

ITEM 665.8901--25 - ELECTRICAL WORK

1. DESCRIPTION:

- 1.01 Under this item the Contractor shall furnish, install, and place in operating condition all electrical work as specified. This work shall include all wire and cable, junction boxes, conduit system, fasteners and terminations, power panels, wiring to control equipment provided under another item.

2. MATERIALS:

2.01 Low Voltage Conductors - 600V and Under:

- A. All wire and cable shall be stranded copper. Sizes shall be as indicated on the plans with no size smaller than #10 AWG.
- B. Unless otherwise specified, all wiring shall be insulated with moisture and heat resistant thermoplastic or cross linked synthetic polymer 90°F, 600V or types THW, THWN or XHHW.
- C. All wire and cable shall be provided with an outer jacket continuously identified with the following: Manufacturer, insulation type, conductor size, rated voltage. All power and branch circuit wiring shall have circuit identification tags applied at both ends with panel name and number. All control wiring shall have device ID numbers at each termination. Wire tags for identification shall be hot stamped or have plastic bands with heat-shrunk protective sleeving.
- D. Acceptable wire and cable manufactures are American Insulated Wire Corp., Anaconda Wire and Cable, Rome Cable Corp., or approved equal.
- E. All wiring shall be color coded with #8AWG or smaller having colored insulation and #6AWG and larger having colored tape over black insulation at all panels, boxes, junctions, and terminations. The color green shall be used only for grounding and white shall be used for neutrals on 120/240V. Phase conductors shall be red, blue, and black for 120/240V. Control circuit cables shall be numbered as shown on plans in lieu of color coding.
- F. All terminations of #8AWG wire and greater shall have solderless high compression indent type lugs except when connected to equipment with pressure, screw type lugs. All terminations of #10AWG wire and smaller shall use nylon, self-insulating compression indent type for connections in control panels, terminal strips, etc.
- G. Splice connectors for #8AWG or smaller shall be the spring type with insulating thumb screw cover or indent type with insulating cover. For conductors #6AWG and larger, use uninsulated indent type pressure connectors and apply insulating plastic or rubber tape to provide an insulation equivalent to that of the conductor.
- H. Acceptable manufacturers of terminations and connectors are Brundy Corp., Ideal Industries, Thomas and Betts Company or approved equal. Acceptable manufacturers for insulating tape are 3M Company, Bishop/Tomic, Plymouth Rubber Company or approved equal.

2.02 Boxes:

- A. Exposed interior surface mounted outlet boxes shall have a cadmium or galvanized finish and be pressed code gauge steel or malleable iron with threaded hubs. All covers shall be stainless steel with a satin finish to match size of box.

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2. MATERIALS: (cont'd)

2.02 Boxes: (cont'd)

- B. Boxes used with surface raceway system shall be of same manufacturer as raceway system.
- C. Exterior surface mounted outlet boxes shall be malleable iron with threaded hubs and have a cadmium or galvanized finish. All covers shall have a neoprene gasket to provide a raintight-seal and shall be made of either aluminum or stainless steel construction.
- D. Standard outlet boxes shall be a minimum of 4 inches square by 2-1/8 inches deep. Size shall conform to Article 370 of the NEC for wire fill and conduit attachments.

2.03 Wiring Devices:

- A. Convenience receptacles shall be duplex type, 20A, 125V, 2 pole 3 wire type and brown color. Receptacles shall be specification grade NEMA 5-20R, grounding type with side and back terminal screw connections.
- B. Receptacles for outdoor applications shall be installed in rain tight boxes with neoprene gasketed covers. All exterior receptacles, including those installed in the pits, shall be GFI type.
- C. Ground fault interrupter (GFI) type duplex shall be NEMA Class 5-20R 20A, 120V rating. Device trip level shall not exceed 6 milliamps and a "TEST" and "RESET" button shall be provided in the face of the device.
- D. Acceptable manufacturers for all switches and receptacles are Hubbell, Arrow-Hart, Pass and Seymour or approved equal.

2.04 Panelboard Circuit Breakers: Circuit breakers shall be molded case with ampere rating, interrupting rating, voltage, poles, type, etc. as called for on the drawings and as recommended by the existing panelboard manufacturer. Label all circuit breakers and provide a distinct number adjacent to each branch pole. All circuit breakers shall be quick-make, quick-break thermal/magnetic type. Multi-pole circuit breakers shall be single handle, common trip. Circuit breakers shall be made by the same manufacturer as the panelboard in which they are being installed. Provide GFI breakers of same make as the panelboard as shown on the drawings.

2.05 Ground Bus: Provide predrilled 1/4"x2"x10" copper ground bus bar with standard NEMA bolt hole sizing and spacing for the type of connectors to be used. The bus bar shall be sized in accordance with the immediate requirements plus 150% spare capacity (minimum bus bar length shall be 10 inches). Provide bus bar with 2 inch standoff insulators. Provide 2-hole compression connectors for the connections of the bonding conductor with the ground bus bars.

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2. MATERIALS: (cont'd)

2.06 Grounding

- A. The grounding system shall equal or exceed the requirements of the NEC, Article 250. The conduit system which includes metal conduit, surface metal raceway, pullboxes, junction boxes, built-up enclosures, enclosures, motor frames, panelboards, etc. shall be made to form a continuous, conducting, permanent ground circuit of 25 ohms or less impedance to allow the safe conduction of ground fault currents. All conduits shall have an equipment ground to be connected to the panelboard ground bus and to all devices. The grounding system shall be designed to prevent objectionable differences in voltage between metal non-load current carrying parts of the electrical system. In the event of a conflict or discrepancy with plans or other specifications and the NEC Article 250, the more stringent requirements shall apply.
- B. Exposed grounding conductors such as bars, straps, cables, flexible jumpers, braids, shunts, etc. shall be bare stranded, soft drawn or soft annealed copper unless otherwise called for. The cable size shall be as required by NEC code, Article 250 or as indicated on the drawings.
- C. All ground rods shall be copper-clad, 3/4" diameter, cylindrical 10' long. Any welding shall be molded fusion designed for size and type of cable, rods, and structure. Acceptable manufacturers are Caldwell, Metalweld, Thermoweld or approved equal.

3. CONSTRUCTION DETAILS:

- 3.01 The Contractor shall submit shop drawings of all items to the Engineer for approval.
- 3.02 The Contractor shall have a licensed master electrician oversee all electrical work.

A. Low Voltage Conductors - 600V and Under

Install conductors in conduit or raceway systems only after the raceway system is completed, including boxes and bushings. No grease, oil, or lubricant other than manufacturers recommended pulling compounds shall be used to facilitate the pulling in of conductors. All splices shall be made in terminal or junction boxes and not inside conduits or fittings. Conductors shall be continuous from terminal to terminal. All splices and terminations shall be mechanically and electrically secure.

Provide number and size of conductors as shown on the drawings. A common neutral may be used for 2 or 3 branch circuits enclosed within the same conduit provided each branch circuit is connected to different phase busses in the same panelboard. All wires shall be color coded or tagged before being pulled into the conduit system. An equipment grounding conductor shall be installed in all conduits in accordance with Article 250 of the NEC.

B. Boxes

All boxes shall be firmly mounted to structural members and shall be level and plumb. Unless otherwise indicated, install boxes so that the long axis of each device will be vertical. All boxes shall be accessible at all times and not hidden behind other equipment or devices.

Provide supplementary boxes to facilitate installing wiring. Total bends in any conduit shall not-exceed 180° between boxes.

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3. CONSTRUCTION DETAILS:

3.02 (cont'd)

C. Wiring Devices

Install all devices where called for on the drawings. Adjust location as required to avoid interferences with existing equipment, windows, frames, etc. Provide a green ground wire from source, through the wiring system and connected to the ground terminal of every wiring device. Test all convenience receptacles for proper voltage, polarity and grounding. Test each GFI device for 6 milliamp leakage current rating. Replace all GFI units that fail to trip during testing. Rewire any receptacles that fail the voltage, polarity or grounding tests.

D. Panelboard Circuit Breakers

Circuit breakers shall be mounted inside the panel with all wiring terminating on the load side terminals. All breakers shall be located in positions as called out on the drawings. Corresponding wiring shall be identified with that location.

E. Grounding

Structural steel shall be bonded with equipment conductors at points not exposed and not subjected to damage of the conductor, and if possible where accessible for inspection. Bonding to ground rods shall be by molded exothermic welds.

The conduit system, metal enclosures, and panels shall be bonded with conductors as stated in the NEC, Article 250 to provide a continuous grounding system. Bonding jumpers shall be installed across transition points such as conduit entrances into enclosures, liquid-tight flexible conduit runs, and any other area of discontinuity.

4. METHOD OF MEASUREMENT

4.01 The work of the item will be measures as a lump sum unit of work.

5. BASIS OF PAYMENT

5.01 The lump sum price bid shall include the cost of all labor, materials, and equipment required to complete the work of this item.