wrench-operated switch.

3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.

4. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.5 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.

2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

3. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.

4. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

5. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.

6. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.

b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.

c. Provide multiple levels of detection sensitivity for each sensor.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.

2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

a. Primary status.

b. Device type.

c. Present average value.

d. Present sensitivity selected.

e. Sensor range (normal, dirty, etc.).

C. Ionization Smoke Detector:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.

2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

a. Primary status.

b. Device type.

c. Present average value.

d. Present sensitivity selected.

e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.

2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

a. Primary status.

b. Device type.

c. Present average value.

d. Present sensitivity selected.

e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.

4. Each sensor shall have multiple levels of detection sensitivity.

5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.

6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.6 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.

1. Mounting: Adapter plate for outlet box mounting.

2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.7 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling line circuit, equipped for mounting as indicated and with screw terminals for system connections.

B. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

C. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.

D. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.

E. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.

F. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch high letters on the lens.

1. Rated Light Output:

a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.

3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.

4. Flashing shall be in a temporal pattern, synchronized with other units.

5. Strobe Leads: Factory connected to screw terminals.

6. Mounting Faceplate: Factory finished, red.

2.8 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnet: Requires no more than 3 W to develop 25-lbf (111-N) holding force.

2. Wall-Mounted Units: Flush mounted unless otherwise indicated.

3. Rating: 24-V ac or dc.

4. Rating: 120-V ac.

B. Material and Finish: Match door hardware.

2.9 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.10 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

B. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall.

2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply or loss of power.
5. Low battery.
6. Abnormal test signal.
7. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.12 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

1. Factory fabricated and furnished by manufacturer of device.

2. Finish: Paint of color to match the protected device.

2.13 SURGE PROTECTION

A. Acceptable Manufacturers:

1. 120Volt/20 Amp – Ditek 120SR

2. Analog Dialer – Ditek 2MHTPWB

3. IP Dialer – Ditek MRJ45C5E

4. Exterior Fire Alarm Circuits – Ditek LVLP Series

5. The above list of equipment represents a minimum standard of quality. It is not intended to limit the acceptable manufacturers. Equivalent surge protection devices may be provided by other manufacturers.

B. Provide surge protection for the following:

1. 120 Volt AC circuits connected to the control panel, extender panels and any other fire alarm device requiring 120 Volt connections.

2. All exterior fire alarm circuits.

3. IP or analog automatic dialers. Provide protection on the telephone or data cables extending to/from the dialer.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Connecting to Existing Equipment in Renovated Spaces: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to existing control panel in existing part of the building.

2. Connect new equipment to existing monitoring equipment at the supervising station.

3. Expand, modify, and supplement existing control and monitoring equipment as necessary to extend existing control and monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

C. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.

2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.

3. Smooth ceiling spacing shall not exceed 30 feet.

4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A or Appendix B in NFPA 72.

5. Remote Booster Power Supplies: These are not shown on the contract documents. This is part of the delegated design and the location and quantities are left to the discretion of the contractor. System smoke detectors shall be installed at each remote power supply location.

6. HVAC: Locate detectors not closer than 5 feet from air-supply diffuser or return-air opening.

7. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.

D. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Connect the integral relay to the associated HVAC equipment as required to shut down the fan(s). Coordinate all work with the Mechanical contractor.

E. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

F. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

G. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.

H. Device Location-Indicating Lights: Locate in public space near the device they monitor.

I. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches above the finished floor.

J. Annunciator: Install with top of panel not more than 72 inches above the finished floor.

3.2 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.

2. Smoke dampers in air ducts of designated air-conditioning duct systems.

3. Alarm-initiating connection to elevator recall system and components.

4. Supervisory connections at valve supervisory switches.

5. Supervisory connections at elevator shunt trip breaker.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Basic Electrical Material and Methods."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.5 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.

b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.

4. Test audible appliances for the private operating mode according to manufacturer's written instructions.

5. Test visible appliances for the public operating mode according to manufacturer's written instructions.

6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

3.7 MONITORING

A. The contractor is responsible for providing a U.L. Listed fire alarm monitoring service for one year after substantial completion.

END OF SECTION 28 31 11

ACORD

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 06/26/2019

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 Willis Towers Watson Midwest, Inc. fka Willis of Minnesota, Inc. c/o 26 Century Blvd P.O. Box 305191 Nashville, TN 372305191 USA	**CONTACT NAME:** **PHONE (A/C, No, Ext):** 1-877-945-7378 **FAX (A/C, No):** 1-888-467-2378 **E-MAIL ADDRESS:** certificates@willis.com
INSURED Landmark Sprinkler, Inc. 2317 Frankfort Court Lexington, KY 40510	**INSURER(S) AFFORDING COVERAGE** — **NAIC #** INSURER A: Insurance Company of the State of Pennsylv — 19429 INSURER B: National Union Fire Insurance Company of P — 19445 INSURER C: AXIS Surplus Insurance Company — 26620 INSURER D: New Hampshire Insurance Company — 23841 INSURER E: INSURER F:

COVERAGES **CERTIFICATE NUMBER:** W11771253 **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] Contractual Liability GEN'L AGGREGATE LIMIT APPLIES PER: [ ] POLICY [X] PRO-JECT [ ] LOC [ ] OTHER:	Y		GL 746-88-12	12/31/2018	12/31/2019	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG	$ 2,000,000 $ 1,000,000 $ 10,000 $ 2,000,000 $ 4,000,000 $ 4,000,000
B	AUTOMOBILE LIABILITY [X] ANY AUTO [ ] OWNED AUTOS ONLY [ ] SCHEDULED AUTOS [X] HIRED AUTOS ONLY [X] NON-OWNED AUTOS ONLY			CA 657-93-31	12/31/2018	12/31/2019	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident)	$ 5,000,000 $ $ $
C	[ ] UMBRELLA LIAB [X] OCCUR [X] EXCESS LIAB [ ] CLAIMS-MADE [ ] DED [ ] RETENTION $			P-001-000068228-01	12/31/2018	12/31/2019	EACH OCCURRENCE AGGREGATE	$ 5,000,000 $ 5,000,000
D	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANYPROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? Y/N No (Mandatory In NH) If yes, describe under DESCRIPTION OF OPERATIONS below	N/A		WC 014-62-9635	12/31/2018	12/31/2019	[X] PER STATUTE [ ] OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	$ 1,000,000 $ 1,000,000 $ 1,000,000

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

Stop Gap Employers Liability for the Monopolistic States of North Dakota, Ohio, Washington and Wyoming is provided under Workers' Compensation policy, however, Statutory coverage for the Monopolistic states is not.

Project Name/Description: Fire Protection System Replacement @ The Material Recovery Facility; 360 Thompson Road, Lexington, Kentucky

CERTIFICATE HOLDER

LFUCG
200 East Main Street
Lexington, KY 40507

CANCELLATION

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

Eric J. Hou

SR ID: 18170556 BATCH: 1259538

AGENCY CUSTOMER ID: _____

LOC #: _____

ADDITIONAL REMARKS SCHEDULE

AGENCY		NAMED INSURED
Willis Towers Watson Midwest, Inc. fka Willis of Minnesota, Inc.		Landmark Sprinkler, Inc. 2317 Frankfort Court Lexington, KY 40510
POLICY NUMBER See Page 1		
CARRIER See Page 1	NAIC CODE See Page 1	EFFECTIVE DATE: See Page 1

ADDITIONAL REMARKS

THIS ADDITIONAL REMARKS FORM IS A SCHEDULE TO ACORD FORM,

FORM NUMBER: 25 FORM TITLE: Certificate of Liability Insurance

LFUCG is included as Additional Insured under the General Liability policy when required by written contract, agreement or permit and executed prior to the loss.

SR ID: 18170556 BATCH: 1259538 CERT: W11771253

ENDORSEMENT #MAN002

This endorsement, effective 12:01 A.M. **12/31/2018** forms a part of

Policy No. GL 746-88-12 issued to API GROUP, INC.

BY Insurance Company of the State of Pennsylvania

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

AMENDATORY ENDORSEMENT - ADDITIONAL INSURED - OWNERS, LESSEES OR CONTRACTORS - COMPLETED OPERATIONS

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE FORM

Schedule

Name of Additional Insured Person(s) or Organization(s)	Location(s) of Covered Operations
Blanket when required by written contract, agreement, or permit and is executed prior to loss.	All projects or locations where required by written contract.

Information required to complete this Schedule, if not shown above, will be shown in the Declarations

Section II - Who is An Insured is amended to include as an additional insured the person(s) or organization(s) shown in the Schedule, but only to the extent of liability for "bodily injury" or "property damage" caused by your negligent acts or omissions in the completion of your work at the location designated and described in the schedule of this endorsement performed for that additional insured and included in the "products-completed operations hazard".

Thomas A. Gardner

Authorized Representative

ENDORSEMENT #MAN001

This endorsement, effective 12:01 A.M. 12/31/2018 forms a part of

Policy No. GL 746-88-12 **issued to** API GROUP, INC

BY Insurance Company of the State of Pennsylvania

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

AMENDATORY ENDORSEMENT - ADDITIONAL INSURED - OWNERS, LESSEES OR CONTRACTORS – SCHEDULED PERSON OR ORGANIZATION

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE FORM

Schedule

Name of Additional Insured Person(s) or Organization(s)	Location(s) of Covered Operations
Blanket when required by written contract, agreement, or permit and is executed prior to loss.	All projects or locations where required by written contract.

Information required to complete this Schedule, if not shown above, will be shown in the Declarations

A. Section II – Who is An Insured is amended to include as an additional insured the person(s) or organization(s) shown in the Schedule, but only to the extent of liability for "bodily injury", "property damage" or "personal and advertising injury" caused by: :

1. Your negligent acts or omissions; or

2. The negligent acts or omissions of those acting on your behalf;

In the performance of your ongoing operations for the additional insured(s) at the location(s) designated above.

B. With respect to the insurance afforded to these additional insureds, the following additional exclusions apply:

1. All work, including materials, parts or equipment furnished in connection with such work on the project (other than service, maintenance, or repair(s) to be performed by or on behalf of the additional Insured(s) at the location of the covered operations has been completed; or

2. That portion of "your work" out of which the injury or damage arises has been put to its intended use by any person or organization other than another contractor or subcontractor engaged in performing operations for a principal as a part of the same project.

Thomas A. Bandura

Authorized Representative

LFUCG MATERIAL RECYCLING CENTER - PHASE 2 - FIRE PROTECTION

BID NUMBER___-2019

360 THOMPSON ROAD
LEXINGTON, KENTUCKY 40508

APRIL 22, 2019
100% BID DOCUMENTS

OWNER:
LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT
200 E MAIN ST
LEXINGTON, KY 40507

BID ALTERNATES
#1 - FIVE YEAR SERVICE CONTRACT

MECHANICAL / ELECTRICAL ENGINEER:
SHROUT TATE WILSON CONSULTING ENGINEERS, PLLC.
628 WINCHESTER ROAD
LEXINGTON, KY 40505
859-277-8177

DRAWING INDEX

100% OWNER REVIEW

4/22/2019

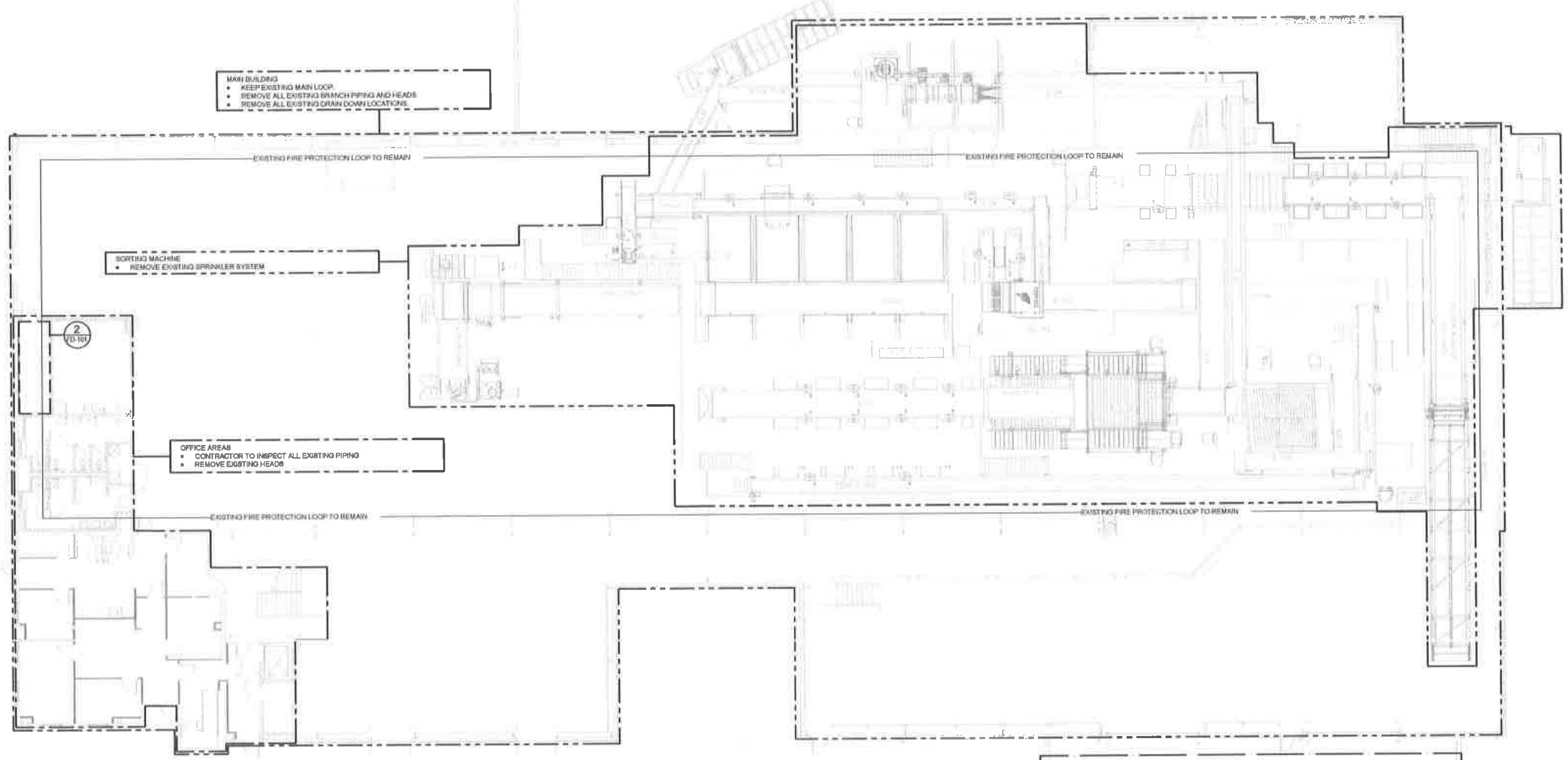
SHROUT TATE WILSON MECHANICAL AND ELECTRICAL ENGINEERS
Lexington - Louisville
www.stweng.com

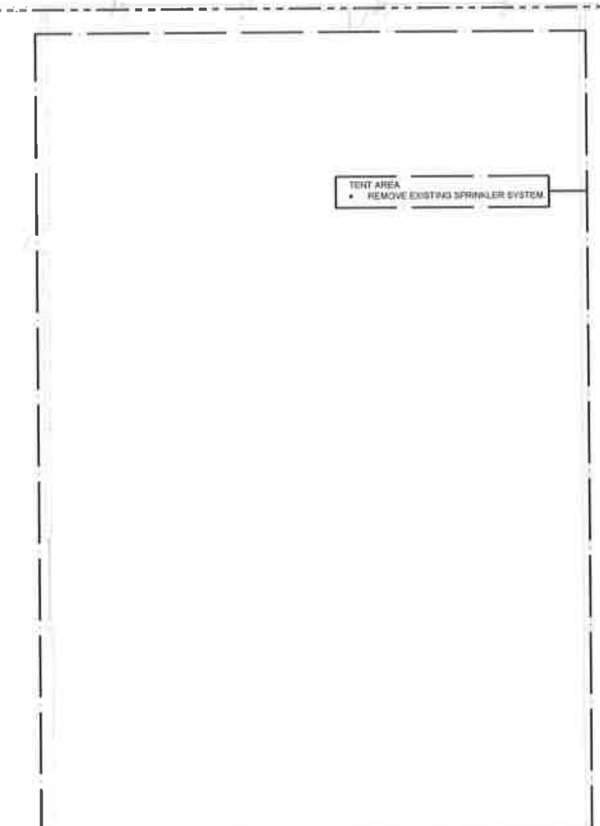
COVER SHEET

LFUCG - MATERIAL RECYCLING CENTER - PHASE 2 - FIRE PROTECTION
360 THOMPSON ROAD LEXINGTON, KENTUCKY 40508

REVISIONS

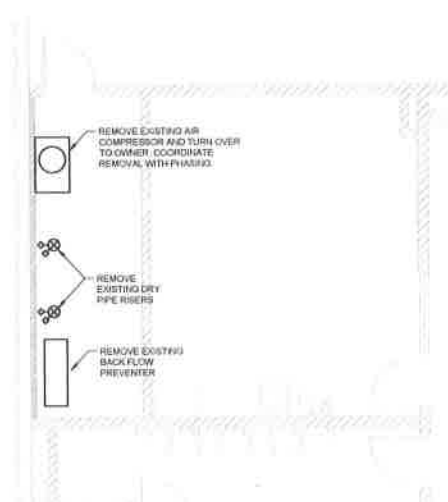
DATE 4/22/2019
SCALE NONE
SHEET NO
G-101





1 FLOOR PLAN - FIRE PROTECTION DEMOLITION

PLAN NORTH



2 FIRE PROTECTION DEMOLITION ENLARGED FLOOR PLAN -

SCALE: 1/4"=1'-0"

PLAN NORTH

4/22/2019

100% OWNER REVIEW

STW PROJECT NO. 19016

SHROUT TATE WILSON
MECHANICAL AND ELECTRICAL ENGINEERS
Lexington - Louisville
www.stweng.com

FLOOR PLAN
FIRE PROTECTION DEMOLITION

LFUCG - MATERIAL RECYCLING CENTER - PHASE 2 - FIRE PROTECTION

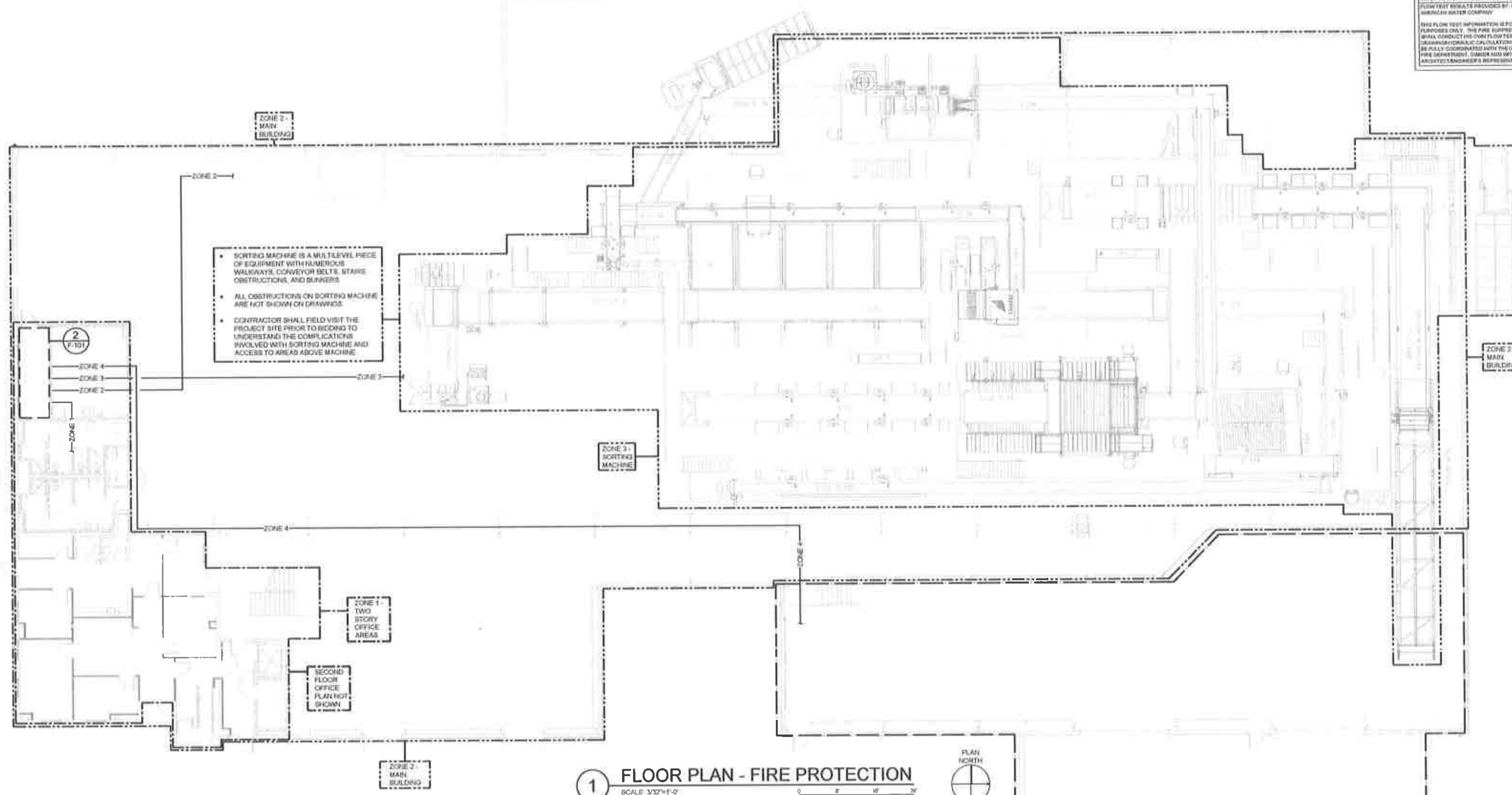
360 THOMPSON ROAD LEXINGTON, KENTUCKY 40508

REVISIONS

NO.	DESCRIPTION	DATE

SCALE CHECK: THIS MARK SHOULD MEASURE EXACTLY 1" WHEN PLOTTED

DATE: 4/22/2019
SCALE: VARIES
SHEET NO. FD-101



1 FLOOR PLAN - FIRE PROTECTION
SCALE 3/32"=1'-0"

PLAN NORTH

ZONE 1 - OFFICE AREAS
- TWO STORY
- CONTRACTOR TO INSPECT ALL EXISTING PIPING TO CONFIRM THE CONDITION IS ACCEPTABLE TO REMAIN IN PLACE
- REPLACE ALL HEADS

ZONE 2 - MAIN BUILDING
- KEEP AND REUSE EXISTING MAIN LOOP THAT WAS REPLACED IN 2016
- REPLACE ALL EXISTING BRANCH PIPING AND HEADS
- COVERAGE AREAS SHALL MATCH EXISTING.

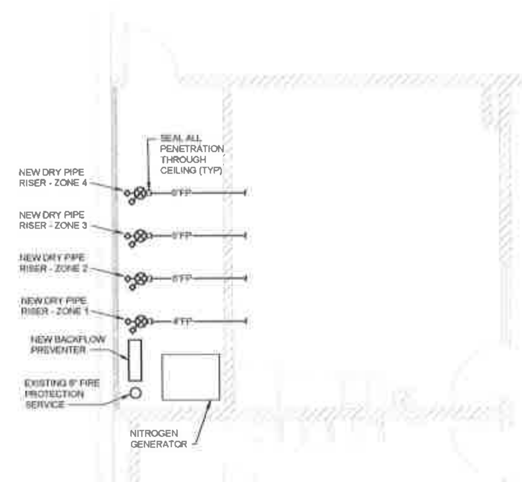
ZONE 3 - SORTING MACHINE
- REMOVE EXISTING SPRINKLER SYSTEM
- INSTALL 100% NEW SYSTEM.
- MINIMIZE DRAIN LOCATIONS.

ZONE 4 - TENT AREA
- REMOVE EXISTING SPRINKLER SYSTEM
- INSTALL 100% NEW SYSTEM
- MINIMIZE DRAIN LOCATIONS

WATER FLOW TEST RESULTS
REFER TO SPECIFICATION SECTION [illegible] - FLOW TEST
FLOW TEST RESULTS PROVIDED BY: KENTUCKY AMERICAN WATER COMPANY
THIS FLOW TEST INFORMATION IS FOR BIDDING PURPOSES ONLY. THE FIRE SUPPRESSION CONTRACTOR SHALL CONDUCT HIS OWN FLOW TEST FOR USE IN SHOP DRAWINGS/HYDRAULIC CALCULATIONS. THE TEST SHALL BE FULLY COORDINATED WITH THE UTILITY COMPANY, FIRE DEPARTMENT, OWNER AND WITNESSED BY THE ARCHITECT/ENGINEER'S REPRESENTATIVE.

FIRE PROTECTION GENERAL NOTES

1 BID ALTERNATE #1 CONTRACTOR SHALL INCLUDE, IN HIS BID, COST FOR A MAINTENANCE AGREEMENT FOR 5 YEARS FROM DATE OF FINAL COMPLETION REFER TO SPECIFICATIONS FOR CONTRACT REQUIREMENTS
2 ALL FIRE-SUPPRESSION WORK SHALL BE PERFORMED BY A LICENSED FIRE-SUPPRESSION CONTRACTOR WITH A MINIMUM OF 5 YEARS EXPERIENCE DESIGN AND ERECTING FIRE-SUPPRESSION SYSTEMS
3 PROVIDE A COMPLETE FIRE-SUPPRESSION SYSTEM INCLUDING MODIFICATIONS TO EXISTING WORK, NEW PIPING AND ACCESSORIES, AND TESTING AS REQUIRED TO MEET ALL PROVISIONS OF THE KENTUCKY BUILDING CODE AND ALL APPLICABLE NFPA CODES
4 THE FIRE-SUPPRESSION CONTRACTOR SHALL HYDRAULICALLY DESIGN AND SIZE THE MAIN SERVICE AND SPRINKLER SYSTEM TO FULLY PROTECT THE ENTIRE BUILDING IN COMPLIANCE WITH THE KENTUCKY BUILDING CODE, NFPA-13, NFPA-14, NFPA-20, NFPA-24, AND LOCAL CODES THE FIRE-SUPPRESSION CONTRACTOR SHALL PROVIDE AND SUBMIT DRAWINGS AND HYDRAULIC CALCULATIONS TO THE MECHANICAL ENGINEER FOR REVIEW AND ALL AHJ FOR CODE APPROVAL
5 COORDINATE HEAD TYPES WITH LOCATIONS STRUCTURAL MEMBERS SHALL NOT BE CUT OR COMPROMISED IN ANY WAY DO NOT MOUNT SPRINKLER HEADS OR HANG PIPING SO AS TO BLOCK ACCESS TO HVAC OR ELECTRICAL EQUIPMENT DO NOT INSTALL PIPING OVER ELECTRICAL PANELS/SWITCHGEAR OR THE 36" CLEARANCE IN FRONT OF THESE ELECTRICAL ITEMS COORDINATE ADDITIONAL REQUIREMENTS WITH NEC FIRE-SUPPRESSION CONTRACTOR SHALL COORDINATE AND SCHEDULE ALL FIRE-SUPPRESSION WORK WITH THE GENERAL CONTRACTOR AND ACCOMMODATE CONSTRUCTION PHASING REQUIREMENTS AND ALL OTHER TRADES AS REQUIRED
6 REPAIR ALL SURFACES DISTURBED BY CONSTRUCTION TO MATCH EXISTING CONDITIONS
7 ALL AUXILIARY DRAINS SHALL HAVE LOCKABLE VALVES CONTRACTOR TO SUPPLY LOCKS AND KEYS
8 ALL FIRE-SUPPRESSION COMPONENTS INCLUDING BUT NOT LIMITED TO VALVES, PIPE, FITTINGS, CONTROL SYSTEMS, AND TRIM SHALL BE UL AND/OR FM LISTED FOR FIRE SERVICE AS REQUIRED BY THE KENTUCKY BUILDING CODE AND/OR THE AUTHORITY HAVING JURISDICTION
9 PROVIDE GUARDS AND/OR SPECIAL HEADS AS REQUIRED FOR A COMPLETE AND FUNCTIONAL DESIGN AND INSTALLATION AND AS REQUIRED TO COMPLY WITH NFPA-13 PROVIDE HIGH TEMPERATURE HEADS FOR AREAS NEAR SPACE HEATING OUTLETS AND EQUIPMENT AS REQUIRED
10 NEW OPENINGS FOR FIRE-SUPPRESSION ITEMS SHALL BE CUT, SLEEVED, ETC BY THE FIRE-SUPPRESSION CONTRACTOR ALL OPENINGS SHALL BE CORE DRILLED OR SAW-CUT NO HAMMER DRILLING WILL BE ALLOWED.
11 COMPLIANCE WITH NFPA-13 IS THE RESPONSIBILITY OF THE FIRE SUPPRESSION CONTRACTOR ALL AREAS NOT SHOWN TO BE SPRINKLERED BUT REQUIRED TO BE SPRINKLERED PER NFPA-13 SHALL BE SPRINKLERED IN COMPLIANCE WITH THE CONTRACT DOCUMENTS AND AS PART OF THE DELEGATED DESIGN AND INSTALLATION PROCESS
12 CONTRACTOR SHALL PROVIDE PROVISIONS AND COSTS IN THEIR BID FOR SPECIALIZED EQUIPMENT, LIFTS AND ARTICULATING BOOMS THAT WILL BE NECESSARY TO INSTALL PIPING AND HEADS IN MAIN BUILDING ABOVE SORTING MACHINE, AND ALL OTHER AREAS AS REQUIRED. VERIFY LOCATIONS OF ALL EXISTING EQUIPMENT
13 EXISTING MAIN BUILDING AND TENT = 50,000 SQUARE FEET
14 ALL NEW PIPING TO BE SCHEDULE 40
15 MINIMIZE THE NUMBER OF DRUM DRIP LOCATIONS



2 FLOOR PLAN - FIRE PROTECTION
SCALE 1/4"=1'-0"

PLAN NORTH

100% OWNER REVIEW

4/22/2019

STW PROJECT NO 19016

SHROUT TATE WILSON
MECHANICAL AND ELECTRICAL ENGINEERS
Lexington - Louisville
www.stweng.com

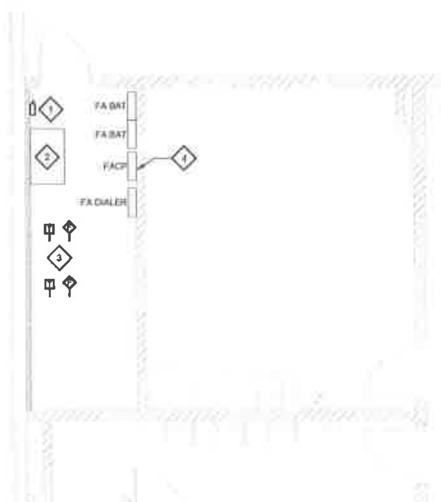
XXX
XXX

LFUCG - MATERIAL RECYCLING CENTER - PHASE 2 - FIRE PROTECTION
360 THOMPSON ROAD LEXINGTON, KENTUCKY 40508

REVISIONS

NO	DESCRIPTION	DATE

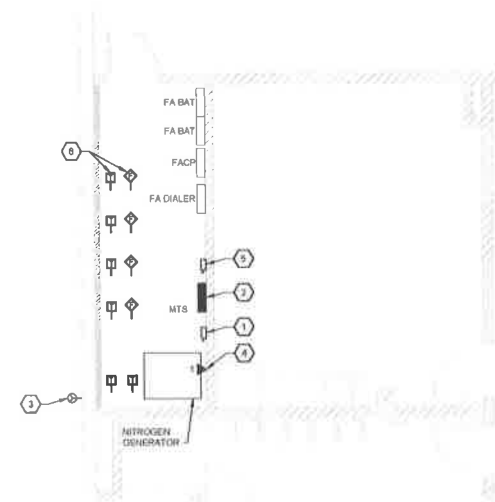
DATE 4/22/2019
SCALE VARIES
SHEET NO
F-101



1 ENLARGED FLOOR PLAN - ELECTRICAL DEMOLITION

SCALE: 1/4"=1'-0"

PLAN NORTH



2 ENLARGED FLOOR PLAN - ELECTRICAL NEW WORK

SCALE: 1/4"=1'-0"

PLAN NORTH

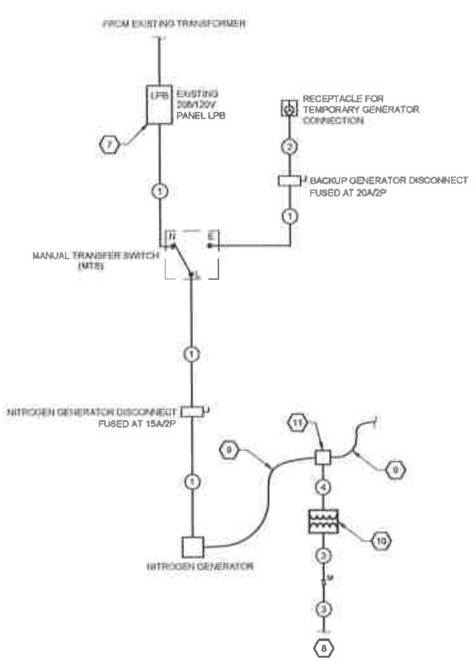
GENERAL NOTES:

DEMOLITION:

1. ALL ELECTRICAL DEVICES SHOWN AS LIGHTER WEIGHT ARE EXISTING TO REMAIN UNLESS OTHERWISE NOTED.
2. ALL ELECTRICAL DEVICES SHOWN IN HEAVIER WEIGHT SHALL BE REMOVED WHERE SHOWN ON THE DEMOLITION PLAN UNLESS OTHERWISE NOTED.
3. CONDUCTORS FOR REMOVED DEVICES AND EXPOSED CONDUITS SHALL BE REMOVED.
4. THE ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR PATCHING AND REPAIRING ALL AREAS WHERE WALLS, SLABS AND MATERIALS HAVE BEEN CUT, REMOVED OR MODIFIED AS A RESULT OF DEMOLITION. PATCHING AND REPAIRS SHALL MATCH THE ADJACENT EXISTING MATERIALS, RATINGS AND FINISHES.
5. COORDINATE WITH FIRE PROTECTION CONTRACTOR FOR TIMING/SEQUENCE OF ELECTRICAL DEMOLITION ASSOCIATED WITH MECHANICAL EQUIPMENT. REFER TO THE FIRE PROTECTION PLANS FOR LOCATION OF EQUIPMENT REQUIRING ELECTRICAL DEMOLITION. THE ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR REMOVING THE ELECTRICAL CONNECTION TO EQUIPMENT.
6. ALL EXISTING UTILITIES AND DEVICES SHOWN HAVE BEEN COMPILED FROM SITE SURVEYS, RECORD DRAWINGS AND VISUAL SITE INSPECTIONS. ALL DEVICES ITEMS TO BE REMOVED MAY NOT BE SHOWN ON THIS DRAWING. THE CONTRACTOR SHALL VISIT THE SITE PRIOR TO BID TO BECOME FAMILIAR WITH THE EXTENT OF THE DEMOLITION WORK REQUIRED.
7. THE ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR KEEPING ALL EXISTING DEVICES AND SYSTEMS ACTIVE UNTIL THEY ARE DEMOLISHED IN THEIR RESPECTIVE PHASES. PROVIDE ALL TEMPORARY CONNECTIONS AS REQUIRED. COORDINATE ALL DEMOLITION WORK WITH THE TIMING/SEQUENCE OF NEW WORK.

SYSTEMS:

1. ALL FIRE ALARM CABLING SHALL BE INSTALLED WITHIN A MINIMUM OF 3/4 INCH CONDUIT.
2. ALL ELECTRICALLY CONDUCTIVE CABLES THAT ARE CONNECTED TO EXTERIOR MOUNTED DEVICES SHALL BE PROVIDED WITH A SURGE PROTECTIVE DEVICE. INCLUDING, BUT NOT LIMITED TO, FIRE ALARM CABLES FOR TAMPER AND FLOW SWITCHES, SECURITY CAMERAS AND INTERCOM SPEAKERS.
3. CONNECT NEW FIRE ALARM DEVICES TO THE EXISTING FIRE ALARM SYSTEM. PROVIDE MODIFICATIONS TO THE EXISTING SYSTEM AS NECESSARY TO ACCOMMODATE ALL NEW DEVICES AND CONNECTIONS.



○ ONE LINE SCHEDULE	
1	3#12, 1#12G, 1"C
2	3#10, 1#10G, 1"C
3	2#12, 1#12G, 3/4"C
4	2#14, 1#14G, 3/4"C

3 ONE-LINE DIAGRAM

NOT TO SCALE

◇ DEMOLITION KEYNOTES:

1. DEMOLISH EXISTING DISCONNECT
2. DISCONNECT EXISTING AIR COMPESSOR. TURN OVER EQUIPMENT TO OWNER
3. DEMOLISH EXISTING TAMPER, FLOW, AND/OR PRESSURE SWITCHES IN ROOM. FIELD SURVEY REQUIRED TO DETERMINE EXACT QUANTITY.
4. EXISTING FIRE ALARM CONTROL PANEL, NOTIFIER AFP-200, TO REMAIN.

⬡ NEW WORK KEYNOTES:

1. PROVIDE A 240V, 30A, 2 POLE, SAFETY SWITCH FUSED AT 15A IN A NEMA 1 ENCLOSURE. COORDINATE LOCATION WITH PLUMBING CONTRACTOR. MAKE FINAL CONNECTION TO NITROGEN GENERATOR.
2. PROVIDE 240V, 30A, 2 POLE MANUAL TRANSFER SWITCH, SCHNEIDER ELECTRIC 82251 OR EQUAL.
3. PROVIDE WEATHER PROOF POWER INLET BOX WITH TWIST LOCK L14-30P CONNECTION FOR TEMPORARY GENERATOR CONNECTION. PROVIDE HEAVY DUTY SO CORD, 20 FEET LONG, RATED FOR OUTDOOR USE, WITH A WEATHERPROOF L14-30 RECEPTACLE CONNECTOR ON ONE END. TURN CORD OVER TO OWNER.
4. PROVIDE CAT NETWORK/DATA DROP FROM NEAREST MDF/IDF FOR NITROGEN GENERATOR COMMUNICATION/ALARMS.
5. PROVIDE A 240V, 30A, 2 POLE, SAFETY SWITCH FUSED AT 20A IN A NEMA 1 ENCLOSURE. COORDINATE LOCATION WITH PLUMBING CONTRACTOR. MAKE FINAL CONNECTION TO NITROGEN GENERATOR.
6. PROVIDE FIRE ALARM CONNECTION TO TAMPER AND FLOW SWITCHES. COORDINATE WITH FIRE PROTECTION CONTRACTOR. TYPICAL.
7. PROVIDE NEW 15A/2P CIRCUIT BREAKER IN PANEL LPB TO FEED NEW MANUAL TRANSFER SWITCH.
8. PROVIDE 120V, 15A OR 20A CONNECTION FROM NEAREST UNSWITCHED LIGHTING OR RECEPTACLE CIRCUIT TO (4) PURGE VALVES TO BE LOCATED BY FIRE PROTECTION CONTRACTOR.
9. CONNECT 'INB SERIES NITROGEN GENERATOR' TO 'INTELLIPURGE NITROGEN PURGE VALVES' VIA COMMUNICATION CABLE AS SPECIFIED BY MANUFACTURER. (BASIS OF DESIGN EQUIPMENT DESCRIBED, EQUALS ARE PERMISSIBLE.)
10. 120V, 24V, 40VA TRANSFORMER PROVIDED BY THE FIRE PROTECTION CONTRACTOR. ELECTRICAL CONTRACTOR TO PROVIDE ALL CONNECTS. COORDINATE LOCATION OF TRANSFORMERS WITH FIRE PROTECTION CONTRACTOR. TYPICAL OF FOUR (4)
11. PURGE VALVES PROVIDED BY THE FIRE PROTECTION CONTRACTOR. ELECTRICAL CONTRACTOR TO PROVIDE ALL CONNECTIONS. COORDINATE LOCATION OF VALVES WITH FIRE PROTECTION CONTRACTOR. TYPICAL OF FOUR (4)

ELECTRICAL LEGEND

MISC

SYMBOL	DESCRIPTION
^{M}	MANUAL MOTOR STARTER W/ HANDLE GUARD KIT AND PADLOCK
XXX	PANEL
	DOUBLE THROW SWITCH OR TRANSFER SWITCH
X	TAMPER RESISTANT SPECIAL PURPOSE RECEPTACLE
	DISCONNECT SWITCH (SIZE/FUSING/POLES/NEMA - OPTIONAL)
	TRANSFORMER

FIRE ALARM

SYMBOL	DESCRIPTION
F	FIRE ALARM MANUAL PULL STATION
	FIRE ALARM STROBE (WALL & CEILING)
F	FIRE ALARM COMBINATION AUDIO/VISUAL APPLIANCE (WALL & CEILING)
S H A	FIRE ALARM DEVICE - SUBSCRIPT INDICATES THE FOLLOWING : S - SMOKE DETECTOR, H - HEAT DETECTOR, A - ADDRESSABLE MODULE
XX	FIRE ALARM DUCT TYPE SMOKE DETECTOR
	WALL MOUNTED MAGNETIC DOOR HOLDER
	FLOOR MOUNTED MAGNETIC DOOR HOLDER
	FIRE ALARM TAMPER SWITCH
	FIRE ALARM FLOW SWITCH
	FIRE ALARM CONTROL PANEL. PANEL IS RECESSED TYPE WHEN SHOWN WITHIN WALLS ON DRAWING.
	FIRE ALARM ANNUNCIATOR. PANEL IS RECESSED TYPE WHEN SHOWN WITHIN WALLS ON DRAWING.

4/22/2019

100% OWNER REVIEW

STW PROJECT NO. 19016

SHROUT TATE WILSON
MECHANICAL AND ELECTRICAL ENGINEERS
Lexington – Louisville
www.stweng.com

ELECTRICAL

LFUCG - MATERIAL RECYCLING CENTER - PHASE 2 - FIRE PROTECTION

360 THOMPSON ROAD LEXINGTON, KENTUCKY 40508

REVISIONS

NO.	DESCRIPTION	DATE

DATE
4/22/2019

SCALE
VARIES

SHEET NO.

E-101