**SECTION 26 27 02**

**EQUIPMENT WIRING SYSTEMS**

**BASED ON DFD MASTER ELECTRICAL SPEC DATED 03/01/23**

This section has been written to cover most (but not all) situations that you will encounter. Depending on the requirements of your specific project, you may have to add material, delete items, or modify what is currently written. The Division of Facilities Development expects changes and comments from you.

***This consultant is to coordinate this section with all other applicable Divisions and is to include a complete schedule of equipment including, but not limited to, conduit and wire size (including quantity), type of final connection, volts, amps and equipment number.***

**PART 1 - GENERAL**

**SCOPE**

The work under this section includes electrical connections to equipment specified under other Divisions and/or Sections, or furnished by Owner, including, but not limited to:

-Misc. Equipment

-HVAC and Plumbing motors, VFDs, and panels

-Elevators

-Coolers & Freezers

-Kitchen, Dishwashing and Laundry Equipment

-Lab Equipment

-Steam Pits

Included are the following topics:

PART 1 - GENERAL

 Scope

 Related Work

 Submittals

 Coordination

PART 2 - PRODUCTS

 Cords and Caps

 Other Products

PART 3 - EXECUTION

 Inspection

 Preparation

 Installation

 Miscellaneous Connections

 HVAC and Plumbing Connections

 Elevator Connections

 Cooler and Freezer Wiring

 Kitchen, Dishwashing and Laundry Equipment Connections

 Lab Equipment Connections

 Steam Pit Connections

 Equipment Connection Schedule

**RELATED WORK**

Applicable provisions of Division 1 govern work under this Section.

Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables

Section 26 05 33 – Raceway and Boxes for Electrical Systems

Section 26 27 29 - Elevator Distribution Equipment

Section 01 91 01 or 01 91 02 – Commissioning Process

**SUBMITTALS**

Product Data: Provide data for cord and wiring devices.

**COORDINATION**

Coordinate all equipment requirements with the various contractors and the Owner. Review the complete set of drawings and specifications to determine the extent of wiring, starters, devices, etc., required.

Coordinate the available fault current at equipment including control panels and internal components. Equipment shall be listed to interrupt the available fault current at point of connection.

**PART 2 - PRODUCTS**

**CORDS AND CAPS**

Straight‑blade Attachment Plug: NEMA WD 1.

Locking‑blade Attachment Plug: NEMA WD 5.

Attachment Plug Configuration: Match receptacle configuration at outlet provided for equipment.

Cord Construction: Oil‑resistant thermoset insulated multi-conductor flexible cord with identified equipment grounding conductor, suitable for hard usage in damp locations.

Cord Size: Suitable for connected load of equipment and rating of branch circuit overcurrent protection.

**OTHER PRODUCTS**

Refer to related sections for other product requirements.

**PART 3 - EXECUTION**

**INSPECTION**

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

Working space for equipment shall be provided that is likely to require examination, adjustment, servicing or maintenance per NEC 110.26(A)(1) table.

**PREPARATION**

Review equipment submittals prior to installation and electrical rough‑in. Verify location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.

**INSTALLATION**

Use wire and cable with insulation suitable for temperatures encountered in heat‑producing equipment.

Provide a green equipment ground conductor for all installed equipment wiring.

Make conduit connections to equipment using flexible PVC-coated metal conduit.

Requirements of NEC Article 300.22 shall apply for boxes, conduit, conduit connections to equipment, devices and luminaire located in Mechanical Plenum spaces.

Install pre‑finished cord set where connection with attachment plug is indicated or specified, or use attachment plug with suitable strain‑relief clamps.

Provide suitable strain‑relief clamps for cord connections to outlet boxes and equipment connection boxes.

Make wiring connections in control panel or in wiring compartment of pre‑wired equipment in accordance with manufacturer's instructions. Provide interconnecting wiring where indicated.

Install disconnect switches, controllers, control stations, and control devices such as limit switches and temperature switches as indicated. Connect with conduit and wiring as indicated.

All 120V single phase motor operated equipment such as fan coil units, unit heaters, door operators, shall be provided with a SSY, 2 gang combination plug fuse holder/ switch mounted adjacent to equipment.

**MISCELLANEOUS CONNECTIONS**

Hand Dryers: Provide handle lock on source circuit breaker to serve as required lock open disconnect.

Drinking Fountains and Bottle Fill Fountains: Provide GFCI source circuit breaker to serve receptacle at fountain.

Knox Box: Provide 3/4” conduit stubbed between Knox Box and nearest interior location above accessible ceiling.

**HVAC AND PLUMBING CONNECTIONS**

Provide all power wiring including all circuitry carrying electrical energy from panelboard or other source through starters, variable frequency drives (VFDs), controller overcurrent protection and disconnects to motors or to packaged control motor protection panels.

Packaged control motor protection panels may include disconnects and starters and overcurrent protection. Provide all wiring between source and packaged control motor protection panel and motors. Install panel on exterior wall or adjacent to AHU’s.

Contractor shall verify with mechanical contractor the electrical requirements including voltages, horsepower, disconnecting means, starters and variable frequency drives for motors and equipment prior to ordering circuit breakers, disconnects, controller overcurrent protection devices and starters.

VFD Installations: Input power wiring shall be installed in a separate conduit, output power wiring shall be installed in a separate conduit and control wiring shall be installed in a separate conduit. Do not mix input power, output power, or control wiring in a common conduit. Separate conduits for input and output power wiring shall be provided for each motor.

***Consultant is to coordinate the following with DFD electrical staff if the VFD application includes controlling multiple motors with a single VFD. Coordinate with drive manufacturer if they recommend utilizing common conduit for output circuitry to multiple motors until point of separation to serve each motor.***

VFD Installations: Output power wiring for more than one motor shall not share a common conduit.

VFD installations: Provide aux contact in local disconnect to de energize VFD when opening local disconnect.

Provide 120 volts to each temperature control panel. Coordinate quantity and exact locations with HVAC/DDC contractors.

Unless otherwise specified, all electrical control devices such as aqua-stats, float and pressure switches, fan powered VAV boxes, switches, electro-pneumatic switches, solenoid valves and damper motors requiring mechanical connections shall be furnished and installed and wired by the Contractor supplying the devices.

Provide 120V, single phase 20 ampere combination lighting and convenience outlet circuit and switching means to serve field installed receptacles and interior lighting within each HVAC unit. Each access section shall contain a minimum of one marine grade light fixture/ luminaire. Sections wider than 6 feet shall have multiple marine grade light fixtures/luminaire with maximum spacing of 6 feet. Provide separate junction box at exterior of air handling unit.

All conduit penetrations to AHU’s shall be sealed by electrical contractor. See Casing Penetrations in 23 73 13, 23 73 23 and 23 73 24 for exact requirements.

Each motor terminal box shall be connected with a minimum 12", maximum 36" piece of flexible PVC-coated metal conduit to a fixed junction box. When connections are located in Mechanical Plenum spaces located within Mechanical equipment, flexible metal conduit shall be utilized. Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.

Provide separate junction box for each engineered supply, return/relief/exhaust system at exterior of air handling unit for [208V][480V], 3-phase source.

All wiring shall be routed in conduit and a minimum of 12 AWG wire shall be used for all luminaires, switches and convenience outlets. All lighting, switches and convenience outlet circuits shall be a minimum of 20 amperes.

Provide local disconnect within each walk-in HVAC units to serve as line-of-site local motor disconnect. Disconnect enclosure shall be NEMA 4X stainless steel.

Check for proper rotation of each motor.

All heating, air conditioning and refrigeration equipment installed on the exterior of the building or rooftop shall have a 120V, single phase, 20 ampere rated outlet at an accessible location within 25 feet of the equipment.

**ELEVATOR CONNECTIONS**

**Disconnect Switch (Power Module) - Fused Elevator Shunt Trip**

Description: Provide shunt-trip fused disconnect switch with necessary relay(s), control transformer and other options, as required per specification Section 26 27 29.

**Connections**

Provide all power wiring from source to elevator controller including disconnect, line accessories equipment such as transformers and line reactors/inductors. Provide final connection between elevator controller and elevator motor. Coordinate with elevator contractor.

Provide all ground connections and wiring from building ground bus to elevator controller associated , elevator transformers. Sized per NEC 250.

***Consultant shall review the following and circuit as needed to meet the Code requirements. Elevator cab lighting shall be circuited to NEC Article 700 branch circuit for high rise buildings, I2 healthcare occupancies, and for buildings where elevator is utilized as part of egress path. Circuit to NEC Article 702 for all other buildings where an emergency generator is present.***

Provide single means of disconnect; manual starter, enclosed circuit breaker or disconnect, labeled "elevator cab lights" located in equipment room Per NEC 620.22. The means of disconnect shall be capable of being locked in the open position. Extend 120 volt circuit from source through lockable switch to controller. Provide one lockable switch and 120 volt circuit per unit. The overcurrent device protecting the branch circuit shall be located in the elevator machine room.

***Consultant shall specify a small panelboard in elevator equipment room to serve the loads identified below.***

Provide 120V, 20 ampere separate branch circuit to serve machine room lighting and receptacle(s) per NEC 620.23. Provide light switch and duplex receptacle(s). A GFCI receptacle shall be located adjacent to elevator motor. The lighting shall not be connected to load side of GFCI.

Provide 120V, 20 ampere separate branch circuit to serve elevator pit lighting and receptacle(s) per NEC 620.24. The lighting shall not be connected to load side of GFCI. Electrical installation in elevator pit shall be suitable for wet locations when the pit contains a fire protection sprinkler.

Provide 120V, 20 ampere separate branch circuit to serve elevator pit sump pump. Dedicated circuit shall not be GFCI protected. Cord and plug connection, shall be single receptacle. Electrical installation in elevator pit shall be suitable for wet locations when the pit contains a fire protection sprinkler.

Provide 120V, 20 ampere separate branch circuits for additional circuits supplying utilization equipment not identified in NEC 620.22, 620.23 and 620.4 but limited to loads per 620.1. Coordinate with elevator manufacturer’s requirements. Overcurrent devices protecting these additional loads shall be located in the elevator equipment room.

Provide 120V, 20 ampere separate branch circuit to serve hoist way receptacles. Locate receptacles on every other floor above lowest level.

***Consultant shall show location of all lights, switches and receptacles in the elevator shaft, equipment room and lobby. Locate luminaires as needed to meet the code required illumination levels.***

**Lighting**

Provide minimum of two (2) luminaires in the elevator pit. Electrical installation in elevator pit shall be suitable for wet locations when the pit contains a fire protection sprinkler.

Provide switch adjacent to pit access ladder, 36" above door sill.

Provide luminaires as required to maintain a minimum of 10 FC throughout the elevator pit.

Provide luminaires as required to maintain a minimum of 19 FC throughout the elevator equipment room or required working clearance around equipment in room-less equipment locations (equipment integral with elevator car).

Provide elevator lobby lighting to provide minimum 10 FC at elevator door (s) with the door (s) closed.

***Consultant shall review the following code requirement. Where elevator serves as the Fire Service Access Elevator, the hoistway shall be illuminated to a minimum of 1 FC (11 lux) per IBC 3008.3 and circuited to NEC 701.***

**Lighting - Hoistways**

Provide lighting on every [other] floor above lowest level [as required to maintain a minimum of 1 FC throughout the hoistway]. Provide 3-way and 4-way switches.

**Misc. connections**

Provide all wiring for and mount exterior alarm bell. Feed from emergency source.

Provide smoke detector in each elevator equipment room or space. Connect main alarm contacts to fire alarm system and auxiliary contacts to the controller.

Provide smoke detector in each elevator lobby. Connect main alarm contacts to fire alarm system and auxiliary contacts to elevator controller.

All traveling cables, control stations, control station wiring and final control connections at the controller shall be furnished and installed under Division 14 Elevator Work.

All elevator wiring from elevator controller shall be installed with raceway connectors. Hoistway cabling shall utilize raceway connectors or bushings at entrance to equipment enclosure.

Provide 3/4" conduit from controller to nearest telephone wiring closet (IDF) with four pair UTP Cat.-5e or better cable.

Entire installation shall be coordinated with DFDM electrical inspector prior to installation. Discussion shall be in addition to required electrical pre installation discussion as outlined in pre construction requirements.

Coordinate entire installation with Division 14 Contractor prior to rough-in.

Coordinate entire installation with Division 27 contractor prior to rough-in for communication and security requirements.

**COOLER AND FREEZER WIRING**

Provide rigid metal conduit or IMC for all surface wiring in coolers and freezers. Whenever possible avoid the use of surface wiring and run conduit in space behind or above insulated panels. PVC shall not be routed exposed inside units.

Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

Provide RMC, IMC or non-metallic nipple and sealing fittings whenever conduit pierces wall of cooler or freezer. Provide grounding conductor.

All openings cut in walls of cooler or freezer shall be patched and insulation integrity shall be maintained. Patching shall be approved by freezer or cooler installer.

Install all wiring for lighting, switches, evaporator, coil fans, compressors, interlocks, defrost heaters, door heaters, drain heaters, alarms, or any other electric devices supplied with unit.

Freezer and refrigeration drain lines with freeze protection wrap (heat trace) shall be served from a dedicated circuit protected with a Ground Fault Protection (GFP) circuit breaker with a protection level of 30 milliamps and higher.

Seal all conduits entering and leaving temperature-controlled areas.

**KITCHEN, DISHWASHING AND LAUNDRY EQUIPMENT CONNECTIONS**

Check loose equipment delivered to job by equipment installer against approved shop drawings or other required Drawings. Delivered equipment shall be listed by a Nationally Recognized Testing Laboratory.

Loose electrical equipment including disconnects, starters, thermostats, controls, local and remote switches furnished by equipment contractor shall be installed by electrical contractor.

Review dimensioned equipment layouts, detailed shop drawings of equipment, wiring, control and final connection diagrams available from the equipment supplier.

Provide non-fused disconnect switches serving equipment. Equipment installed in damp or wet locations shall be provided with NEMA 4X enclosures.

Provide Rigid Metal Conduit (RMC) or Intermediate Metal Conduit (IMC) for all surface conduit and fittings in these spaces.

Equipment contractor will receive all equipment and position in place.

Electrical Contractor shall rough in for equipment only from approved equipment shop drawings.

Rough in location shall be within three inches of equipment. If direct connection is required, use liquid-tight flexible conduit. If receptacle connection is required, verify proper receptacle configuration with equipment installer.

Final connections shall include extension of all service to each piece of equipment. All labor and material required to completely connect the equipment ready to operate shall be included in the final connections. All control wiring not integral with equipment shall be included.

Provide all required power and control wiring. This may include (but is not limited to) the following:

Provide switch in hood and branch circuit for integral light fixtures.

Provide pushbutton switch or manual starter for exhaust fan.

Provide emergency branch circuit for fire suppression system (if applicable). Wire automatic heat detectors or manual station so, when activated, valve of dry chemical bottle opens, gas solenoid valve shuts down, all dampers close, and make-up fans shut down, electrical power contactor opens (integral in equipment), and building fire alarm system is activated. Provide all required wiring, conduit and final connections. Refer to wiring diagrams supplied with equipment.

Provide wash-down system wiring; refer to schematic wiring diagrams supplied with hoods. Interconnect fire prevention system with wash-down system so wash-down system is activated upon alarm.

**LAB EQUIPMENT CONNECTIONS**

Check loose equipment delivered to job by equipment installer against approved shop drawings or other required Drawings. Loose electrical equipment including disconnects, starters, controls, local and remote switches furnished by equipment contractor shall be installed by electrical contractor.

Equipment contractor will receive all equipment and position in place.

Review dimensioned equipment layouts, detailed shop drawings of equipment, wiring, control and final connection diagrams available from the equipment supplier.

Electrical Contractor shall rough in for Lab equipment only from approved Lab equipment shop drawings.

Rough in location shall be within three inches of equipment. If direct connection is required, use liquid-tight flexible conduit. If receptacle connection is required, verify proper receptacle configuration with equipment installer.

Final connections shall include extension of all service to each piece of equipment. All labor and material required to completely connect the equipment ready to operate shall be included in the final connections. All control wiring not integral with equipment shall be included.

Provide all required power and control wiring. This may include (but is not limited to) the following:

Provide switch in hood and branch circuit for integral light fixtures.

Provide pushbutton switch or manual starter for exhaust fan.

Provide emergency branch circuit for fire suppression system (if applicable). Connect automatic heat detectors or manual station so, when activated, valve of dry chemical bottle opens, gas solenoid valve shuts down, all dampers close, and make-up fans shut down, electrical power contactor opens (integral in equipment), and building fire alarm system is activated. Provide all required wiring conduit and final connections. Refer to wiring diagrams supplied with equipment.

**STEAM PIT CONNECTIONS**

Check loose equipment delivered to job by equipment installer against approved shop drawings or other Drawings. Loose electrical equipment including disconnects, starters, controls, local and remote switches shall be installed by electrical contractor.

Review detailed shop drawings of equipment, wiring, control and final connection diagrams available from the equipment supplier.

Rough in location shall be within three inches of equipment. If direct connection is required, use liquid-tight flexible conduit. If receptacle connection is required, verify proper receptacle configuration with equipment installer.

Final connections shall include extension of all service to each piece of equipment. All labor and material required to completely connect the equipment ready to operate shall be included in the final connections. All control wiring not integral with equipment shall be included.

All equipment shall be installed in NEMA 4X Stainless Steel enclosures.

Provide Aluminum Rigid Metal Conduit and fittings for all current carrying conduits installed and routed in steam pit.

Aluminum Rigid Metal Conduit installation shall account for temperature disparities during installation- warm conduits in pits prior to final installation or AL conduit expansion fittings shall be utilized.

Aluminum Rigid Metal Conduit and fittings shall be installed so no direct contact between conduit and concrete exists.

Provide Sch 40 PVC conduit for all conduits utilized for tunnel/ pit grounding systems routed thru concrete structure.

***Consultant shall identify a 120/208V, 3phase 4-wire source panelboard in an adjacent building near the proposed steam pit with available 3 pole space. Indicate location, name, manufacturer and AIC rating of panelboard on drawings. Site plan shall denote multi-wire branch circuit routing. Where multiple steam pits exist, each pit shall be provided with separate multi-wire branch circuit.***

Provide a 20A, 3P circuit breaker in source panel indicated on drawings.

Provide a 120/208V, 3-phase 4-wire with ground, multi-wire branch circuit from source circuit breaker to steam pit structure. Conductors shall be oversized to accommodate voltage drop. The multi-wire branch circuit shall terminate in a non-fused, NEMA 4X disconnect or approved rated switch.

The multi-wire branch circuit disconnecting means shall be located in a ready accessible location, nearest point of entrance- not exceed 8’-0” of the circuit entering the steam pit. The maximum height from floor to disconnect operating handle shall be 6’-7”.

Provide one 120V, 20A circuit from disconnecting means (Phase A) to serve steam pit single phase sump pump. Coordinate cord/ plug configuration with sump pump manufacturer and provide matching single receptacle (Non GFCI protected). In addition. Install a (Phase C) , steam pit GFCI protected convenience receptacle adjacent (3 ft) to the sump pump receptacle per SPS 316.210 (1)(d).

Provide one 120V, 20A circuit from disconnecting means (Phase B) to serve steam pit lighting. Provide single pole light switch adjacent to access hatch/ ladder for lighting control while descending or entering.

Provide one 120V, 20A circuit from disconnecting means (Phase C) to serve steam pit receptacles. Receptacles shall be GFCI.

Control Panel. If a separate control panel is required for BAS interface and monitoring of loss of power and high level alarms, control panel shall be served from identified Phase B, the un-switched side of the lighting circuit.

All openings or cores into steam pit shall be patched and sealed.

Seal all conduits entering steam pit.

**EQUIPMENT CONNECTION SCHEDULE**

***Consultant shall provide the schedules on the drawings, not in the specification. The schedule is to include the conduit size, the wire size and quantity, branch circuit, source and the final connection. If the final connection is anything other than a direct connection then it should be determined by this consultant and listed.***

As indicated on the drawings.

END OF SECTION