

**DIVISION 14**  
**CONVEYING SYSTEMS**

## SECTION 14556 - SCREW CONVEYORS

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Section Includes: Labor, materials, and equipment necessary for fabrication, production, delivery, and training for the items specified in this Section as shown on Drawings or listed on Schedule.
- B. Related Sections: General provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections and the following sections apply to the Work of this Section.
  - 1. Section 05500 Metal Fabrications
  - 2. Section 05520 Handrails and Railings
  - 3. Section 05530 Grating
- C. Products Furnished But Not Installed Under This Section: Anchor bolts shall be installed by installation Contractor in accordance with certified prints furnished by equipment manufacturer.

#### 1.02 REFERENCES

- A. Reference Standards:
  - 1. ASTM A 36 Steel
  - 2. ASTM A 242 Steel
  - 3. ASTM A 588 Steel
  - 4. SAE 4140 Hi-Carbon Flats
  - 5. AGMA American Gear Manufacturers Association
  - 6. CEMA Conveyor Equipment Manufacturers Association
  - 7. AWS D.1.1-90 American Welding Society

#### 1.03 SYSTEM DESCRIPTION

- A. Design Requirements: The design of the screw conveyors shall be the standard of manufacturer and as shown on Drawings. The conveyors shall have suitable length and shall operate at the angles shown on Drawings. The screw conveyors shall be sized for a maximum trough loading of 20 percent at the loadings shown on Schedule.
  - 1. The screw conveyors shall be designed to fit as detailed on Drawings and to accommodate the configuration shown. Conveyor loading and discharge points shall be coordinated with actual conditions and the equipment being provided.
  - 2. The screw rotational speed shall not exceed the value noted on the Schedule.
- B. Performance Requirements: The screw conveyors will perform as required to meet the conditions noted on Schedule. The equipment shall handle the material noted below and at the loading and speed indicated. The equipment shall also be able to withstand any installation loads imposed.
  - 1. All necessary supports shall be provided to adequately mount the conveyor equipment without excessive deflections or vibrations and support layout shall accommodate maintenance access, support platforms and any other obstructions shown or indicated on Drawings.

2. Shaftless screw conveyors shall convey wastewater screenings captured on a mechanical bar screen and then compacted, washed and dried by a screenings compactor. The discharged material shall be assumed to be same diameter as the compactor discharge chute and fall into the conveyor in large heavy pieces. At times excess water may also be present in the discharged material.
3. Screw conveyors shall have shafted screws and shall convey wastewater grit. In general the grit will be washed however it will contain organics and at times relatively large amounts of water will also be discharged into the conveyor.

#### **1.04 SUBMITTALS**

- A. Shop Drawings: Submit in accordance with Section 01300, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
  1. Conveyor data sheet including typical cuts and all materials of construction.
  2. General arrangement Drawings.
  3. Sections and details.
  4. Support loadings that will be transmitted to the building structure.
  5. Conveyor torque, drive and HP calculations.
  6. Motor data sheets.
  7. Component and accessory details.
  8. Wiring diagrams for control panels.
- B. Test and Inspection Report: A written report shall be submitted to the Engineer documenting testing and/or inspection results for each visit to construction Site. The report shall be prepared as noted in this Section.
- C. As-Constructed Drawings: Under this Section, manufacturers shall furnish Owner 6 sets of as-constructed Drawings.
- D. Operation and Maintenance Manuals: Submit in accordance with requirements of Section 01780, operation and maintenance manuals for items included under this Section.
- E. Warranty: Submit in accordance with requirements of Section 01782, warranties covering the items included under this Section.

#### **1.05 QUALITY ASSURANCE**

- A. Regulatory Requirements: All equipment furnished under this Section shall meet the requirements of the Federal Occupational Safety and Health Act (OSHA). Each equipment supplier shall submit to Engineer certification that equipment furnished is in compliance with OSHA and MIOSHA.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Storage and Protection: Equipment shall be delivered to the Site, unloaded, stored, and protected as recommended by equipment manufacturer and approved by Engineer.

#### **1.07 MAINTENANCE**

- A. Extra Materials:

1. Provide one set for each shaftless screw:
  - a. 1 set of trough liners (formed and banded to shape)
  - b. 1 zero speed switch
  - c. 1 packing gland set
  - d. Manufacturers recommended spare parts for control panels (fuses, bulbs, etc.)
  
2. Provide one set for each screw:
  - a. 1 zero speed switch
  - b. 3 sets of packing
  - c. 1 set of replacement brushes
  - d. 2 sets of hanger bearing inserts
  - e. 2 sets of shaft couplings
  - f. Manufacturers recommended spare parts for control panels (fuses, bulbs, etc.)

## **PART 2 – PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:

Shaftless Screw Conveyors:

1. Custom Conveyor Corporation.
  
2. Huber Technology.

Screw Conveyors:

1. Custom Conveyor Corporation.
  
2. Huber Technology.

### **2.02 MATERIALS**

- A. Materials of Construction shall include:

- |   |  |
|---|--|
| 1. Trough bodies, End Plates              | 304 stainless steel plate, 3/16-inch thick, minimum  |
| 2. Spiral Screw Flighting<br>220 Brinnell | Hot Rolled micro-alloy steel bar minimum hardness    |
| 3. Shaftless Screw End Shaft              | C1045 medium tensile steel                           |
| 4. Screw Shaft                            | Schedule 40 stainless steel                          |
| 5. Screw Shaft couplings                  | 304 stainless steel                                  |
| 6. Screw Flights                          | 304 stainless steel, .25" thick with hardened facing |
| 7. Trough Covers                          | 304 stainless steel, 12 gauge                        |
| 8. Liners                                 | UHMW polyethylene                                    |
| 9. Housing                                | Stainless steel                                      |
| 10. Anchor bolts                          | 304 stainless steel                                  |

11. Chute and built-up flanges	304 stainless steel, 3/8-inch thick, minimum
12. Belt and coupling guard	Galvanized steel or fiberglass
13. Rotors, drive shaft, end shaft	304 stainless steel
14. Supports	304 stainless steel
15. Gaskets	Neoprene
16. Hardware	304 stainless steel
17. Bearings	304 stainless steel
18. Bearing sleeves	Bronze or thordon
19. Bearing housings	Cast brass, cast iron or ductile iron
20. Platforms, walkways, landing	Aluminum
21. Ladders, stairs	Aluminum
22. Gear casing	Cast iron
23. Gears	Hardened heat-forged steel
24. Gear drive bearings	Chrome alloy steel balls
25. Wall Closure	Neoprene sheet
26. Wall closure anchors and backer bars	304 stainless steel

### 2.03 MANUFACTURED UNITS

- A. A conveyor, as shown on Drawings and indicated on Schedule, shall be provided to convey the material listed on Schedule. Each conveyor shall consist of an inlet hoppers, conveyance mechanism, drive unit, discharge chute, covers, and supports. The complete system shall be factory assembled and tested prior to shipment.
- B. All necessary structural members for supporting the conveyors, service platforms and safety guards shall be designed and furnished by equipment manufacturer.
- C. Screw Conveyor General:
  - 1. Electric motors shall be 480-volt high-efficiency meeting requirements of Section 16220 with minimum motor horsepower listed on Schedule. Motor nameplate horsepower shall be sufficient for non-overloading operation for all anticipated operational conditions including any horsepower requirements of the equipment drive. At no operational condition shall the required brake horsepower exceed 85 percent of the motor nameplate horsepower multiplied by the motor service factor.
  - 2. Unless specified otherwise, bearing shall conform to AFBMA standards and have minimum B-10 life of 50,000 hours.

### 2.04 COMPONENTS/ACCESSORIES

- A. Conveyor Inlets and Discharges – Shaftless and Screw Conveyors: Inlets into the conveyors shall be constructed so that material will enter the conveyor without any spillage or obstruction from the equipment shown on Drawings. Inlets shall be located as shown to accommodate the materials being conveyed. The conveyor shall have discharges at locations indicated on Drawings.
1. An inlet hopper shall be provided to help direct material from the discharge chute of the equipment or different type of conveyor into the conveyor. The inlet hopper requirements shall be coordinated with the equipment discharge design.
  2. The inlet hopper shall be fabricated of not less than 3/16-inch-thick material as shown. Where angled side walls shall be inclined at a minimum angle of 60 degrees from the horizontal axis to prevent solids accumulation in the hopper. The hopper shall either extend approximately 10 inches above the discharge chute of the equipment or be directly connected to the equipment to ensure complete collection of materials.
  3. Manufacturer shall provide flexible connections to account for minor misalignments and to prevent translation of vibrations from the various equipment items associated with the conveying system.
  4. Inspection doors shall be provided at convenient locations to allow viewing of the interior of the hopper and for cleaning purposes.
- B. Housings – Shaftless and Screw Conveyors: Conveyor housings shall be U shaped, provided with flanges formed with or welded to the trough. Each trough section shall be fabricated in a single welded construction for lengths compatible with installation but no longer than 18 feet. Trough bodies greater than 18 feet in length are to be constructed of two or more sections bolted together at trough joining flanges. A gasket shall be provided over the full face on flanges to provide a liquidtight method for joining the flanges. Each housing shall have a minimum of one 3-inch-diameter drain connection provided at the low point of the trough.
1. The screw conveyor trough shall be U-shaped with angle flanges and hardware. Flanges shall be for attaching the trough cover, as well as connecting sections of the trough together. Troughs and connections shall be designed with a minimum factor of safety of 3 and shall adequately transmit all structural and dynamic loads without deformation.
  2. Flanged drain connections shall be provided where shown and as required to facilitate cleaning and drainage from wet material being conveyed inside the trough.
  3. A removable cover shall be provided for the entire length of the conveyor attached at a minimum of 16-inch intervals to the continuous flanges with quick opening covers. To prevent unsafe access to the conveyors the quick opening clips shall be the bolt down type.
  4. Covers shall be maximum 4 feet long and supplied with handles to allow for easy access. Inspection hatches with finger guards will be supplied over each discharge location or as shown.
  5. Where shown conveyor trough shall be equipped with a perforated screen drainage section with exterior jacket around the approximate bottom half of the U shaped trough. Perforated screen shall have openings small enough to prevent grit from passing through. Exterior jacket shall have flanged 4" drain pipe connection.
  6. Shaftless:
    - a. The inside trough shall have ½ inch thick liner held in place with stainless steel clips. Liner shall be in maximum 4' long sections to provide easy handling during replacement.

- C. Supports and Framework Shaftless and Screw Conveyors: Mounting feet and saddles for the conveyor shall be provided by manufacturer, and be of similar material as the trough. Mounting structure and interval of mounting shall be as recommended by manufacturer, taking into account all structural and dynamic considerations. Mounting and structural interconnections shall be provided to accommodate the building design. Any additional reinforcement required to accommodate the connections to the building structure shall be by equipment manufacturer to provide a complete workable system.
1. All necessary structural members for supporting conveyors and service platforms shall be designed and furnished by the conveyor manufacturer. Members shall be adequate for all operating loads that will be imposed on them and for the prevention of vibration. Supports shall be so arranged as to not interfere with erection or operation of other equipment shown on Drawings and provided at a maximum of 11 foot intervals.
  2. Supports shall be constructed of pipe, structural tubing or angles minimum 0.25 inch and shall be assembled and fitted to the conveyor prior to its delivery to the jobsite. Supports and conveyor segments shall be match marked prior to shipment to the jobsite. Supports shall be designed for 1 inch of grout beneath each support foot pad.
  3. Conveyor manufacturer shall furnish all platforms, walkways, landings, stairs, and ladders required for the operation and maintenance of the conveyor system, including the structural supports.
- D. Anchor Bolts: All anchor bolts shall be provided by equipment manufacturer and shall be a minimum 1/2-inch diameter.
- E. Screws:
1. Shaftless:
    - a. The minimum dimensions shall be as shown on Schedule and as required to handle the specified capacity at the maximum specified speed and inclination. The spiral screw shall be manufactured of the highest quality material to ensure that it fits securely in the conveyor and is not deformed due to stresses from pushing and pulling drives or any other loads imposed by the screw itself or conveyed material.
    - b. A uniform pitch spiral screw shall be cold formed into the final specified diameter, pitch, hardness and strength. To eliminate irregular OD and pitch tolerances cold-forming process must be a single-stage process utilizing a "captured winding" technology. The diameter and pitch is formed simultaneously with machinery built specifically to form spirals. To provide extra stiffness a second inner spiral shall be provided. The torsional rating of the auger fighting shall exceed the torque rating of the drive motor at 150% of its nameplate horsepower. The "spring effect" of the spiral shall not exceed + 0.16" per foot of length at maximum load conditions. The minimum outer spiral thickness shall be 0.75" for spiral diameters up to 14" and 1" for spirals diameters exceeding 14".
    - c. Spiral screw fighting shall be formed in sections from one continuous flat bar and shall be concentric to within +0.125". Sectional fighting formed from plate is not acceptable.
    - d. Spiral fighting shall have full penetration welds at all splice connections. The flights shall be aligned to assure true alignment when assembled in the field and shall be made in accordance with the supplier's requirements. The spiral flights shall be coupled to the end shaft by a flanged, bolted connection.
    - e. The spiral end shaft flange shall be connected to the reducer drive shaft with a mating flange plate inside of the conveyor trough.

- f. The drive shaft shafts shall be made drip-proof by means of a two Teflon fiber packing rings and a split flanged gland to seal the drive shaft at its penetration through the trough end plate.
  - g. If indicated the spiral shall have brushes bolted to the flighting where it passes over perforated drain areas. Brushes shall move grit over the perforations and onto the liner material. Brushes shall be replaceable and attached to flighting with stainless steel hardware.
2. Screw Conveyor:
- a. Flights shall be full face, constant pitch and continuously welded on both sides of the flight junction to the shaft.
  - b. The screw shaft sections shall be coupling type located at hanger bearings and consisting of coupling shaft with tail shafts inserted into the screw shafts secured with through bolts. The screw shaft one side of the coupling shaft shall have a removable cover (quick key) secured with a through bolt and arranged to allow easier screw removal. Screw shaft coupling assemblies shall be complete with stainless steel hardware.
  - c. To provide for easier screw replacement provide screw sections and additional hanger bearings as shown on Drawings or listed on Schedule.
  - d. Hanger bearings shall be CEMA type 226 with hard iron bearings.
  - e. Tail shaft bearing shall have minimum diameter equal to shaft diameter with cast iron housing and flange mounted roller bearing.
  - f. End shaft shall have and external lip seal with packing and internal gland.
- F. Drive Unit - Shaftless and Screw Conveyors: A drive motor and speed reducer unit shall be provided to drive the conveying screw. The motor shall be TEEP or as listed on Schedule. The speed reducer unit shall include anti-friction bearings with high overhung load properties and a double-lip, high temperature synthetic oil seal riding on a precision-ground shaft. The speed reducer shall be mounted inside a totally enclosed, oil-filled, gear casing. The gear case shall be isolated from the conveyor body with seals which are specifically designed to prevent contamination of the gear case. All components will be designed with an additional 1.5 safety factor based on AGMA calculated torque and AGMA safety factors. Belt drives shall be sized based on a safety factor of 1.5 times the motor horsepower.
- 1. Drive shall be mounted to the trough end plate with an adaptor flange to allow any leakage of material from inside of the trough to escape to the atmosphere rather than entering into the gear reducer or drive motor.
- G. Controls:
- 1. One NEMA 12 stainless steel main control panel shall be provided for the shaftless conveyors.
  - 2. One NEMA 12 stainless steel main control panel shall be provided for the screw conveyors.
  - 3. Panel construction shall be in conformance with Section 17430.
  - 4. Panel enclosures shall be furnished with a circuit breaker disconnect and flange mounted operating handle, and be suitable for connection to a 480 volt, 3-phase, 60 Hertz feeder circuit.
  - 5. The control panels which have PLCs meeting the requirements of Section 17311.



6. Each conveyor shall have a local control panel.
7. One truck loading control panel shall be provided.
8. The main control panels shall consist of PLC, programming logic and all necessary integration between the main panels, local panels, truck loading panel, screening compactors, grit system, plant controls system and all ancillary push button stations and E-Stops.
9. Control panels shall be suitable for mounting as shown..
10. Spare I/O shall be provided.
11. Shaftless conveyor local panels (one panel per conveyor) shall be NEMA 7 copper free aluminum rated NEMA 3R and NEMA 4 with equivalent ratings on lights, switches and buttons and shall have as minimum:
  - a. Remote – Local selector switch
  - b. Hand - Off – Auto selector switch
  - c. Start and Stop push buttons
  - d. Momentary Reverse Push Button
  - e. Momentary Forward Push Button
  - f. E-Stop
  - g. Indicating lights
  - h. Alarm lights
12. Screw conveyor local panels (one panel per conveyor) shall be NEMA 7 copper free aluminum rated NEMA 3R and NEMA 4 with equivalent ratings on lights, switches and buttons and shall have as minimum:
  - a. Remote – Local selector switch
  - b. Hand - Off – Auto selector switch
  - c. Start and Stop push buttons
  - d. E-Stop
  - e. Indicating lights
  - f. Alarm lights
13. Truck loading panel shall be NEMA 4X stainless steel and shall have as minimum:
  - a. Replace Truck
  - b. Truck Ready

- c. Move Truck Indicator Green Light
  - d. Conveyor A thru D Running Green Indicator Lights
14. As a minimum the main panel for shaftless and screw conveyor shall include:
- a. Inputs
    - 1) Conveyor Start
    - 2) Conveyor Stop
  - b. Outputs
    - 1) Local Panel in Remote
    - 2) Local Panel in Auto
    - 3) Conveyor Running
    - 4) Alarm
    - 5) Power on
    - 6) Heartbeat
    - 7) Running time meter for conveyors
    - 8) System general fault
    - 9) Additional output from shaftless conveyor control panel
    - 10) High amp draw
15. Laminated plastic nametags shall be provided for the name of the control panel and all disconnects, switches, lights, and meters.

## **2.05 ACCESSORIES**

- A. Zero Speed Switch: Where indicated on Schedule, furnish a zero speed switch mounted opposite the drive motor to detect conveyor failure. Unit shall have 10 amp DPDT contacts as manufactured by Allen-Bradley or Milltronics.
- B. Wall Closure: Where indicated on Schedule provide a removable wall closure assembly consisting of two piece neoprene sheet 3/16 inch thick cut to fit around the conveyor where it passes thru a wall. Closure piece shall be attached to the wall with backer bars and bolts as shown.
- C. Motor Electric Overload Relay: Where indicated on Schedule provide a motor starter overload monitor. Monitor shall be solid state by Tsubaki Emerson Shock Relay.
- D. Screw Lifting Assembly: Where indicated on Schedule provide a pair of lifting supports and manual hoist. Lifting assembly supports shall mount on the conveyor trough and be equipped with a lifting points for manual hoist support. Supports shall provide enough vertical clearance to allow the screw to be lifted high enough to allow replacement of one liner section at a time. Supports shall be carbon

steel with epoxy paint and manual hoist shall be of adequate capacity as determined by the manufacturer to lift the length of screw necessary for liner section replacement.

## **2.06 FABRICATION**

- A. Shop Finishing Ferrous Metal: Surfaces of the screw shall be factory prepared and coated with the manufacturer's standard protective system. All exposed surfaces, support steel, gears, and motors shall be painted as set forth in the Section 09961.
- B. Shop Finishing Stainless Steel: Conveyor troughs, covers, inlet and discharge chutes, screw flights, shafts and conveyor supports shall be passivated.

## **2.07 SOURCE QUALITY CONTROL**

- A. All conveyors shall be factory assembled for fit, and when practical, run dry prior to being shipped. All components shall be checked for fit prior to disassembly and preparation for shipment.

## **PART 3 - EXECUTION**

### **3.01 ERECTION**

- A. Equipment furnished under this Section shall be fabricated, assembled, and placed in proper operating condition in full conformity with detail Drawings, specifications, and engineering data, instructions, and recommendations of equipment manufacturer approved by Engineer.

### **3.02 INSTALLATION**

- A. Conveyor manufacturer shall furnish all platforms, walkways, landings, stairs, and ladders required for the operation and maintenance of the conveyor system, including the structural supports. All equipment and supports shall be arranged not to interfere with erection or operation of other equipment shown on Drawings.

### **3.03 FIELD QUALITY CONTROL**

- A. The total minimum manufacturer-supplied services shall be 2 days with 2 trips to the Site. Additional trips may be required to aid in the installation, to troubleshoot the system, and to provide modifications to bring the system to within specified parameters.
- B. Installation Check: Manufacturer shall provide a factory-trained representative to check the installation of all equipment furnished in this Section. The services shall include checking the equipment prior to installation to review installation procedures and, following installation, to inspect, check, and adjust, if necessary, and approve the equipment installation.
- C. An experienced, competent, and authorized representative of the manufacturer or supplier of each item of equipment shall visit Site of Work a minimum of 2 times, once prior to installation to review installation procedures with Contractor and once after installation to inspect, check, adjust if necessary, and approve the equipment's installation. The equipment supplier's representative shall revisit Site as often as necessary until all trouble is corrected and the equipment installation and operation is satisfactory to Engineer.
- D. Manufacturer's representative shall provide all necessary tools and testing equipment required including noise level and vibration sensing equipment.

- E. Each equipment supplier's representative shall furnish to Owner, through Engineer, a written report certifying that the equipment:
1. Has been properly installed and lubricated;
  2. Is in accurate alignment;
  3. Is free from any undue stress imposed by connecting piping or anchor bolts;
  4. Has been operated under full load condition and that it operated satisfactorily to Engineer;
  5. That Owner's Representative has been instructed in the proper maintenance and operation of the equipment; and
  6. Furnish Owner a copy of all test data recorded during the installation check including noise level and vibration readings.

### **3.04 OPERATION AND MAINTENANCE TRAINING**

- A. Provide services of manufacturer's service representative to instruct Owner's personnel in operation and maintenance of equipment. Training shall include start-up and shutdown, servicing and preventative maintenance schedule and procedures, and troubleshooting procedures plus procedures for obtaining repair parts and technical assistance.
1. Manufacturer's representative shall provide two (2) days consisting of eight (8) hours each day for a total of sixteen (16) person hours of on-Site training
  2. Review operating and maintenance data contained in the operating and maintenance manuals.
  3. Schedule training with Owner, provide at least 7-day prior written notice to Engineer.

SCREW CONVEYOR EQUIPMENT SCHEDULE

Mark	Type	Location	Approximate Length (feet)	Material	Min Screw Diameter (inch)	Max RPM	Capacity Each Conveyor (cubic feet per hour)	Motor Description	Accessories / Notes
A & B	Shaftless	Screen and Grit Room	57	Stainless Steel	20	20	52 from each screenings compactor or 104 total	TEEP, Constant Speed, Reversing Starter	Zero Speed Switch Motor Electric Overload Relay Wall Closure Screw Lifting Assembly
B & C	Screw (shafted)	Screen and Grit Room	30	Stainless Steel	10	20	50	TEEP, Constant Speed	Zero Speed Switch Wall Closure Note: Provide Additional Screw Sections and Hanger bearings as Shown.

END OF SECTION

## **SECTION 14600 - CRANES AND HOISTS**

### **PART 1 - GENERAL**

#### **1.01 REQUIREMENTS**

- A. The Contractor shall furnish, install and make fully operational the crane and hoist systems in the locations and conditions of service, as shown on the Drawings and as specified in the Crane and Hoist Schedule.
- B. These Specifications shall be considered as minimum requirements. The Contractor shall add such additional features as are necessary for satisfactory operation.
- C. All equipment supplied under this Specification shall comply in all respects with the provisions of the Occupational Safety and Health Act of 1970, including all standards promulgated under the authority of such Act, and shall also meet all applicable industrial codes in the Commonwealth of Kentucky.
- D. The manufacturer and ultimately the Contractor shall be totally responsible for structural design of the crane and hoist systems, for the compatibility of all equipment, and for verification of required operating clearances.
- E. All parts of the mechanism furnished shall be amply designed and constructed for the maximum stresses occurring during fabrication, erection and continuous operation. All equipment specified herein shall be designed for the Crane Manufacturer's Association of America Duty Classification as specified herein.
- F. If the Contractor elects to utilize the crane and hoist equipment in any way during the erection of piping and installation of equipment, he shall notify the Owner in writing and shall provide for an inspection by the equipment manufacturer and take any steps necessary to return the equipment to "as new" condition. He shall also obtain recertification by the manufacturer and reinstate all warranties and guarantees.

#### **1.02 CAPACITY AND DESIGN LOADS**

- A. Cranes and hoists shall be designed to withstand the dead load (caused by the weight of the crane and components themselves), the live load and hoist load, and the inertia forces caused by movement of the crane, components, and loads during standard operation.
- B. Standard capacity ratings shall represent the net rated load at the hook of any type of trolley hoist with the same load rating installed on the crane having a trolley hoist weight within the established limits.
- C. All design loads shall meet CMAA requirements. The design load for stress calculations shall be based upon the capacity plus 15% for the weight of the hoist and trolley and an additional 25% for impact (capacity x 1.25). Design load for deflection calculations shall be based upon the capacity plus 15% for the weight of the trolley hoist (capacity x 1.15).
- D. The rated load capacity of each crane or hoist shall be clearly labeled on each using a label size easily read from the floor level and/or loading position.

### 1.03 CRANE AND HOIST SCHEDULE

Location	WWS/Influent Pump Stations	Grit Tanks	Pipe Gallery	Screen Bldg	Truck Bay
<b>General</b>					
Quantity	1	1	1	1	1
Indoor / Outdoor	Outdoor	Outdoor	Indoor	Indoor	Indoor
Capacity, tons	10	3	5	1	2
Operating Floor Elevation	902.5	916.0	889.0	902.5	897.0
<b>Crane</b>					
Crane Type	Bridge	Bridge	Bridge	Monorail	Monorail
Mounting	Top Running	Top Running	Top Running	Under Running	Under Running
CMAA Duty Classification	A	A	A	A	A
Span, ft	29'-6"	37'-6"	16'-5"	-	-
Max Bridge Speed, fpm	100	100	100	-	-
<b>Hoist</b>					
Hoist Type	Electric	Electric	Electric	Manual	Electric
ASME Duty Classification	A	A	A	A	A
Hook Elevation:					
High Point	918.58	933.25	911.17		
Low Point	850.00	891.00	889.00	867.00	896.00
Operating Speeds:					
Hoist Speed(s), fpm	20/3	16/4	20/3	-	-

Note: All elevations and spans are approximate. All equipment shall be installed as shown on the Drawings.  
See section 2.04 for Gantry Crane Schedule

### 1.04 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of other requirements of the Specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced Specifications, codes and standards refer to the most current issue available at the time of the Bid.

1. CMAA Crane Manufacturers Association of America
  - a. Specifications for Top Running and Under Running Single Girder Electric
  - b. Overhead Cranes Utilizing Under Running Trolley Hoist - No. 74 (2004)
2. AISC "Manual of Steel Construction"
3. ASTM A48 Standard Specifications for Gray Iron Castings
4. ANSI B30.11 Safety Code for Underhung Cranes and Monorail Systems
5. ANSI B30.16 Safety Code for Overhead Hoists
6. MMA MH27.1 Monorail Manufacturers Association
7. OSHA Occupation Safety and Health Administration

- a. Part 1926.554 - Overhead Hoists
- b. Part 1910.179 – Overhead and Gantry Cranes

## **1.05 SUBMITTALS**

- A. The following items shall be submitted with the Shop Drawings in accordance with, or in addition to the submittal requirements specified in Section 01300, Submittals:
  - 1. Certification that the systems have been designed to resist all loads implied herein and loadings stipulated in the applicable building codes of the Commonwealth of Kentucky. The Certification shall also state that the design has been performed and signed and sealed by a Professional Engineer registered in the Commonwealth of Kentucky.
  - 2. Performance Affidavit
- B. Certification that the equipment has been field tested and passed.
- C. Details and design calculations shall be submitted, signed, and sealed by a Professional Engineer registered in the State in which the project is located for any of the following components furnished by the Manufacturer:
  - 1. Bridge beams.
  - 2. End stops and connections.

## **1.06 WARRANTY AND GUARANTEE**

- A. Warranty and Guarantee shall be as specified in Section 01782.

## **PART 2 - PRODUCTS**

### **2.01 ACCEPTABLE MANUFACTURERS**

- A. The equipment covered by these Specifications are intended to be standard equipment of proven reliability and as manufactured by reputable manufacturers having experience in the production of such equipment.
- B. Crane Bridge Hoists
  - 1. R&M Materials Handling, Inc. (Design Basis)
  - 2. Acco/Wright.
  - 3. Harnischfeger P&H.
  - 4. Shaw-Box.
  - 5. Shepard Niles.
- C. Manual and Electric Chain Hoists:
  - 1. Chester.
  - 2. CM Hoist.
  - 3. Coffing.
  - 4. Ingersoll-Rand.
  - 5. KCI Konecranes.
  - 6. R&M Materials Handling.
  - 7. Yale.
- D. Electric Wire Rope Hoists:
  - 1. Acco/Wright.
  - 2. Harnischfeger P & H.
  - 3. R&M Materials Handling.
  - 4. Shaw-Box.
  - 5. Shepard Niles.
  - 6. Yale.



## 2.02 GENERAL

- A. The crane system shall be constructed of structural steel, in accordance with current AISC (American Institute of Steel Construction) and ASTM (American Society for Testing and Materials) A-36 specifications minimum.
- B. All crane and monorail equipment shall be MMA-certified products.
- C. All crane components shall have properly finished ends and surfaces.
- D. Welding shall follow the current recommended practices of the AWS (American Welding Society) D14.1 specifications.
- E. Moving members of the crane shall be separated by a clearance of at least 3 inches vertically from any overhead obstruction, and 2 inches horizontally from any lateral obstruction.

## 2.03 BRIDGE CRANES

- A. Design of crane bridges shall meet all the requirements of OSHA, and the supplier shall furnish to Owner, through Contractor, a certification that all the requirements of OSHA have been met. Crane bridges shall be designed for Class A standby service.
- B. Bridges: Crane bridges shall be top running, single or double sections, to carry full-rated load listed on Schedule, plus load allowance for impact in accordance with Design Drawings and recommendations of Crane Manufacturers Association of America.
  - 1. The crane shall be without undue vertical deflection, lateral deflection, or vibration length and shall be as shown on Drawings.
  - 2. If necessary, top flange shall be reinforced by a channel welded thereto.
  - 3. Girder shall be rigidly connected to end trucks so as to prevent skewing
  - 4. Auxiliary girders shall be provided as required for support of end truck drive assembly. Trolley stops shall be provided.
  - 5. The top of the girder shall be flush with the top of the end truck channel sections.
- C. End Trucks: End trucks shall be constructed of channel sections rigidly welded together.
  - 1. Truck wheels shall be provided with ball or roller bearings permanently lubricated or furnished with easily accessible alemite fittings.
  - 2. Wheels shall be double flanged, hardened, and have tapered treads or other means of self-alignment. Wheels shall be designed to run on the standard ASCE rails shown on Drawings.
- D. Runway tolerances shall be within those specified in Table 1.4.1-1 from the CMAA. Cranes shall be built to operate on specified level runways held to nominal span within plus or minus 1/8-inch tolerance. The runways shall be straight and level with a maximum of 1/2 degree horizontal variation and within span tolerance limits. The total track deflection shall not exceed 1/600 of the support structure.
- E. Cranes shall be designed with a minimum safety factor of 5 to 1 in relation to the ultimate strength of the materials and a minimum resistance to permanent deformation of any of its parts of 3 to 1 in relation to the yield point of the materials, whichever of the two conditions shall set the minimum. Cranes shall be designed to resist longitudinal and lateral loads, as per AISC specifications.
- F. Electrical motor driven trucks shall be operated from same push-button station as hoist.
  - 1. Bridge drive speed shall be as listed on Schedule.
  - 2. Motors shall be equipped with a built-in braking mechanism to facilitate shock-free acceleration and deceleration.
  - 3. Runway conductors shall be sized to power the bridge. Runway conductors shall be connected to power source in accordance with requirements of Division 16.

**2.04 GANTRY CRANE**

A. The Contractor shall provide to the Owner the gantry cranes listed in the Schedule below:

<b>Location</b>	<b>Screen and Grit Handling Operating Level</b>	<b>Screen and Grit Handling Grade Floor</b>
<b>General</b>		
Quantity	1	1
Indoor / Outdoor	Indoor	Indoor
Capacity, Tons	1	1
Operating Floor Level	878.0	902.5
<b>Crane</b>		
Crane Type	Gantry	Gantry
Mounting	Under Running	Under Running
CMAA Duty Classification	A	A
Span, Ft.	10	8
<b>Hoist</b>		
Hoist Type	Manual	Manual
Hook Height, Ft.	12	12

- B. The rate load of the gantry crane shall be visibly marked on each side of the gantry crane.
- C. The gantry crane shall be fixed height with a hook height as specified in the Schedule.
- D. Gantry crane shall be of steel construction, with a maximum deflection of L/600.
- E. The cranes structural design shall be based on the live load capacity plus fifteen percent (15%) for hoist and trolley weight and twenty-five percent (25%) for impact.
- F. The span listed in the gantry crane Schedule is the span required between the wheels.
- G. Design of gantry cranes shall meet all the requirements of OSHA, and the supplier shall furnish to the Owner, through the Contractor, a certification that all the requirements of OSHA have been met.
- H. The provided gantry cranes shall meet the design specifications of the American National Standard Safety Code for Overhead and Gantry Cranes, ANSIB.30.2.0-1967.
- I. The crane shall be supported by four (4) position swivel lock casters and polyurethane wheels.
- J. Gantry cranes shall be provided with brakes. Foot operated brakes shall not require an applied force of more than 70 pounds to develop the manufacturer's rated brake torque.
- K. The gantry crane shall be painted in accordance with an epoxy coating system to be corrosion resistant or equal.
- L. The girder shall be rigidly connected to the end uprights to prevent skewing and dislodging.
- M. The gantry shall be without undue vertical or lateral deflection

## 2.05 HOISTS

- A. Hoists shall be as listed on Schedule.
- B. Hand Chain Hoists:
  - 1. Hoists shall be operated by endless chain hanging to within 18 inches of the operating floor.
  - 2. Hoists shall be equipped with positive holding friction brake and capacity limiter to prevent overloading of hoist.
  - 3. The chain hoist shall include an oil bath geared train with a minimum 5-pocket load sheave, load chain, chain container, and suspension hook. Rated capacity shall be stamped on the hoist frame. The frame shall be oil-tight, of lightweight die cast aluminum alloy housing. Gearing shall be machine cut, heat-treated alloy steel, and shall operate in an oil bath. Shafting shall be ground and polished and all bearings shall be of the antifriction type. The load chain shall be stainless steel, have a safety factor of at least five, and shall have a chain stop attached to the slack end. The load and suspension hooks shall be constructed of forged carbon steel and shall be furnished with spring-loaded safety latches. The load hook thrust bearing shall allow 360-degrees of rotation to prevent twisting of load chain.
- C. Electric Hoists:
  - 1. Electric hoists shall be either chain or wire rope type as noted on Schedule.
  - 2. Electrically driven hoists shall include a single speed, direct coupled motor, electrical controls, and solenoid brake. The solenoid brake shall be spring set with magnetic release operated by and interlocked with the electrical control equipment. Either a worm gear drive with an inherent load brake or a mechanical load brake designed in accordance with the Hoist Manufacturer's Institute standards shall be provided for controlling the speed when lowering, and for holding maximum hook load for any load up to capacity. Stressed parts shall be of cast or forged steel. In the event of a power failure the braking system shall automatically lock the piece of equipment being lifted to prevent further movement. Hoists shall also include either a clutch-type or electric-type overload cut-off device to protect hoist from an overload condition. Adjustable upper and lower limit switches shall be provided to regulate load travel.
- D. Trolleys:
  - 1. Hoists shall be mounted on plain, geared, or single-speed motor trolley as indicated on Schedule.
  - 2. Trolleys shall have wheels with ball or roller bearings and shall be sized to fit monorail beam section on which they are to be installed as shown on Drawings.
  - 3. Geared trolleys shall be operated by endless chains hanging to within 18 inches of the operating floor.
  - 4. Motor driven trolleys shall be operated from same push-button station as attached hoist. Trolley speed shall be 30 feet per minute.
  - 5. Rated capacity of trolley hoists shall be painted with stencil on the trolley hoist.
- E. Cable Reel: A spring operated cable reel shall be provided for electric hoist when listed on Schedule.
  - 1. Reel shall take up slack in cable supplying electric power to hoist. Cable shall be flexible, 4/C No. 12 AWG heavily insulated, and of sufficient length to allow hoist to be operated in any position on track.
  - 2. Provide swivel type reels where required.
  - 3. Erection of reel and necessary electrical connections shall be made in accordance with requirements of Division 16.
  - 4. On those units with permanently mounted control station, provide sufficient number of conductors for required control functions.
- F. Where listed on Schedule, electrical feed rails shall be provided under Division 16; cable reels shall not be required.

## 2.06 ELECTRICAL AND CONTROL REQUIREMENTS

- A. Electrical power wiring and connection to the electrical system integral to the equipment shall be provided under Division 16, Electrical. All other power wiring associated with and integral to the hoist systems shall be furnished and installed under Division 14.
- B. All electrical appurtenances furnished by the equipment manufacturer shall be rated for installation in classified areas where such areas are indicated on the Drawings or specified herein.
- C. All wiring between motor, limit switches and starters shall be short, compact and protected by rigid galvanized steel conduit or flexible steel neoprene jacketed cable. Rigid galvanized steel conduit shall be PVC coated.
- D. The Electrical System providing power to the bridge crane drives, trolley drives, and hoists shall be the festoon type as specified herein.
  - 1. Festoon Type A: A track supported festoon system shall be supplied where specified herein and shall include trolleys with tandem wheels of a corrosion resistant material which shall provide suitable service with the track that is used. The trolleys shall have saddles for supporting the cables in equal loops not exceeding 9'-0" of cable per loop. The track shall be stainless steel and supported at spans not exceeding 6'-0". The track shall be adequately supported with horizontal arms spanning to the festoon tow bar. The equipment manufacturer shall be fully responsible for the design and suitability of the festoon system.
  - 2. Festoon Type B: Trolleys for the festoon systems shall be designed to ride inside of the enclosed track and shall have tandem wheels constructed of a corrosion resistant material which shall provide suitable service with the track that is used. A festoon stack-up section of adequate length shall be utilized to store the festoon trolleys beyond the hook coverage area. The trolleys shall have saddles for supporting the cables in equal loops not exceeding 9'-0" of cable per loop. The equipment manufacturer shall be fully responsible for the design and suitability of the festoon system.
- E. Starting equipment shall be integral with the chain hoist unit and shall be of the full voltage, magnetic-reversing type with three overload elements. Equipment shall be housed in an enclosure suitable to the conditions of service and as specified herein.
- F. Motors shall be of the totally enclosed type designed for hoist service. The motor rating shall be on a 30-minute 55 degree C, duty cycle basis.
- G. Electrical/Control Requirements shall be as specified in Table 14600-B
- H. Limit switches shall be approved geared typed, positive in action, compact, oil proof and readily accessible. Solenoid brakes shall be disk type, spring set with magnetic release. Solenoids shall be totally enclosed, protected from oil and moisture, readily accessible for adjustment and maintenance and shall develop the required forces without overheating.
- I. All electrical and control components shall conform to the applicable standards of UL and NEMA, unless specified otherwise. International Electrotechnical Commission (IEC) standards are not recognized. Equipment designed, manufactured, and labeled in compliance with IEC standards is not acceptable.

## 2.07 CONTROLS

- A. The Control System providing control of the bridge crane drives, trolley drives, and hoists shall be either through wired pendent controls or wireless radio controls as specified herein. A spare wireless radio transmitter shall be provided for each station that wireless radio controls are furnished as specified in the Electrical/Control Requirements table.

1. Pendant controls for lift and travel shall be provided complete with heavy-duty push-button station of constant pressure type with silver-to-silver contact elements, and sufficient control cable and chain for support of the control station at a point 4 feet above the lowest operating floor where multiple levels are to be accessed. A balancer shall be provided which shall allow the control pushbutton station to be retracted to a maximum of four feet above the upper operating level. Two speed infinitely variable control of the hoist drive shall be affected by a two-step pushbutton. Pendant control stations shall be rated NEMA 4.
  2. Wireless Radio controls for lift and travel shall be provided complete with transmitter, receiver, and mounting hardware, designed for both indoor and outdoor installations. Transmitter shall be battery powered, consisting of a NEMA 4 gasketed enclosure with large diameter buttons and LED lights for visual feedback. Two speed infinitely variable control of the hoist drive shall be affected by a two-step pushbutton. A 110 VAC, 60 Hz receiver shall be panel mounted with NEMA 4 sealing. LED lights shall be furnished with the receiver for visual diagnostic feedback. Radio frequency shall be microprocessor controlled with a range of no less than 300 feet. Wireless Radio controls shall be manufactured by Enrange, or approved equal.
- B. Control power shall be 120 volt, provided by a control power transformer (fused on primary and secondary) within the starter units.

### **PART 3 - EXECUTION**

#### **3.01 MANUFACTURER'S FIELD SERVICES**

- A. The services of a qualified manufacturer's technical representative shall be provided in accordance with Section 11000, Equipment General Provisions and shall include the following site visits for each crane and hoist system:

<b>Service</b>	<b>Number of Trips</b>	<b>Number of Days/Trip</b>
Installation and Testing	1	1
Startup and Training	1	1
Services after Startup	1	1

#### **3.02 INSTALLATION**

- A. All crane equipment shall be installed in accordance with the applicable sections of Division 5 - Metals, Division 16 - Electrical, and the manufacturer's instructions and recommendations.

#### **3.03 FIELD TESTS**

- A. Field tests shall be conducted in accordance with the manufacturer's instructions and recommendations. Prior to initial use, all cranes shall be proof-tested at 125% of their rated load in accordance with all OSHA requirements.

#### **3.04 LABELING**

1. Hoists and bridge beams shall be labeled with load rating.
2. A corrosion-resistant nameplate shall be fixed to the bridge or hoist with the following information:
  - a. Name of manufacturer
  - b. Mfg.'s model number and serial number
  - c. Capacity
  - d. Date of manufacture (month and year)

### **3.05 PAINTING**

- A. Painting shall be in accordance with the procedures and requirements set forth in Section 09961.
- B. The crane shall be painted OSHA safety yellow before shipment. A wire-brushing and/or solvent wipe shall be performed prior to painting to clean and remove debris, mill scale, dirt, and oils.
- C. At least one spray can of matching color paint shall be shipped with each crane for field touch-ups.
- D. The crane shall be properly banded and skidded prior to shipment. Any paint damage, scratches, blemishes to the finish of the crane, caused by shipping, transportation via common carrier, etc., shall be repaired by the Contractor.
- E. Rated capacity of crane system shall be painted with stencil on all components of crane system as specified herein.

END OF SECTION