SECTION 00 01 01
PROJECT TITLE PAGE

PROJECT MANUAL

FOR

WELDING LAB DUST COLLECTOR REPLACEMENT

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END OF DOCUMENT

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SECTION 22 15 00
GENERAL-SERVICE COMPRESSED-AIR SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe and pipe fittings.

B. Pressure reducing station.

1.02 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

D. ASME B31.1 - Power Piping; 2014.

E. ASME B31.9 - Building Services Piping; 2014.

F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

G. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2015.

H. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).

I. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

J. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.

K. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2013.

L. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010.

M. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Protect piping and equipment from weather and construction traffic.

PART 2 PRODUCTS

2.01 PIPE AND PIPE FITTINGS

A. Steel Pipe: ASTM A53/A53M, Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
   2. Joints: Threaded or welded to ASME B31.1.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, solder, Grade Sn95.

2.02 VALVES

A. Bronze ball valves;
   1. Two Piece, Regular Port with Bronze Trim:
      a. Comply with MSS SP-110.
      b. SWP Rating: 150 psig.
      c. CWP Rating: 600 psig.
      d. Body: Bronze.
      e. Ends: solder ends with union.
      f. Seats: TFE.
      g. Stem: Bronze, blow-out proof.
      h. Ball: Chrome plated brass.

B. Iron ball valves;
   1. Class 125, Full Port, Stainless Steel Trim:
      a. Comply with MSS SP-72.
      b. CWP Rating: 200 psig.
      c. Body: ASTM A536, Grade 65-45-12, ductile iron.
      d. Ends: Flanged.
      e. Seats: PTFE or TFE.
      f. Stem: Stainless steel.
      g. Ball: Stainless steel.
      h. Operator: Lever, with locking handle.

2.03 UNIONS AND COUPLINGS

A. Unions:
   1. Ferrous Pipe: 150 psi malleable iron threaded unions.
   2. Copper Tube and Pipe: 150 psi bronze unions with soldered joints.

B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

C. Flexible Connector: Neoprene with brass threaded connectors.

2.04 PRESSURE REDUCING VALVE

A. Pressure Reducing Station: Consisting of automatic reducing valve and bypass, and low pressure side relief valve and gage.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.

B. Make air cock and drain connection on horizontal casing.

C. Install valved drip connections at low points of piping system.

D. Install tees instead of elbows at changes in direction of piping. Fit open end of each tee with plug.

3.02 FIELD QUALITY CONTROL

A. Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ASME B31.1.

B. Repair or replace compressed air piping as required to eliminate leaks, and retest to demonstrate compliance.

C. Cap and seal ends of piping when not connected to mechanical equipment.

END OF SECTION

SECTION 23 07 13
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Insulation jackets.

1.02 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.

C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2016.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

E. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. K-Flex USA LLC.
   2. IMCOA.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.03 JACKETS

A. Aluminum Jacket: ASTM B209 (ASTM B209M).
   1. Thickness: 0.016 inch sheet.
   2. Finish: Embossed.
   3. Joining: Longitudinal slip joints and 2 inch laps.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with with calked aluminum jacket with seams located on bottom side of horizontal duct section.

D. External Duct Insulation Application:
   1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
   2. Secure insulation without vapor barrier with staples, tape, or wires.
   3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.

4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

3.03 SCHEDULES

A. Ducts Exposed to Outdoors:
   1. Polymer Foam Insulation: 2 inches thick.

END OF SECTION

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

B. Duct cleaning.

1.02 RELATED REQUIREMENTS

A. Section 23 07 13 - Duct Insulation: External insulation.

1.03 REFERENCE STANDARDS

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; 2013.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

F. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

G. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for air systems.

C. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.05 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A standards.

1.06 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   2. VOC Content: Not more than 250 g/L, excluding water.
   3. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.

C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

D. Ducts: Galvanized steel, unless otherwise indicated.

E. Medium and High Pressure Exhaust and Supply: 4 inch w.g. pressure class, galvanized steel.

F. Ductmate or WDCI duct connection systems are acceptable. Ductwork constructed using these systems shall refer to manufacturer's recommendations for sheet metal gage intermediate and joint reinforcement.

2.02 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.

B. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE (FUND) Handbook - Fundamentals.

C. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

2.03 MANUFACTURED DUCTWORK AND FITTINGS

A. Double Wall Insulated Round Ducts: Round spiral lockseam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with solid inner wall.
   1. Manufacture in accordance with SMACNA (DCS).
   2. Insulation:
      a. Thickness: 2 inch.

B. Transverse Duct Connection System: SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install in accordance with manufacturer's instructions.

C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

D. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

E. Duct sizes indicated shall be of sizes indicated. However, necessary changes in shape offsets or crossovers to clear piping, lighting, building construction obstructions, etc. shall be made without additional cost.

F. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

H. Use double nuts and lock washers on threaded rod supports.

I. Connect terminal units to supply ducts with 1 feet maximum length of flexible duct. Do not use flexible duct to change direction.

3.02 CLEANING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment that could be harmed by excessive dirt with temporary filters, or bypass during cleaning.

END OF SECTION

SECTION 23 35 14
DUST COLLECTION EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ductwork and duct fittings.

B. Variable speed drive control system.

C. ALTERNATE NO. 1: Automatic gate controllers.

D. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ACGIH (IV) - Industrial Ventilation, A Manual of Recommended Practice; 2010, 28th edition.

B. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; http://www.amca.org/certified/search/company.aspx.

C. AMCA 99 - Standards Handbook; 2010.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2007.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

F. AWS D9.1M/D9.1 - Sheet Metal Welding Code; 2012.

G. NFPA 91 - Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids; 2010.

H. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

I. SMACNA (ROUND) - Round Industrial Duct Construction Standards; 1999.

J. SMACNA (RIDC) - Rectangular Industrial Duct Construction Standards; 2007.

K. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate dimensions, sizes, weights and point loadings, material thickness, and locations and sizes of field connections. Submit construction layout and details for inlet fittings.

C. Product Data: Provide manufacturers literature and data indicating rated capacities, dimensions, weights and point loadings, accessories, electrical characteristics and connection requirements, wiring diagrams, and location and sizes of field connections.

D. Provide fan curves with specified operating point clearly plotted.

E. Submit sound power levels for both fan inlet and outlet at rated capacity.

F. Manufacturer's Installation Instructions: Indicate assembly and installation instructions.

G. Operation and Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Filter Separator Filters: One set.

1.05 QUALITY ASSURANCE

A. Fans:
   1. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 DUCTWORK AND DUCT ACCESSORIES

A. Materials:
   1. Galvanized Steel Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M, FS Type B, with G90/Z275 coating.
      a. Thickness: Base sheet steel, 24 gage, 0.0239 inch minimum.

B. Ductwork:
   1. Fabricate and Support to UL 181 in Accordance With:
      a. SMACNA (DCS), 6 inch pressure class.
      b. SMACNA (ROUND) and SMACNA (RIDC).
      c. ACGIH (IV) Industrial Ventilation Manual.
   2. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline.
   3. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
   4. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Prime coat welded joints.
   5. Joints shall be clamp together design utilizing a gasket and locking clamp for the final connection.
      a. Clamp together 4" to 26" diameter ducts. Duct clamp shall be all welded stainless steel clamp fitted with winged O-ring gasket of N-butyl rubber. Clamp shall fully encompass the entirety of the duct rolled lips.

b. Flanged together 28" and larger ducts. Interior gasket for flanged connections shall be Ductmate 440 butyl rubber.
c. Manufacturer; K&B Duct.

6. Joints: Minimum 4 inch cemented slip type, brazed, or electric welded to AWS D9.1M/D9.1.
7. Provide standard 45 degree lateral wye branch fittings unless otherwise indicated.
8. Use double nuts and lock washers on threaded rod supports.

C. Flexible Connectors: UL listed, fire-retardant chloroprene or chlorosulfonated polyethylene impregnated fabric, minimum density 20 oz per sq yd, approximately 2 inches wide, crimped into metal edging strip.

D. Angle rings: Carbon Steel, unpainted, leg out, drilled with bolt holes.

2.02 FILTER SEPARATOR

A. Manufacturers:
1. Amtech; Model ATV-18.
2. Filter-1.
3. Airflow Systems.

B. Principle of Operation:
1. Dust/fume laden air is drawn into a top inlet of the collector by the system blower. The air is distributed uniformly across the interior of the cabinet. Air then moves downward into the vertical filter section. Most of the dust/fume continues to travel downward to the dual hoppers due to air movement and gravity. A portion of the dust/fume is collected on the vertical filters as the air passes through them. The clean air passes through the system fan and is exhausted from the collector. The clean air can be ducted to another location if required. Once the vertical filters become loaded the reverse jet pulse cleaning system is activated either manually or automatically. Compressed air is blasted through the vertical jet pulse venturies located in the clean air duct (CAD), then up through the filters and expelled out into the downward air flow where gravity assists in the conveying of the contaminant to the hoppers.

C. Cabinet Construction:
1. The cabinet shall be fabricated of 11 Gauge steel minimum. Areas under excessive loads and stress such as filter sealing flanges, motor mounts, rib bracing, and filter clamping mechanism shall be constructed of 7 Gauge steel as needed to assure integrity. All seams and joints shall be continuously welded. After the weld process, each seam that separates the contaminated air and clean air shall be inspected to assure all dust is filtered and there is no bypass. The doors shall include a welded, 2” open width, continuous hinge with a 3/8” pin minimum. A proper door seal shall be accomplished by providing a steel cord, extruded neoprene gasket. The gasket shall be secure without adhesives. The door latching shall be with six (6) threaded latches to assure an effective air tight seal under all conditions. The bottom internal edge of the door incorporates a dust baffle to prevent build up around the door opening. The cabinet shall be polyester powder coated. The baked curing shall be in accordance to the powder manufacturer’s standard.

D. Filter Specification:
1. Filters shall be made of fire retardant nanofiber technology media. Each filter shall have 254 square feet of media. Eighteen each filters shall be installed in the ATV-18 for a total of 4,572

square feet of media surface area. The filters shall be industry standard sized, the configuration shall be 13.8" O.D. x 9.4" I.D. x 26" long and open/open end cap style with caps constructed of 22 gauge electro galvanized metal. Inner and outer retainer shall be electro-galvanized expanded metal 3/8" x 5/8" with 72% open area.
2. Minimum efficiency reporting value of MERV 15 @ 900 cfm.
3. Manufacturer: Clarcor ProTura.

E. Filter Arrangement:
1. The collector shall include 18 each pleated cartridge filters. The cartridge filters shall be positioned in the collector vertically and supported from the bottom by a clean air duct (CAD). Air flow into the collector shall be from above the filter section and continuously flow downward. No more than 2 filters per filter stack. The inside of the filters must be free of obstruction. The securing of the filters must be accomplished without any devises within the filter that would hinder the reverse jet pulse or airflow.

F. Reverse Jet Pulse Design Specification:
1. The reverse jet pulse cleaning shall be the vertical venturi assisted jet pulse design. The reverse jet pulse cleaning shall be accomplished with compressed air, released into lateral blow pipe of 1.5" diameter. The pipe shall be Schedule 80. A 1.5" fast acting, double diaphragm solenoid valve shall control the compressed air. When actuated the compressed air shall flow into the blow pipe and directed into the clean side of the filters with a GOCO nozzle and cone assembly. There shall not be more than 4 filters per pulse valve. There shall be 1 ea. each 0.75" diameter nozzle with GOCO Cone per filter stack.

G. Pulse Valve Specification:
1. The compressed air for the reverse jet pulse cleaning shall be released via a 1.5" double diaphragm valve. Valves shall have cycle time of less than .20 seconds. The valve body shall be aluminum. Valve actuation is with a 120 volt solenoid.

H. Reverse Jet Pulse Control Specification: Digital Micro-Processor with Off Line (Cycle Down) Cleaning Feature:
1. Controller shall have a E2T 12000 turbo digital pressure differential sensor. Controller will sense the filter differential pressure and initiate a cleaning cycle automatically. When pressure reaches the normal operating point the cleaning cycle stops. The control shall have a "Cycle Down" feature. This feature automatically initiates a cleaning cycle whenever the fan is shut down. The controller shall be programmed easily to adjust the cleaning cycle sequence timing to best fit the application. This shall include the low differential set point, high differential set point, valve on-time, valve off time and number of cycles required for the "Cycle Down" feature.

I. Hopper Specification:
1. The hoppers shall be a fabricated square to round transition with solid welded seams.
2. The hoppers shall be constructed of 14 gauge steel. The slope of the hoppers shall be 60 degree minimum. The discharge has a 14"Ø collar. The hoppers shall be polyester powder coated. The baked curing shall be in accordance to the powder manufacturer's standard.

J. Leg Specification:
1. The legs shall be constructed of 3" x 3" x. 250" angle with 2" x 2" x .125" bracing with welded joints. Foot pads shall be pre-drilled for 3/4" anchors. Legs shall be bolted to the hopper

assembly to ease installation and increase structural rigidity. The leg assembly shall be polyester powder coated. The baked curing shall be in accordance to the powder manufacturer's standard.

K. Drum Lid Kit & 55 Gallon Drum:
   1. A 14" Drum Lid Kit shall provide the connection from the dust collector hopper outlet to a 55 Gallon Drum for dust storage. Kit shall include standard 14" hopper outlet adaptor, flex hose connection, hose clamps, drum lid with gasket, clamps and a 55 Gallon Drum.

L. Blower Specification:
   1. The blower shall be a direct drive, 22" diameter 90% wheel width and of class III construction as designed and manufactured by Mechanovent. Blower shall have a full length inlet venturi to enhance performance. Motor shall be a Premium High Efficiency 40 HP Totally Enclosed Fan Cooled with cast iron frame and 1.15 Service Factor, 460V/60hz/3ph. The fan will be balance to AMCA standards. Blower shall be designed for 12,000 CFM @ 12.0" Total Static Pressure. The blower shall be capable of performing up to 17.0" of static pressure water gauge. Electrical: 40 HP at 460/3/60.

M. Silencer Specification:
   1. The silencer shall be installed to the discharge section of the blower. The silencer shall be approximately 4 feet in length, reducing sound power levels to 75 DBA. Construction shall include 3-6" Sound Damper lining with expanded metal retainer. Sound pressure at 4' shall not exceed a weighted 82 dBA with silencer installed.

N. Impingement Inlet:
   1. Impingement Inlet is internal to the unit located under the dirty air inlet and is fabricated of 7 gage steel construction minimum. Abrasive inlet prevents wear to the filters.

O. Catwalk with Ladder:
   1. Catwalk and Ladder shall be fabricated from 2" x 2" x .25" angle iron, 4" x 4" x .375" Angle iron, 1" x .125" bar grate and .75" bar stock. Handrails fabricated from 1.5" x 1.5" x .125" square tubing. Safety kick plate fabricated from 4" x .187" steel plate. Catwalk and Ladder shall meet or exceed OSHA standard 1910.27.

2.03 COLLECTOR DRIVE CONTROL PANEL

A. Manufacturers:
   1. IVEC Systems; Model Intelligent Panel System (IPS).
   2. Dust Control.
   3. PlymoVent.

B. Variable frequency drive and controls to modulate dust collector fan speed to match air flow requirements of extraction arms in use.
   1. NEMA 4X enclosure.
   2. 0-5 inch differential pressure transducer.
   3. Hand/Off/Auto selector switch.
   4. Thermostatically controlled fan.
   5. Electrical diagram and termination/installation diagram.
   6. Drive OK indication LED.

7. Danfoss variable frequency drive with Modbus RTU communications port.
8. Remote start/stop capability.
9. Zero speed relay.
10. Main fuses.
11. Programming receptacle for easy programming and cloning.
12. Pilot tube kit, tie straps, brass barb for ductwork and 1/4-inch tubing between control panel and ductwork sensor.
13. Electrical; 460/3/60.

C. Accessories:
1. Over Pressure Kit (OPK) - The overpressure kit is a safeguard to this system if for whatever reason the negative duct pressure increases rapidly it will turn off the IPS2 once a certain level is reached. The pressure switch shall be adjustable between 4-20”WC and should be adjusted per application based on system requirements. The adjustment can be made via the dial on the pressure switch itself.
2. The OPK shall be wired directly into the IPS2 to avoid any control logic delays. The wiring between the OPK and the IPS2 should be a 2C/18awg connection.

D. Sequence of Operation;
1. The enclosure shall have a "Hands-Off-Auto" selector switch on the front door. In "Hand" position the fan will run at a preset speed that is set in the variable frequency drive parameter. In "Auto" position the fan speed will follow the differential pressure transducer to maintain the inches of w.c. that is set in the variable frequency drive parameter. In the "Off" position the variable frequency drive is disabled and the fan will not run.
2. As dampers are manually opened and closed the output of the differential pressure transducer changes in relation to the ductwork pressure and the variable frequency drive controls the speed of the fan to maintain the inches of w.c. setpoint.

2.04 ALTERNATE NO. 1: AUTOMATIC GATE CONTROLLERS

A. Manufacturers:
1. IVEC Systems; Steward System.
2. Dust Control.
3. PlymoVent.

B. Automatic control system to open and close gates on ductwork to extraction arms as welders are being utilized. System shall communicate with dust collector drive control panel for operation of fan speed.
1. NEMA 4X fiberglass enclosure.
2. 15" color touch screen.
3. 4-wire power and data control cable (network) between control panel and gate controllers.
4. 24 VDC power supply/VAC/13 W. Overload protection.
5. 24 VDC to DC converter.
6. DC control fuses.
7. Terminals.
8. 115 VAC power cord.
9. UL Labeled.
10. Current sensors and 60 minute timers.

11. Input/Output box for communication between damper gate controller RCP.
12. 24 VDC motorized gates.
13. Power and data cable network Modbus.
14. Network repeaters as required for system.
15. All other necessary operating equipment, devices and system components not specifically listed, are required for a complete and operational automatic control system.
16. 5-year warranty.

C. IVEC Assist can allow gates to open independent of their sensors to maintain duct velocity.
   1. Gates are defined by their RCP and MP bus address. They must be enabled in order.
   2. Setpoint Low: If the air velocity is below this value, more assist gates will open.
   3. Setpoint High: If the air velocity is above this value, assist gates will close.
   4. Delay: Time in seconds between each assist gate opening, giving time for air velocity to react.
   5. The velocity sensor can either be connected to the MCP or any RCP with the Air Velocity option.

D. EZ Gate - Electric
   1. Blade 100% out of air stream
   2. High Pressure Duct Seal 40” W.C.
   3. Self-centering
   4. Power Supply 24 vdc/vac/13 W
   5. Quick Open Time.
   6. Dirty high abrasion environment examples-fume, mist, grinding, wood dust
   7. 5 year warranty on actuator

E. Sequence of Operation;
   1. When the Drive Control Panel (DCP) "Hand-Off-Auto" selector switch is in the "Hand" position, the fan will run with preset speed that is set in a VFD parameter and can be changed from the Automatic Gate Controller (AGC). In "Auto" position the fan speed shall follow the differential pressure transducer to maintain the inches of w.c. that is set in a VFD parameter known as "closed loop" and can be changed from the AGC. In "Off" position the VFD shall be disabled and the fan shall not run.
   2. Controls must be wired and UL Approved in a UL 508A Panel assembly facility.
   3. When the DCP is in "Auto" mode, the AGC shall control the starting and stopping of the fan via the Modbus serial communications link.
   4. If the Modbus serial communication cable is not connected or the power to the VFD is removed a message indicating "No Comms" shall be displayed on the AGC and cannot be reset until communications is re-established.
   5. The status of the VFD shall be monitored and if it should fault a message shall be displayed on the AGC indicating "VFD Fault". The VFD fault shall be capable of being reset from the AGC.
   6. A drive status screen shall display the motor current, motor frequency and inches of water column, as well as if the fan is enabled and if it is running.
   7. Each damper, air cleaner and dust collector shall have a I/O module with PLC. Sensors and/or switches and the damper motor/solenoid shall be wired to the I/O modules. Each I/O module shall have a Node number assigned to it and set with switches mounted in the gate actuator. The AGC shall monitor the Network status for each node. Dampers shall be assigned a block of node numbers and auxiliary devices.

8. The AGC shall monitor the inputs to automatically open and close dampers/gates.
9. Whenever an input calls for a damper to open, the AGC shall send a signal to the damper to open it and also send a "Run" signal to the VFD that starts the fan. Whenever the "Open" signal from a damper is no longer calling for the damper to be open, an off-delay timer shall start timing and when it times out the "Run" signal to the VFD is removed and the fan shall stop. For set-up and troubleshooting, dampers shall be capable of being operated manually by selecting the Manual Mode on the AGC screen.
10. Sweep Mode: In the event the main duct velocity is unable to convey dust/fumes to the collector and there is fallout, a sweep mode shall be enabled so the fan can increase to maximum capacity to send material to the dust collector.
11. A three color light shall indicate when to change the filters (green indicates ok, yellow indicates filter warning, and red indicates filters need to be changed).
12. The system shall be provided with sequential pulse controllers (SPC) to clean dust collector filters when the fan stops. If the differential pressure indicates a high pressure in the dust collector, the SPC shall cycle until the pressure drops below the setting. The cleaning system must be on the network.
13. Motorized Gates: Shall be 24 VDC, 100% clear through, non-pneumatic, limit switch interruption must be in a separate enclosure, maximum 2 second, 100% open time when 24 VDC is applied and maximum 2 second 100% close time when 24 VDC is removed. Gates must have a seal at the blade entry to guarantee the 100% seal around the closed blade and 100% seal at the duct entry when the blade is removed from the air stream. 24 VDC wire quick disconnect coupling. Actuator does not have any limit switches but is electronically protected against overload - 5 -year warranty - Actuator is brushless. Built in sensing functions to prevent damage in a stall condition with manual override.
14. DCP to include a zero stop relay, electrical termination diagrams, an enclosure to meet NFPA 70E with a filtered fan thermostatically controlled, completely programmed to communicate with the AGC.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

3.02 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.

B. Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

C. Provide pitot tube openings where required for testing of systems, complete with metal cap with spring device or screw to ensure against air leakage.

D. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

END OF SECTION

SECTION 26 05 00
BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Basic Electrical Requirements and materials specifically applicable to Division 26 Sections, in addition to Division 1 - General Requirements. Section includes:
   1. Electrical Identification.
   2. Minor Demolition.
   3. Conductors and Devices.
   4. Raceways and Boxes.
   5. Supporting Devices.

1.03 REGULATORY REQUIREMENTS

A. Conform to NFPA 70 - National Electrical Code, latest edition with amendments as adopted by the City of Joliet, IL.

B. Conform to building codes as adopted by the City of Joliet, IL.

C. Install electrical Work in accordance with the NECA Standard of Installation.

1.04 DELIVERY, STORAGE AND HANDLING

A. Store and protect all materials as specified under the provisions of Section 01 60 00 and as specified herein.

B. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

C. Ship products to the job site in their original packaging. Receive and store products in a suitable manner to prevent damage or deterioration. Keep equipment upright at all times.

D. Investigate the spaces through which equipment must pass to reach its final destination. Coordinate with the manufacturer to arrange delivery at the proper stage of construction and to provide shipping splits where necessary.

1.05 PROJECT/SITE CONDITIONS

A. Install work in locations shown on Drawings, unless prevented by Project conditions. Drawings have omitted certain branch circuitry in areas for ease of reading. All branch circuitry is to be provided by Contractor.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission from Architect/Engineer before proceeding as specified under modification procedures.

1.06 QUALITY ASSURANCE

A. Provide Work as required for a complete and operational electrical installation.

B. All products shall be designed, manufactured, and tested in accordance with industry standards. Standards, organizations, and their abbreviations as used hereafter, include the following:
   1. American National Standards Institute, Inc (ANSI).
   2. American Society for Testing and Materials (ASTM).
   3. National Electrical Manufacturers Association (NEMA).
   4. Underwriters Laboratories, Inc. (UL).

C. Install all Work in accordance with the NECA Standard of Installation.

1.07 SUBMITTALS

A. Submit all requested items in Division 26 Sections under provisions of Section 01 30 00.

1.08 SUBSTITUTIONS

A. Substitutions will be considered only as allowed within the provisions of Section 01 60 00.

1.09 PROJECT RECORD DOCUMENTS

A. Cooperate and assist in the preparation of project record documents under the provisions of Section 01 78 00.

1.10 PROJECT MANAGEMENT AND COORDINATION

A. Proper project management and coordination is critical for a successful project. Manage and coordinate the Work with all other trades in accordance with Section 01 30 00 requirements. Reliance on the Drawings and Specifications only for exact project requirements is insufficient for proper coordination.

PART 2 PRODUCTS

2.01 WIRING METHODS

A. All locations: Building wire in raceway.

B. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.
   1. Use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 100 feet. Use minimum #10 AWG conductor wire in all the following locations:
      a. All programmable panel branch circuits (larger where indicated).
      b. All emergency lighting and exit branch circuits.

2.02 WIRE AND CABLE

A. Manufacturers:
   1. Okonite.
   2. Southwire.
   3. Collyer.

B. Building Wire:

1. Feeders and Branch Circuits Larger Than 6 AWG: Copper, stranded conductor, 600 volt insulation.
2. Feeders and Branch Circuits 6 AWG and Smaller: Copper conductor, 600 volt insulation. 6 and 8 AWG, stranded conductor; smaller than 8 AWG, stranded conductor (solid for device terminations).
3. Control Circuits: Copper, stranded conductor, 600 volt insulation.
4. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.
5. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet.
6. Use conductor not smaller than 12 AWG for power and lighting circuits.
7. Use conductor not smaller than 16 AWG for control circuits.

C. Locations:
1. Concealed Dry Interior Locations: Use only building wire with Type THHN insulation in raceway.
2. Exposed Dry Interior Locations: Use only building wire with Type THHN insulation in raceway.
3. Above Accessible Ceilings: Use only building wire with Type THHN insulation in raceway.
4. Wet or Damp Interior Locations: Use only building wire with Type THWN insulation in raceway.
5. Exterior Locations: Use only building wire with Type XHHW insulation in raceway.
6. Underground Installations: Use only building wire with Type XHHW insulation in raceway.

2.03 RACEWAY REQUIREMENTS

A. Use only specified raceway in the following locations:
1. Branch Circuits and Feeders:
a. Concealed Dry Interior Locations: Electrical metallic tubing.
b. Exposed Dry Interior Finished Locations: Electrical metallic tubing.
c. Exposed Dry Interior Unfinished Locations: Electrical metallic tubing.
d. All other locations: Galvanized Rigid Metallic Conduit.

B. Size raceways for conductor type installed.
1. Minimum Size Conduit Homerun to Panelboard: 3/4-inch.

2.04 METALLIC CONDUIT AND FITTINGS

A. Conduit:
1. Rigid Steel Conduit: ANSI C80.1.
2. Electrical metallic tubing: ANSI C80.3.
3. Flexible Conduit: UL 1, zinc-coated steel.
a. Liquidtight Flexible Conduit: UL360. Fittings shall be specifically approved for use with this raceway.

B. Conduit Fittings:
1. Metal Fittings and Conduit Bodies: NEMA FB 1.
a. EMT fittings: Use set-screw indentor-type fittings.

2.05 NONMETALLIC TUBING

A. Manufacturers:
1. Carlon Co.
2. LCP National Plastics, Inc.

3. Pacific Western Extruded Plastics Co.

B. Description: UL651A "Type EB and A PVC Conduit and HDPE Conduit."
   1. Conduit: Schedule 40. Suitable for exposure to sunlight and direct burial.

2.06 CONDUIT HANGERS

A. Manufacturers:
   1. Minerrallac Electric Company.
   2. Substitutions: Or Approved Equal.

B. Description:
   1. Standard conduit hanger, zinc-plated steel with bolts.
   2. Threaded rod and hardware: Plated finish, size and length as required for loading and conditions.

2.07 BEAM CLAMPS

A. Manufacturers:
   1. Appleton.
   2. Midwest.
   3. Raco.

B. Description: Malleable beam clamp, zinc plated steel.

2.08 ELECTRICAL BOXES

A. Manufacturers:
   1. Raco.
   2. Steel City.
   3. Appleton.
   4. Substitutions: Or Approved Equal.

B. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized steel, suitable for installation in masonry:

C. Equipment Support Boxes: Rated for weight of equipment supported; include 2 inch male fixture studs where required.

D. Wet Location Outlet Boxes: Cast aluminum: Cast alloy, deep type, gasket cover, threaded hubs.

2.09 PENETRATION SEALANTS

A. Fire-rated assemblies: Provide firestopping of all penetrations made by Work under this Contract in accordance with provisions of Section 07 84 00 requirements.

B. Thermal and Moisture Protection: Provide thermal and moisture protection made by Work under this Contract of all exterior wall, floor and roof penetrations in accordance with Division 7 requirements.

2.10 NAMEPLATES AND LABELS

A. Nameplates: Engraved three-layer laminated plastic, black letters on white background.

B. Locations:
   1. Each electrical distribution and control equipment enclosure.

C. Letter Size:
   1. Use 1/8 inch letters for identifying individual equipment and loads.
   2. Use 1/4 inch letters for identifying grouped equipment and loads.

D. Labels: Embossed adhesive tape, with 3/16 inch white letters on a black background. Use only for identification of individual wall switches and receptacles and control device stations.

2.11 WIRE AND CABLE MARKERS

A. Manufacturers:
   1. Brady Model PCPS.
   2. Panduit Model PCM.
   3. T & B Model WM.

B. Description: Cloth type wire markers.

C. Locations: Each conductor at panelboard gutters, pull boxes, and each load connection.

D. Legend:
   1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.

2.12 CONDUIT MARKERS

A. Location: Furnish markers for each conduit longer than 6 feet.

B. Spacing: 20 feet on center.

C. Color:
   1. 480 Volt System: Orange
   2. 208 Volt System: Black
   3. Fire Alarm System: Red.

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Demolition Drawings are based on casual field observation and are intended to identify the limits of the construction site. Remove all electrical systems in their entirety in proper sequence with the Work.

B. Disconnect electrical systems in walls, floors, and ceilings for removal.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service and Emergency Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner and Architect at least 24 hours before partially or

completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Notify Owner, Architect/Engineer and local fire service at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

F. Beginning of demolition means installer accepts existing conditions.

G. Verify that supporting surfaces are ready to receive work.

H. Electrical boxes are shown on Drawings, in approximate locations, unless dimensioned.
   1. Obtain verification from Architect/Engineer for locations of outlets throughout prior to rough-in.

I. Degrease and clean surfaces to receive wire markers.

J. Verify that interior of building is physically protected from weather.

K. Verify that mechanical work which is likely to injure conductors has been completed.

L. Completely and thoroughly swab raceway system before installing conductors.

3.02 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove all existing electrical installations to accommodate new construction.

B. Remove abandoned wiring to source of supply.

C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

D. Relocate existing fire alarm devices affected by wall, ceiling and floor demolition.

E. Repair adjacent construction and finishes damaged during demolition and extension work.

F. Properly dispose of all ballast to approved ballast recycler. Do not land fill ballasts.

3.03 APPLICATION

A. Install nameplate and label parallel to equipment lines.

B. Secure nameplate to equipment front using screws.

C. Secure nameplates to inside surface of door on panelboard that is recessed in finished locations.

D. Identify underground conduits using underground warning tape. Install one tape per trench at 3 inches below finished grade.

E. Neatly train and secure wiring inside boxes, equipment, and panelboards.

F. Use wire pulling lubricant for pulling 4 AWG and larger wires.

G. Route wire and cable as required to meet project conditions.
   1. Wire and cable routing indicated is approximate unless dimensioned.
   2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

H. Pull all conductors into raceway at same time.

I. Protect exposed cable from damage.

J. Neatly train and lace wiring inside boxes, equipment and panelboards.

K. Support cables above accessible ceilings to keep them from resting on ceiling tiles.

L. Make splices, taps, and terminations to carry full ampacity of conductors without perceptible temperature rise.

M. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

N. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".

O. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.

P. Do not use powder-actuated anchors.

Q. Do not drill or cut structural members.

R. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

S. Install surface-mounted cabinets and panelboards with minimum of four anchors.

T. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch off wall.

U. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

V. Terminate spare conductors with electrical tape.

W. Do not share neutral conductor on load side of dimmers.

X. Install wiring devices in accordance with manufacturer's instructions.
   1. Install wall switches at height shown on drawings, OFF position down.
   2. Install convenience receptacles at height shown on drawings grounding pole on bottom.
   3. Install specific purpose receptacles at heights shown on Drawings.

Y. Install wall plates flush and level.
   1. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
   2. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.

END OF SECTION

SECTION 26 27 17
EQUIPMENT WIRING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment and devices not and integral part of the electrical distribution system.

1.02 RELATED REQUIREMENTS

A. Section 26 05 00 - Basic Electrical Requirements

1.03 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).

B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Provide conduit rough-in and electrical connection to powered equipment and devices identified in the Project Manual and on the Drawings. Refer specifically, but not limited to, these Specification Sections for further information:
   1. Section 23 35 14 - Dust Collection Equipment

B. Coordination: Determine connection locations and requirements for furniture, equipment and devices furnished or provided under other sections.
   1. Do not rely solely on the Drawings and Project Manual for execution of the Work of this Section.
   2. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions.
   3. Include necessary field evaluation time to inspect connection requirements.
   4. Coordinate with other trades to determine exact rough-in requirements.

C. Sequencing:
   1. Install rough-in of electrical connections before installation of furniture and equipment is required.
   2. Make electrical connections before required start-up of equipment.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Conform to NEMA WD 1.
   2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
   3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
   4. Product: Carol.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION