METAL–CLAD CABLE SYSTEMS

1.1 SCOPE:

a. Furnish and install a complete system of metal–clad cable for branch circuit, signal, and remote–control wiring as specified herein.

b. Branch circuit cable system types AC, NM, and NMC are not permitted.

1.2 APPLICATIONS:

a. Metal–clad cables may be used in lieu of wire in metal raceway only for concealed work in dry locations above suspended ceilings and within stud partitions.

b. Cables may not be run in, or through, concrete or masonry, fire–rated partitions, smoke partitions, or floors.

1.3 SUBMITTALS:

a. Submit for approval manufacturer's data sheets for metal–clad cable systems.

2.1 MATERIALS:

a. Metal–clad cables shall be UL listed as type MC with copper conductors, THHN insulated, with full size green insulated grounding conductors. Minimum sizes shall be #12 AWG for branch circuits, #14 AWG for signal and remote control. Maximum size shall be #10 AWG.

b. Cable connectors shall be UL listed for grounding the metal sheath. Connectors shall be of steel or malleable iron with insulated throats.

c. Cables shall be color–coded in manufacture.

3.1 INSTALLATION:

a. Cables shall not be run exposed. Conduit skirts may be provided on surface mounted panelboards to conceal cables between panel tops and ceilings.

b. Except where installed in continuous rows, lighting fixtures shall be individually connected to a concealed outlet box. Cables may not be looped from fixture to fixture.

c. Cables above ceilings shall be supported from overhead structure clear of ductwork, suspended ceilings, and ceiling hanger wires.

GROUNDING AND BONDING

1.1 SCOPE:

a. Non–current–carrying metal parts, raceways, and enclosures shall be permanently and effectively grounded.

b. Grounding and bonding shall be provided in strict accordance with the National Electrical Code, and as specified herein and on the drawings.

c. The Contractor shall note that required grounding conductors and connections are not all shown on the drawings. NEC requirements apply.

1.2 SUBMITTALS:

a. Submit for approval manufacturer's data sheets for grounding and bonding materials.

2.1 MATERIALS AND APPLICATIONS:

a. Grounding conductors shall be of THWN insulated copper, unless otherwise indicated.

b. Grounding bus bars in distribution equipment shall be bare copper.

c. Aluminum and aluminum alloys are not acceptable as grounding materials.

d. Clamps for attaching conductors to water pipes and ground rods shall be of bronze. Ground rod clamps shall be U.L. listed for direct burial.

e. Clamps for attaching conductors to building steel shall be of steel, bronze, or malleable iron.

f. Threaded hubs for bonding metal raceways to the contained grounding electrode conductors and to the water pipe clamps shall be of bronze or malleable iron. Similar hubs shall be used to bond the same raceways to the conductors and to sheet metal equipment enclosures.

g. Driven grounding electrodes shall consist of copper clad steel rods. Rods shall be 10 feet long and 3/4" diameter unless otherwise indicated.

h. Bonding bushings shall be of steel or malleable iron with non–removable plastic throats rated 150^{0}C.

i. Bonding locknuts and wedges for service conduits shall be of zinc coated steel.

j. Grounding type insulated bonding bushings and jumpers shall be provided where conduits terminate in service entrance equipment, generator feeders, transfer switches, transformers, and where concentric, eccentric or over–sized knockouts are encountered. The jumpers shall be sized per NEC Table 250–66 for services, generator feeders, and transformers, and per Table 250–122 for branch circuits.

3.1 ELECTRICAL EQUIPMENT GROUNDING:

a. All non–current–carrying metal parts, raceways, and enclosures of the electrical system and of equipment supplied through the electrical system shall be permanently and effectively grounded.

b. Equipment grounding conductors shall be provided for each feeder and for each branch circuit and shall be contained within the same raceways as the feeder and branch circuit conductors. The equipment grounding conductor shall be THWN insulated copper, not smaller than #12 AWG.

c. Copper bonding strips normally included in small sizes of liquid–tight flexible metal conduit and dependent upon the terminal connectors for bonding continuity will not be accepted in lieu of the equipment grounding conductors specified herein.

d. Grounding terminals on wiring devices, including switches, shall be connected to the equipment grounding conductor included in the branch circuit raceway, and to the device box with suitable jumpers and lugs bolted to the box, not the plaster ring. "G" clips are not acceptable, and "self–grounding" type device mounting screws will not be accepted as the device grounding method.

e. Where metal raceways enter sheet metal enclosures through knockouts provide bonding bushings and jumpers to the enclosure under any of the following conditions:

1. Voltage exceeds 250 volts to ground.

2. Branch circuit conduit exceeds 1" in size.

3. Feeder conduit regardless of voltage and size.

BOXES

1.1 SCOPE:

a. Furnish and install outlet boxes, switch boxes, pull boxes, terminal boxes, junction boxes and floor boxes complete as shown and specified.

1.2 SUBMITTALS:

a. Submit for approval manufacturer's data sheets for all box types.

2.1 MATERIALS AND APPLICATIONS:

a. Unless specifically noted or approved otherwise, boxes shall be of zinc coated steel or cast ferrous alloy as manufactured by Steel City, Raco, Crouse–Hinds, Appleton, or approved equal.

b. For exposed work on the exterior of the building, and in damp or wet interior locations, boxes shall be of cast metal with threaded conduit hubs and gasket sealed covers; or of zinc coated sheet steel of NEC gauge and size with screw fastened gasket sealed covers and threaded conduits hubs of zinc coated malleable iron and no knockouts or extraneous openings. Cover screws shall be stainless steel.

c. For exposed work in interior dry locations less than 8 feet above a floor or platform in other than Electrical, Mechanical or Communications Closets or Equipment Rooms, boxes shall be of cast metal with threaded conduit hubs and matching covers; or of zinc coated sheet steel of NEC gauge and size with screw fastened covers and no knockouts or extraneous openings. Cover screws shall be steel.

d. For exposed work in interior dry locations in Electrical, Mechanical, or Communications Closets or Equipment Rooms; or, in other dry areas, 8 feet or more above a floor or platform, boxes 5" square and larger shall be NEC gauge and size of zinc coated sheet steel. 4" octagonal, 4" square and 4–11/16" square "knockout" boxes shall be of zinc coated steel, NEC gauge and size. Box extensions are not permitted on exposed "knockout" boxes and covers shall be of the raised surface type. "Handy" boxes are not permitted.

e. For concealed work, fixture outlet boxes shall be 4" octagonal minimum, provided with plaster rings in plastered surfaces. Concrete ring boxes shall be used in poured concrete. Switch and outlet boxes in plastered and dry walls shall be 4" square minimum or one–piece multi–gang with appropriate plaster rings. Switch and outlet boxes in exposed brick, block or tile walls shall be single or multi–gang one–piece boxes not less than 3–1/2" deep with square corners and with internal device mounting holes, equal to Steel City Type GW. Boxes in walls finished with ceramic tile or wood paneling shall be 4" square minimum or one–piece multi–gang boxes, fitted with appropriate tile rings having square corners and internal device mounting holes. Gangable boxes are not permitted.

3.1 INSTALLATION:

a. Set recessed boxes with edges flush with finished surfaces.

b. Immediately after installation cover boxes to prevent entrance of foreign matter.

c. Scaling of plans for outlet locations is not necessarily accurate enough for the intent of these specifications. It is the Contractor's responsibility to comply with the evident intent for centering or symmetric arrangement in ceiling and wall spaces. Special attention is also directed to the location of any outlets which are built into, or located in relation to, other features such as shelving, work counters, and equipment. The Contractor shall consult plans and shop drawings on such features and locate outlets as thereby indicated.

d. Mounting heights indicated herein and on the drawings are approximate dimensions of the center of the box to the floor and may vary slightly to clear obstructions and match joints in masonry. References to "Horizontal" and "Vertical" apply to the orientation of the long dimension of a single–gang plate and of the device mounting strap. Alignment tolerance shall be 1/16 inch. Unless otherwise indicated wall outlet boxes shall be mounted as follows:

1. Receptacle, and communications outlets shall be installed vertical, 18" up.

2. Switch boxes shall be installed vertical, 46" up. Switch boxes beside doors shall be on the strike side, with edge approximately 2" from door jamb or trim.

e. Junction and pull boxes may be used as necessary to facilitate wiring provided, they are hidden from sight (but accessible), or installed in locations where exposed wiring is permitted, or flush mounted at locations approved by the Architect/Engineer.

SECONDARY DISTRIBUTION EQUIPMENT

1.1 SCOPE:

a. Provide equipment for over–current protection, switching, disconnecting, transformation, and control of services, separately derived systems, feeders, and branch circuits as indicated on the drawings and as herein specified.

b. Equipment specified by this section shall be third party listed.

1.2 SUBMITTALS:

a. Submit for approval manufacturer's data sheets for fuses, enclosed switches, and circuit breakers.

2.1 MANUFACTURERS:

a. Distribution equipment, other than fuses, shall be manufactured by Square D, General Electric, Siemens, or Eaton. Equipment design features and components indicated on the drawings are those of Eaton, and the standard construction features of that manufacturer shall be considered as minimum requirements, with additional requirements as specified herein and on the drawings.

b. Fuses shall be manufactured by Bussmann, Gould Shawmut, or Littelfuse.

2.2 OVERCURRENT PROTECTION DEVICES:

a. Unless otherwise indicated, circuit breakers shall be provided as the over–current protection devices for services, separately derived systems, feeders, and branch circuits. Fuses may be used only where indicated on the drawings, or required by the nameplate for equipment connected, or specified herein.

b. Molded–case and insulated–case circuit breakers shall be the static or thermal–magnetic type, quick–make and quick–break for manual and automatic operation. Multi–pole breakers shall be common trip. Circuit breakers shall be bolted in place where possible. Thermal–magnetic breakers shall be calibrated at 40^{0}C. or ambient compensated. Ampere ratings, frame sizes, and short circuit ratings shall be as indicated on the drawings. Series ratings may be applied only where specifically indicated on the drawings. Individual enclosures shall be NEMA 1 indoors, 3R outdoors, unless otherwise indicated. Other circuit breakers shall be suitable for installation in Panelboards, as hereinafter specified.

c. Single–pole 15– and 20–amp circuit breakers shall be SWD rated.

d. Fuses shall be the non–renewable, time delay, cartridge type, UL Class RK5 unless otherwise indicated; for installation in Safety Switches, as hereinafter specified.

2.3 SWITCHING EQUIPMENT:

a. Fusible switches shall be incorporated into Safety Switches, as hereinafter specified. Manual operation shall be quick–make and quick–break. Fuse holders shall be the Class R rejection type unless otherwise indicated.

b. Safety Switches shall be the NEMA heavy duty type, horsepower rated, with interlocked covers that can be defeated, non–fusible except where fused switches are indicated, or fuses are required. Switch mechanisms shall be quick–make and quick–break. Enclosures shall be NEMA 1 indoors, NEMA 3R outdoors unless otherwise indicated. Fuse holders, where required, shall be as specified above for fusible switches. Switch shall have provisions for padlocking switch handle open or closed.

2.4 ENCLOSED CIRCUIT BREAKER:

a. Circuit breakers shall be enclosed in U.L. listed enclosures, NEMA 1 indoors and NEMA 3R outdoors unless otherwise indicated.

b. Circuit breaker handle shall be accessible from outside enclosure with cover closed.

c. Enclosure shall have provisions for padlocking circuit breaker handle open or closed.

2.5 APPLICATION:

a. Distribution Equipment shall be sized for installation with required clearances at the locations shown on the drawings. Alternative arrangements may be submitted to the Architect/Engineer by the Contractor for approval, in the form of shop drawings, drawn to scale and showing actual dimensions of proposed equipment and required clearances.

b. Unless otherwise indicated, Distribution Equipment shall be connected with wire and cable. In general, these specified conductors are rated for a maximum operating temperature of 75^{0}C and are sized for that temperature rating in an ambient of 30^{0}C. Distribution equipment, including terminal lugs, temperature sensitive devices, and enclosures shall be designed, sized, and labeled for field connection with conductors as specified.

c. Power conductors shall be properly tightened and/or torqued as recommended by the equipment manufacturer supplying the lugs/terminals used for terminating the conductors.

d. Lugs/terminals shall comply with UL standards UL486A and UL486B.

2.6 IDENTIFICATION:

a. Group mounted circuit breakers in Panelboards shall be provided with nameplates as described above; or they shall be identified with numerals and cardboard directories in metal or heavy polycarbonate directory frames. Directories in metal frames shall be protected with rigid plastic covers. Directories shall be sized to permit all circuit designations to be read without removing the card from the frame.

c. Manufacturer's nameplates or labels on custom fabricated or factory assembled custom equipment shall contain sufficient identification to expedite the future procurement of parts, additions, and shop drawings.

d. Service Equipment shall be UL labeled as "Suitable for use as Service Equipment." Service disconnects shall be clearly identified.

e. Label all receptacles, light switches, and disconnect switches with feeder panel name and branch circuit number. Use dyno–type labeling. Black background with white letters for normal power. Red background with white letters for emergency power. Labels to be installed on the exterior front cover of disconnect switches and under cover plates of receptacles and switches.

f. Label all power, lighting and distribution panels with name, voltage, # phase, # wires and feeder information. Labels to be engraved laminated phenolic nameplates. Black background with white letters for normal power. Red background with white letters for emergency power.

g. Panelboards shall be marked to warn of potential electric arc flash hazards as required by NEC 110.

PART 3: EXECUTION

3.1 INSTALLATION:

a. Distribution Equipment shall be installed in strict accordance with the manufacturer's instructions for handling, support, connections, assembly, protection, energizing, adjustment, and similar procedures.

b. Fastening methods shall comply with SECTION 16100 BASIC MATERIALS AND METHODS.

c. Floor mounted equipment shall be provided with 4" high concrete pads and shall be secured to the concrete pad. Pads shall have a 3/4–inch chamber on each accessible side.

d. Equipment interiors shall be thoroughly cleaned of dust, dirt, trash, and other foreign material prior to energizing of the equipment.

e. Exterior Safety Switches that are readily accessible to unauthorized persons shall have their covers padlocked closed by the Contractor. Keys shall be identified and delivered to the Owner.

f. Upon completion or the project, furnish to the Owner one complete set of replacement fuses, consisting of three fuses of each type and rating used.

g. Directory cards for Panelboards shall be neatly filled–in with a typewriter to indicate the type and location of the load on each circuit or feeder.

PANELBOARDS

1.1 SCOPE:

a. Furnish and install Lighting, Power, and Distribution Panelboards as indicated on the drawings and as herein specified.

1.2 SUBMITTALS:

a. Submit for approval panelboard shop drawings which include as a minimum the following information:

1. Cabinet dimensions.
2. Mounting requirements.
3. Bussing arrangement.
4. Circuit breaker arrangement.
5. Accessories.

2.1 BRANCH CIRCUIT PANELBOARDS:

a. Panelboard types, ratings, and contents shall be as shown on the Drawings.

b. Equipment shall be built to NEMA Standard PB–1, UL Standards UL50 and UL67, and NEC requirements.

c. Panelboard back–boxes shall be constructed of galvanized sheet steel and shall be securely fabricated with screws, bolts, rivets, or by welding. Back–boxes shall be a minimum 20" wide and 5–3/4" deep, unless noted otherwise, and heights shall not exceed 72" overall. Top or bottom gutter space shall be increased 6" where feeder loops through panel. End plates shall be supplied without knockouts.

d. Covers shall be constructed of high–grade flat sheet steel with:

1. Door–in–door construction shall be provided. The inside hinge door shall allow access to device handles only. Door shall close flush with cover and against a full inside trim stop. Hinges shall be inside type. The outer hinged door shall allow access to wiring gutter.

2. A flush latch and tumbler type lock, so panel door may be held closed without being locked. All such locks shall be keyed alike. Furnish to the Owner two keys with each lock, or a total of 10 keys for the project.
3. Four or more cover fasteners of a type which will permit mounting plumb on box. Cover shall also have inside support studs to rest on lower edge of back–box while being fastened. For flush mounted panelboards, cover fastening hardware shall be concealed behind the hinged door.

e. A means shall be provided for readily adjusting projection of panel interior assembly with all connections in place. A method requiring stacking of washers is not acceptable. Interior trim shall fit neatly between interior assembly and cover leaving no gaps between the two.

f. Panelboard phase and neutral bus bus–work shall be copper. A copper ground bus shall be provided in each panel.

g. Minimum short circuit rating of any panelboard assembly shall be 10,000A. Furnish panelboards with higher rating where so noted or where evidently intended by specification of circuit breakers with higher interrupting capacity.

h. Ampacity of mains shall be equal to, or greater than, the ampacity of the feeder unless otherwise indicated.

i. Where drawing schedules indicate spaces for addition of future circuit breakers; furnish all necessary bus–work, strap, brackets, hardware, and removable blank covers.

j. Breakers in panelboards shall be physically arranged in locations shown in panel schedules on the drawings where possible. They shall be connected to the phases as shown.

k. Unless otherwise indicated and where available for the panelboard type specified, circuit breakers shall be of the bolt–on type.

3.1 INSTALLATION:

a. Equipment shall be perfectly plumb and level.

b. Openings in back–boxes shall be cut or sawed with tools made for that purpose. Burning of openings is unacceptable.

c. Unused openings shall be closed.

d. Only one solid wire is allowable under a screw. Provide approved lugs for connecting stranded wire or more than one solid conductor.

e. Centered above the breakers in each panelboard attach a nameplate indicating panel designation – for example "PANEL A", or "PANEL MDP". Nameplates shall comply with SECTION 16100 BASIC MATERIALS AND METHODS.

f. Panelboard back–boxes shall be mounted with their tops 6'–8" above the floor.

LIGHTING FIXTURES AND ACCESSORIES

1.1 SCOPE:

a. The Contractor shall furnish and completely install Lighting Fixtures and Accessories as indicated on the drawings and as herein specified.

b. A lighting fixture shall be provided for each lighting outlet indicated. Outlets lacking fixture designations shall be brought to the attention of the Architect/Engineer before submitting proposal; otherwise units selected by the Architect/Engineer shall be furnished and installed at no additional charge.

1.2 SUBMITTALS:

a. Submit for approval complete manufacturer's data sheets for all fixtures. Indicate all components, characteristics, and options.

b. Submit for approval Lighting Fixture samples as requested by the Architect/Engineer. Samples shall be equipped with lamps, cords, plugs, and ballasts for 120–volt operation.

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03–06–23

REVISION DATES

JOB NUMBER 22–168
DRAWN BY CH
CHECKED BY MPA
DATE 03.06.23

JOB TITLE
CLEVELAND COUNTY
LEGRAND CENTER LIGHTING

SHEET TITLE
ELECTRICAL
SPECIFICATIONS

SHEET
E401