

DIVISION 26: ELECTRICAL

26 0000 ELECTRICAL

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SECTION 26 0501

COMMON ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Includes But Not Limited To:
1. General electrical system requirements and procedures.
 2. Perform excavating and backfilling work required by work of this Division as described in Contract Documents.
 3. Make electrical connections to equipment provided under other Sections.

1.2 SUBMITTALS

- A. Product Data:
1. Provide following information for each item of equipment:
 - a. Catalog Sheets.
 - b. Assembly details or dimension drawings.
 - c. Installation instructions.
 - d. Manufacturer's name and catalog number.
 - e. Name of local supplier.
 2. Furnish such information for following equipment:
 - a. Section 26 2726: Wiring devices.
 3. Do not purchase equipment before approval of product data.
 4. Submit in three-ring binder with hard cover (six sets)
- B. Quality Assurance / Control:
1. Report of site tests, before Substantial Completion.

1.3 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:
1. NEC and local ordinances and regulations shall govern unless more stringent requirements are specified.
 2. Material and equipment provided shall meet standards of NEMA or UL, or ULC, CSA, or EEMAC and bear their label wherever standards have been established and label service is available.
- B. Materials and equipment provided under following Sections shall be by same Manufacturer:
1. Sections 26 2416, 26 2816, and 26 2913: Panelboards, Enclosed Switches And Circuit Breakers, and Enclosed Controllers.
- C. Contractor shall obtain all permits and arrange all inspections required by local codes and ordinances applicable to this Division.

1.4 OWNER'S INSTRUCTIONS

- A. Provide competent instructor for time required to adequately train maintenance personnel in operation and maintenance of electrical equipment and systems. Factory representatives shall assist this instruction as necessary. Schedule instruction period at time of final inspection.

1.5 OPERATION AND MAINTENANCE MANUALS

- A. Prepare and submit (4) four complete copies of the O & M Manuals—manuals to contain information listed below. Place each manual in a tabbed three-ring binder upon completion of the project.
1. Operation and Maintenance manual must contain the following items:

- a. Copies of reviewed shop drawings.
- b. Letter of 1-year guarantee of workmanship.

1.6 GUARANTEE

- A. The following guarantee is a part of this specification and shall be binding on the part of the Contractor:

“The Contractor guarantees that this installation is free from mechanical defects. He agrees to replace or repair, to the satisfaction of the Owner’s Representative, any part of this installation which may fail or be determined unacceptable within a period of one (1) year after final acceptance.”

1.7 RECORD DRAWINGS

- A. During the course of construction, the Electrical Contractor shall maintain a set of drawings upon which all deviations from the original layout are recorded. These marked-up prints shall be turned over to the Architect/Engineer at the conclusion of the work.

PART 2 - PRODUCTS: Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

- A. All relocations, reconnections, and removals are not necessarily indicated on Drawings. All such work shall be included without additional cost to Owner.
- B. Confirm dimensions, ratings, and specifications of equipment to be installed and coordinate these with site dimensions and with other Sections.

3.2 INSTALLATION

- A. General:
 - 1. Locations of electrical equipment shown on Drawings are approximate only. Field verify actual locations for proper installation.
 - 2. Coordinate electrical equipment locations and conduit runs with those providing equipment to be served before installation or rough-in.
 - a. Notify Architect of conflicts before beginning work.
 - b. Coordinate locations of power and lighting outlets in mechanical rooms and other areas with mechanical equipment, piping, ductwork, cabinets, etc, so they will be readily accessible and functional.
 - 3. Work related to other trades which is required under this Division, such as cutting and patching, trenching, and backfilling, shall be performed according to standards specified in applicable Sections.
- B. Install Penetration Firestop System appropriate for penetration at electrical system penetrations through walls, ceilings, and top plates of walls.

3.3 FIELD QUALITY CONTROL

- A. Site Tests: Test systems and demonstrate equipment as working and operating properly. Notify Architect before test. Rectify defects at no additional cost to Owner.

END OF SECTION

SECTION 26 0502**ELECTRICAL DEMOLITION REQUIREMENTS****PART 1 GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To
 - 1. Demolition involving electrical system as described in Contract Documents.
- B. Related Sections
 - 1. Section 26051 – Common Electrical Requirements
 - 2. New and replacement work specified in appropriate specification Section.

PART 3 EXECUTION**3.1 EXAMINATION**

- A. All relocations, reconnections, and removals are not necessarily indicated on Drawings. All such work shall be included without additional cost to Owner.

3.2 PREPARATION

- A. Disconnect equipment that is to be removed or relocated. Carefully remove, disassemble, or dismantle as required, and store in approved location on site, existing items to be reused in completed work.
- B. Where affected by demolition or new construction, relocate, extend, or repair raceways, conductors, outlets, and apparatus to allow continued use of electrical system. Use methods and materials as specified for new construction.

3.3 PERFORMANCE

- A. Perform drilling, cutting, block-offs, and demolition work required for removal of necessary portions of electrical system. Do not cut joists, beams, girders, trusses, or columns without prior written permission from Architect.
- B. Remove concealed wiring abandoned due to demolition or new construction. Remove circuits, conduits, and conductors that are not to be re-used back to next active fixture, device, junction box or source.
- C. Patch, repair, and finish surfaces affected by electrical demolition work, unless work is specifically called for under other Sections of the specifications.

3.4 CLEANING

- A. Remove obsolete raceways, conductors, apparatus, and lighting fixtures promptly from site and dispose of legally.

END OF SECTION

SECTION 26 0503**EQUIPMENT WIRING SYSTEMS****PART 1 GENERAL****1.01 WORK INCLUDED**

- A. Electrical connections to equipment specified under other sections or finished by Owner.

1.02 RELATED WORK

- A. In the even of conflict regarding equipment wiring system requirements between this Section and any other section, the provisions of this Section shall govern.

PART 2 PRODUCTS

As described in the related sections.

PART 3 EXECUTION**3.01 INSPECTION**

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

3.02 PREPARATION

- A. Review equipment submittals prior to installation and electrical rough-in. Verify location, size, and type of connections, voltage, number of phases, and ampacity. Coordinate details of equipment connections with supplier and installer.

3.03 INSTALLATION

- A. Use wire and cable with insulation suitable for temperatures encountered in heat-producing equipment.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit in damp or wet locations and for connections to vibrating equipment. Make flexible connections to vibrating equipment of sufficient length to form a loop to restrict transmission of noise to structural elements or to the air.
- C. Install prefinished cord set or use attachment plug with suitable strain-relief clamps. Refer to Section 26 2726, Wiring Devices, for details.
- D. Make wiring connections in control panel or in wiring compartment of prewired equipment in accordance with manufacturer's instructions. Provide interconnecting wiring where indicated. Tag all interconnecting wiring to identify source and destination equipment and terminal numbers. Refer to Section 26 0553, Electrical Identification, for details.

END OF SECTION

SECTION 26 0519**LINE VOLTAGE CONDUCTORS AND CABLE****PART 1 -****1.1 SUMMARY**

- A. Includes But Not Limited To:
 - 1. Quality of conductors used on Project except as excluded below.
- B. Related Sections:
 - 1. Section 26 0501: Common Electrical Requirements.

1.2 DEFINITIONS

- A. Line Voltage: Over 70 Volts.

PART 2 - PRODUCTS**2.1 COMPONENTS**

- A. Line Voltage Conductors:
 - 1. Copper with AWG sizes as shown:
 - a. Minimum size shall be No. 12 except where specified otherwise.
 - b. Conductor size No. 8 and larger.
 - 2. Insulation:
 - a. Standard Conductor Size No. 10 And Smaller: 600V type THWN or XHHW (75 deg C).
 - b. Standard Conductor Size No. 8 And Larger: 600V Type THW, THWN, or XHHW (75 deg C).
 - c. Higher temperature insulation as required by NEC or local codes.
 - d. Type TC cable is acceptable for use in cable trays only.
 - 3. Colors:
 - a. 208Y / 120 V System:
 - 1) Black: Phase A.
 - 2) Red: Phase B.
 - 3) Blue: Phase C.
 - 4) Green: Ground.
 - 5) White: Neutral.
 - b. 480Y / 277 Volt System:
 - 1) Brown: Phase A.
 - 2) Orange: Phase B.
 - 3) Yellow: Phase C.
 - 4) Gray: Neutral.
 - 5) Green: Ground.
 - c. Conductors size No. 10 and smaller shall be colored full length. Tagging or other methods for coding of conductors size No. 10 and smaller not allowed.
 - d. For feeder conductors larger than No. 10 at pull boxes, gutters, and panels, use painted or taped band or color tag color-coded as specified above.
- B. Line Voltage Cables:
 - 1. Non-Metallic Sheathed Cable (NM) and Metal Clad Cable (MC) may be used as restricted below.
 - a. Copper Conductors
 - b. Use only indoor, dry locations where:
 - 1) Not subject to damage.
 - 2) Not in contact with earth.

- c. Not in concrete.
 - d. Is allowed by local codes.
- C. Standard Connectors:
- 1. Conductors No. 8 And Smaller: Steel spring wire connectors.
 - 2. Conductors Larger Than No. 8: Pressure type terminal lugs.
 - 3. Connections Outside Building: Watertight steel spring wire connections with waterproof, non-hardening sealant.
- D. Terminal blocks for tapping conductors:
- 1. Terminals shall be suitable for use with 75 deg C copper conductors.
 - 2. Acceptable Products:
 - a. 16323 by Cooper Bussmann, St Louis, MO www.bussmann.com
 - b. LBA363106 by Square D Co, Palatine, IL www.squared.com.
 - c. Equal as approved by Architect before bidding. See Section 01 6000.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
- 1. Conductors and cables shall be continuous from outlet to outlet.
 - 2. Do not use direct burial cable.
- B. Line Voltage Conductors (Over 70 Volts):
- 1. Install conductors in raceway except where specifically indicated otherwise. Run conductors of different voltage systems in separate conduits.
 - 2. Route circuits at own discretion, however, circuiting shall be as shown in Panel Schedules. Group circuit homeruns to panels as shown on Drawings.
 - 3. Neutrals:
 - a. On three-phase, 4-wire systems, do not use common neutral for more than three circuits.
 - b. On single-phase, 3-wire systems, do not use common neutral for more than two circuits.
 - c. Run separate neutrals for each circuit where specifically noted on Drawings.
 - d. Where common neutral is run for two or three home run circuits, connect phase conductors to breakers in panel which are attached to separate phase legs so neutral conductors will carry only unbalanced current. Neutral conductors shall be of same size as phase conductors unless specifically noted otherwise.
 - 4. Pulling Conductors:
 - a. Do not pull conductors into conduit until raceway system is complete and cabinets and outlet boxes are free of foreign matter and moisture.
 - b. Do not use heavy mechanical means for pulling conductors.
 - c. Use only listed wire pulling lubricants.

END OF SECTION

SECTION 26 0526**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
 - 1. Furnish and install grounding for electrical installation as described in Contract Documents except as excluded below.
- B. Related Sections:
 - 1. Section 26 0501: Common Electrical Requirements.

1.2 QUALITY ASSURANCE

- A. Pre-Installation Conference: Participate in pre-installation conference specified in Section 03 3111.

PART 2 - PRODUCTS**2.1 COMPONENTS**

- A. Size materials as shown on Drawings and in accordance with applicable codes.
- B. Grounding And Bonding Jumper Conductors: Bare copper or with green insulation.
- C. Make grounding conductor connections to ground rods and water pipes using approved bolted clamps listed for such use.
- D. Service Grounding Connections And Cable Splices:
 - 1. Make by compression type connectors designed specifically for this purpose.
 - 2. Acceptable Products:
 - a. Burndy
 - b. Thomas & Betts.
 - c. Equal as approved by Architect before bidding.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Interface With Other Work: Coordinate with Section 03 3111 in installing grounding conductor and placing concrete. Do not allow placement of concrete before Architect's inspection of grounding conductor installation.
- B. Grounding conductors and bonding jumper conductors shall be continuous from terminal to terminal without splice. Provide grounding for following.
 - 1. Conduits and other conductor enclosures.
 - 2. Neutral or identified conductor of interior wiring system.
 - 3. Non-current-carrying metal parts of fixed equipment such as motors, starter and controller cabinets, instrument cases, and lighting fixtures.

- C. Pull grounding conductors in non-metallic raceways, in flexible steel conduit exceeding 72 inches in length, and in flexible conduit connecting to mechanical equipment.
- D. Connect equipment grounds to building system ground.
 - 1. Use same size equipment grounding conductors as phase conductors up through #10 AWG.
 - 2. Use NEC Table 250-95 for others unless noted otherwise in Drawings.
- E. Run separate insulated grounding cable from each equipment cabinet to electrical panel. Do not use intermediate connections or splices. Affix directly to cabinet.
- F. Provide and install a #6 ground conductor from main service ground to telephone board. Terminate ground at board on a grounding bar.
- G. Provide a separate, insulated equipment green grounding conductor in all feeder and branch circuits. Terminate each end on a grounding lug, bus, or bushing and to all metallic enclosures. A conduit ground is not acceptable. Install grounding bushings on both ends of all feeder conduit and bond to ground system.

3.2 FIELD QUALITY CONTROL

- A. Inspections: Notify Architect for inspection two days minimum before placing concrete over grounding conductor.

END OF SECTION

SECTION 26 0533

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Includes But Not Limited To:
 - 1. Quality of material and installation procedures for raceway, boxes, and fittings used on Project but furnished under other Divisions.
 - 2. Furnish and install raceway, conduit, and boxes used on Project not specified to be installed under other Divisions.
 - 3. Furnish and install main telephone service raceway as described in Contract Documents and to comply with telephone company requirements.
 - 4. Furnish and install main electrical service raceway to comply with electrical utility company requirements.
- B. Related Sections
 - 1. Section 26 0501: General Electrical Requirements.

PART 2 - PRODUCTS

2.1 COMPONENTS

- A. Raceway And Conduit:
 - 1. Sizes:
 - a. **3/4 inch** for exterior underground use.
 - b. **1/2 inch** minimum elsewhere, unless indicated otherwise.
 - 2. Types: Usage of each type is restricted as specified below by product.
 - a. Galvanized rigid steel or galvanized intermediate metal conduit (IMC) is allowed for use in all areas. Where in contact with earth or concrete, wrap buried galvanized rigid steel and galvanized IMC conduit and fittings completely with vinyl tape.
 - b. Galvanized Electrical Metallic Tubing (EMT) and Electrical Non-Metallic tubing (ENT)
 - 1) Allowed for use only in indoor dry locations where it is:
 - a) Not subject to damage.
 - b) Not in contact with earth.
 - c) Not in concrete.
 - 2) Flexible steel conduit or metal-clad cable required for final connections to indoor mechanical equipment.
 - c. Schedule 40 Polyvinyl Chloride (PVC) Conduit:
 - 1) Allowed for use only underground or below concrete with galvanized rigid steel or IMC elbows and risers.
 - d. Listed, Liquid-Tight Flexible Metal Conduit:
 - 1) Use in outdoor final connections to mechanical equipment, length not to exceed **36 inches**.
 - 3. Prohibited Raceway Materials:
 - a. Aluminum conduit.
 - b. Armored cable type AC (BX) cable.
- B. Raceway And Conduit Fittings:
 - 1. Rigid Steel Conduit And IMC: Threaded and designed for conduit use.
 - 2. EMT:
 - a. Compression type.
 - b. Steel set screw housing type.
 - 3. PVC Conduit:
 - a. PVC type. Use PVC adapters at all boxes.
 - b. PVC components, (conduit, fittings, cement) shall be from same Manufacturer.
 - 4. Flexible Steel Conduit: Screw-in type.
 - 5. Liquid-tight Flexible Metal Conduit: Sealtite type.

6. Expansion fittings shall be equal to OZ Type AX sized to raceway and including bonding jumper.
 7. Prohibited Fitting Materials:
 - a. Crimp-on, tap-on, indenter type fittings.
 - b. Cast set-screw fittings for EMT.
 - c. Spray (aerosol) PVC cement.
- C. Outlet Boxes:
1. Outlet boxes shall be UL listed for the application, Heavy Duty PVC for NM and ENT of proper size and shape are acceptable for all systems. Where metal boxes are used, provide following:
 - a. Provide metal supports and other accessories for installation of each box.
 - b. Equip ceiling and bracket fixture boxes with fixture studs where required.
 - c. Equip outlets in plastered, paneled, and furred finishes with plaster rings and extensions to bring box flush with finish surface.
 2. Telephone / data outlet boxes shall be a deep box to accommodate Cat 6A cables. 4sq. deep box with single gang mudring where two or more cables come to one box.

2.2 MANUFACTURERS

- A. Contact Information:
1. Cooper B-Line, Highland, IL www.bline.com.
 2. Hubbell Incorporated, Milford, CT www.hubbell-wiring.com.
 3. Square D, Palatine, IL www.squared.com.
 4. Steel City, Div Thomas & Betts, Memphis, TN www.tnb.com.
 5. Thomas & Betts, Memphis, TN www.tnb.com.
 6. Walker Systems Inc, Williamstown, www.wiremold.com.
 7. Wiremold Co, West Hartford, CT www.wiremold.com.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Confirm dimensions, ratings, and specifications of materials to be installed and coordinate these with site dimensions and with other Sections.

3.2 INSTALLATION

- A. Interface With Other Work:
1. Coordinate with Divisions 22 and 23 for installation of raceway for control of plumbing and HVAC equipment.
 2. Before rough-in, verify locations of boxes with work of other trades to insure that they are properly located for purpose intended.
 - a. Coordinate location of outlet for water cooler with Division 22.
 - b. Coordinate location of outlets adjacent to or in millwork with Division 06 before rough-in. Refer conflicts to Architect and locate outlet under his direction.
 3. Coordinate installation of floor boxes in carpeted areas with carpet installer to obtain carpet for box doors.
 4. Install pull wires in raceways installed under this Section where conductors or cables are to be installed under other Divisions.
- B. Conduit And Raceway:
1. Conceal raceways within ceilings, walls, and floors, except at Contractor's option, conduit may be exposed on walls or ceilings of mechanical equipment areas and above acoustical panel suspension ceiling systems. Install exposed raceway runs parallel to or at right angles to building structure lines.
 2. Keep raceway runs **6 inches** minimum from hot water pipes.
 3. Make no more than four quarter bends, 360 degrees total, in any conduit run between outlet and outlet, fitting and fitting, or outlet and fitting.
 - a. Make bends and offsets so conduit is not injured and internal diameter of conduit is not effectively reduced.
 - b. Radius of curve shall be at least minimum indicated by NEC.
 4. Cut conduit smooth and square with run and ream to remove rough edges. Cap raceway ends during construction. Clean or replace raceway in which water or foreign matter have accumulated.
 5. Install insulated bushings on each end of raceway **1-1/4 inches** in diameter and larger, and on all raceways where low voltage cables emerge. Install expansion fittings where raceways cross building expansion joints.

6. Run two spare conduits from each new panelboard to ceiling access area or other acceptable accessible area and cap for future use.
 7. Route conduit through roof openings for piping and ductwork where possible; otherwise. All roof penetrations shall be flashed, counter flashed and sealed per Roofing Contractor. Coordinate all roof penetrations with the Roofing Contractor.
 8. Provide nylon pull string with printed footage indicators secured at each end of each empty conduit, except sleeves and nipples. Identify with tags at each end the origin and destination of each empty conduit, and indicate same on all empty or spare conduits on the as-built drawings.
 9. Install expansion-deflection joints where conduit crosses building expansion, seismic, or structural isolation break (SIB) joints.
 10. Where conduit penetrates fire-rated walls and floors, seal opening around conduit with UL-listed foamed silicone elastomer compound. Fill void around perimeter of conduits with nonmetallic nonshrink grout in all concrete or masonry walls.
 11. Bend PVC conduit by hot box bender and, for PVC **2 inches** in diameter and larger, expanding plugs. Apply PVC adhesive only by brush.
 12. Installation In Framing:
 - a. Do not bore holes in joists or beams outside center 1/3 of member depth or within **24 inches** of bearing points. Do not bore holes in vertical framing members outside center 1/3 of member width.
 - b. Holes shall be **one inch** diameter maximum.
 13. Underground Raceway And Conduit:
 - a. Bury underground raceway installed outside building **24 inches** deep minimum.
 - b. Bury underground conduit in planting areas **18 inches** deep minimum. It is permissible to install conduit directly below concrete sidewalks, however, conduit must be buried **18 inches** deep at point of exit from planting areas.
 14. Conduit And Raceway Support:
 - a. Securely support raceway with approved straps, clamps, or hangers, spaced as required.
 - b. Do not support from mechanical ducts or duct supports without Architect's written approval. Securely mount raceway supports, boxes, and cabinets in an approved manner by:
 - 1) Expansion shields in concrete or solid masonry.
 - 2) Toggle bolts on hollow masonry units.
 - 3) Wood screws on wood.
 - 4) Metal screws on metal.
 15. Prohibited Procedures:
 - a. Use of wooden plugs inserted in concrete or masonry units for mounting raceway, supports, boxes, cabinets, or other equipment.
 - b. Installation of raceway that has been crushed or deformed.
 - c. Use of torches for bending PVC.
 - d. Spray applied PVC cement.
 - e. Boring holes in truss members.
 - f. Notching of structural members.
 - g. Supporting raceway from ceiling system support wires.
- C. Boxes:
1. Boxes shall be accessible and installed with approved cover.
 2. Do not locate device boxes that are on opposite sides of framed walls in the same stud space. In other wall construction, do not install boxes back to back.
 3. Locate boxes so pipes, ducts, or other items do not obstruct outlets.
 4. Install outlets flush with finished surface and level and plumb.
 5. Support switch boxes larger than two-gang with side brackets and steel bar hangers in framed walls.
 6. At time of substantial completion, install blank plates on uncovered outlet boxes that are for future use.
 7. Install air / vapor barrier back boxes behind outlet boxes that penetrate vapor barrier.
 8. Location:
 - a. Install boxes at door locations on latch side of door, unless explicitly shown otherwise on Drawings. Verify door swings shown on electrical drawings with architectural drawings, and report discrepancies to Architect before rough-in. Distance of switch boxes from jamb shall be within **6 inches** of door jamb.
 - b. Arrange boxes for ceiling light fixtures symmetrically with respect to room dimensions and structural features.
 - c. Properly center boxes located in walls with respect to doors, panels, furring, trim and consistent with architectural details. Where two or more outlets occur, space them uniformly and in straight lines with each other, if possible.
 - d. Center ceramic tile boxes in tile.

END OF SECTION

SECTION 26 0553

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Nameplates and labels.
- B. Wire and cable markers.

1.02 RELATED WORK

- A. This Section shall be used in conjunction with the following other specifications and related Contract Documents to establish the total requirements for electrical identification.
 - 1. Section 26 0501 - Basic Electrical Requirements
- B. In the event of conflict regarding electrical identification requirements between this Section and any other section, the provisions of this Section shall govern.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Nameplates: Engraved three-layer laminated plastic, minimum 3/16 inch high white letters on a black background.
- B. Nameplates (Emergency Equipment): Engraved three-layer laminated plastic, minimum 3/16 inch high white letters on a red background.
- C. Wire and Cable Markers: Split sleeve or tubing type. Cloth or wraparound adhesive types not approved.
- D. Conductor-color Tape: Colored vinyl electrical tape.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Degrease and clean surfaces to receive nameplates.
- B. Install nameplates and labels parallel to equipment lines.
- C. Secure nameplates to equipment fronts. Secure nameplate to outside face of panelboard doors.
- D. Embossed tape will not be permitted for any application.
- E. Electrical Contractor shall write the circuit number to which each device is connected on the inside of the box (clearly visible when device is removed) and on the backside of each coverplate. Use a permanent black marker.

3.02 WIRE IDENTIFICATION

A. Conductors for power circuits to be identified per the following schedule.

Conductor	System Voltage	
	480Y/277V	208Y/120V
Phase A	Brown	Black
Phase B	Orange	Red
Phase C	Yellow	Blue
Neutral	Grey	White
Grounding	Green	Green
Isolated Ground	Green with yellow stripe	Green with yellow stripe
Switchleg (lighting)	Purple	Pink

3.03 NAME PLATE ENGRAVING SCHEDULE

A. Provide nameplates of minimum letter height as scheduled below.

B. Panelboards, Switchboards and Motor Control Centers:

1. 1st Line - Equipment Name: 1/4 inch Lettering.
2. 2nd Line - Voltage Rating: 3/16 inch Lettering
3. 3rd Line - Feed Source: 3/16 inch Lettering
4. 4th Line - Available Fault Current: 3/16 inch Lettering
5. Nameplate Examples:

PANEL: HA
480Y/277V
FEED FROM:
MSB-2
SCA: 18,560 AMPS

SWBD: MSB
480Y/277V
FEED FROM:
UTIL.
SCA: 35,680 AMPS

MCC-A: SEC. 1
480V-3P
FEED FROM:
MSB-2
SCA: 18,560 AMPS

C. Individual Circuit Breakers, Switches, and Motor Starters in Switchboards, and Motor Control Centers:

1. 1st Line - Load Served: 1/4 inch Lettering.
2. 2nd Line - Location of Load: 3/16 inch Lettering
3. Nameplate Examples:

PUMP: P-1
MECH. RM 112

D. Individual Circuit Breakers, Enclosed Switches, and Motor Starters:

1. 1st Line - Load Served: 1/4 inch Lettering.
2. 2nd Line - Voltage Rating: 3/16 inch Lettering
3. 3rd Line - Feed Source: 3/16 inch Lettering
4. Nameplate Examples:

FAN: F-1
480V-3P
FEED FROM: HM-
1,3,5

- E. Transformers: 3/16 inch; identify equipment designation. 1/8 inch; identify primary and secondary voltages, primary source, and secondary load and location.
1. 1st Line - Equipment Name: 3/16 inch Lettering.
 2. 2nd Line - Voltage Rating: 1/8 inch Lettering
 3. 3rd Line - Feed Source: 1/8 inch Lettering
 4. 4th Line - Available Fault Current: 3/16 inch Lettering
 5. Nameplate Example:

<p style="text-align: center;">XFMR:TA 480-208Y/120V FEED FROM: HA-2 SUPPLIES: PNL LA SCA: 18,560 AMPS</p>
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END OF SECTION

SECTION 26 2417**PANELBOARDS****PART 1 GENERAL****1.01 WORK INCLUDED**

- A. Distribution panelboards.
- B. Lighting and appliance branch circuit panelboards.

1.02 RELATED WORK

- A. This Section shall be used in conjunction with the following other specifications and related Contract Documents to establish the total requirements for panelboards.
 1. Section 26 0501 - Basic Electrical Requirements.
 2. Section 26 0553 - Electrical Identification.
- B. In the event of conflict regarding panelboard requirements between this Section and any other section, the provisions of this Section shall govern.

1.03 SUBMITTALS

- A. Provide the following in addition to the standard requirements: Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

1.04 SPARE PARTS

- A. Keys: Furnish two each to Owner.

PART 2 PRODUCTS**2.01 ACCEPTABLE MANUFACTURERS - PANELBOARDS**

- A. Square D NQOD – NF
- B. “Power Link” Panelboards shall be SQ-D ONLY.

2.02 DISTRIBUTION PANELBOARDS

- A. Panelboards: NEMA PB 1; circuit breaker type: FS W-P-115; Type I, Class I.
- B. Enclosure: NEMA PB 1; Type 1. Cabinet size: 5 3/4 inches deep; 20-inches wide, mount per plans.
- C. Provide cabinet front with concealed trim clamps and hinged door with flush lock. Finish in manufacturer’s standard gray enamel.
- D. Provide panelboards with aluminum bus, ratings as scheduled on Drawings. Provide ground bus in all panelboards.
- E. Molded Case Circuit Breakers: NEMA AB 1; provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as type HACR for air conditioning equipment branch circuits.
- F. Nameplates: Engraved three-layer laminated plastic, minimum 3/16 inch high white letters on a black background. Label to include panel identification, voltage and source. Label to be attached with screws.

2.03 BRANCH CIRCUIT PANELBOARDS

- A. Lighting and Appliance Branch Circuit Panelboards: NEMA PB1; circuit breaker type.
- B. Enclosure: NEMA PB 1; Type 1, mount per plans.

- C. Cabinet Size: 5-3/4 inches deep; 20 inches wide for 240 volt and less panelboards, 20 inches for 480 bolt panelboards.
- D. Provide flush surface cabinet front with typewritten directory, concealed trim clamps, concealed hinge and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.
- E. Provide panelboards with aluminum bus, ratings as scheduled on Drawings. Provide ground bus in all panelboards.
- F. Minimum Integrated Short Circuit Rating: as shown on Drawings.
- G. Molded Case Circuit Breakers: NEMA AB 1, FS W-C-375; plug-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled on Drawings. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
- H. Nameplates: Engraved three-layer laminated plastic, minimum 3/16 inch high white letters on a black background. Label to include panel identification and voltage. Label to be attached with screws.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install panelboards plumb in conformance with NEMA PB 1.1.
- B. Height: 78 inches to top.
- C. Adjust trim to cover all openings.
- D. Provide filler plates for unused spaces in panelboards.
- E. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- F. Provide typewritten circuit schedules in lighting and distribution panelboards and load centers to identify panelboard and load served by each branch breaker. Index shall include specific information including actual room names and numbers and load served. Obtain actual room names from Architect prior to producing indexes.

3.02 FIELD QUALITY CONTROL

- A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multiwire branch circuits.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

END OF SECTION

SECTION 26 2726

WIRING DEVICES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Wall switches.
- B. Receptacles.
- C. Device plates and box covers.
- D. Cords and caps.

1.02 RELATED WORK

- A. This Section shall be used in conjunction with the following other specifications and related Contract Documents to establish the total requirements for wiring devices.
 - 1. Section 26 0501 - Basic Electrical Requirements.
- B. In the event of conflict regarding requirements for wiring devices between this Section and any other section, the provisions of this Section shall govern.

1.03 DESIGN REQUIREMENTS

- A. FS W-C-596 - Electrical Power Connector, Plug, Receptacle, and Cable Outlet.
- B. FS W-S-896 - Switch, Toggle.
- C. NEMA WD 1 - General Requirements for Wiring Devices.
- D. NEMA WD 6 - Wiring Devices - Dimensional Requirements.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS - WALL SWITCHES.

	<u>1-POLE</u>	<u>3-WAY</u>	<u>4-WAY</u>	<u>W-PILOT</u>
Hubbell	1221 X	1223 X	1234 X	1221-P1 X
P&S	20AC1 X	20AC3 X	20AC4 X	20ACI-CPL
Leviton	1223 X	1223 X	1224 X	
Eagle	2221X	2223X	2224X	

2.02 WALL SWITCHES

- A. Wall Switches for Lighting Circuits FS W-S-896; ac general use snap switch with toggle rocker handle, rated 20 amperes and 120-277 volts ac. Handle: Standard color, to be selected, in all areas. Screw type terminals only. (Standards color shall include brown, gray, ivory, black or a white for all devices.)
- B. Pilot Light Type: Green pilot handle; handle lighted when switch is ON.
- C. Locator Type: Lighted handle.
- D. Provide 3-way and 4-way switches of matching style, appearance and specification as indicated on drawings.

2.03 ACCEPTABLE MANUFACTURERS - RECEPTACLES

<u>MFGR.</u>	<u>C.O.'S</u>
Hubbell	5352 X
P&S	5352 X
Leviton	5352 X
Eagle	5362X

2.04 RECEPTACLES

- A. Convenience and Straight-blade Receptacles: NEMA WD 1.
- B. Locking-Blade Receptacles: NEMA WD 5.
- C. Convenience Receptacle Configuration: NEMA WD 1; Type 5-20R. Nylon face: Standard color, to be selected, in all areas. Emergency receptacles: Red nylon face. (Standard colors shall include brown, gray, ivory, black and white for all devices.)
- D. Weatherproof Receptacles: Receptacles as specified mounted in a cast steel box with gasketed, weatherproof device plate as specified.
- E. Specific-use Receptacle Configuration: NEMA WD 1 or WD 5; type as indicated on Drawings, brown nylon face.
- F. GFCI Receptacles: Duplex convenience receptacle with integral ground fault current interrupter. NEMA Type 5-20R. All units shall be feed-through type for downstream device protection. All receptacles indicated to be installed in a toilet room, bathroom, roof top, and outdoors or within 6 feet of a sink, basin, tub or floor sink shall be GFIC protected

2.05 SPECIFIC PURPOSE RECEPTACLES

- A. NEMA WD 1 or WD 5; type as indicated on Drawings.
- B. Isolated Ground Type: Straight blade type 5-20R as indicated on the Drawings. Grey nylon face.
- C. Twist lock type. NEMA configuration as shown on the Drawings.

2.06 WALL PLATES

- A. Decorative Cover Plate: Stainless Steel in all areas. All isolated ground receptacle covers shall bear the engraved phrase "ISOLATED GROUND".
- B. Engraved Plates: Same plate as specified herein. Provide with engraved characters 1/8 inch high characters (all letters in upper case) with filler of black color.
- C. Weatherproof Cover Plate: Gasketed cast metal with hinged gasketed device covers.

2.07 ACCEPTABLE MANUFACTURERS - CORDS AND CAPS

- A. Hubbell.
- B. Leviton.
- C. Pass and Seymour.

2.08 CORDS AND CAPS

- A. Straight-blade Attachment Plug: NEMA WD 1.
- B. Locking-blade Attachment Plug: NEMA WD 5.
- C. Attachment Plug Configuration: Match receptacle configuration at outlet provided for equipment.
- D. Cord Construction: Oil-resistant thermoset insulated Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for hard usage in damp locations.

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

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install wall switches 48 inches above floor, OFF position down.
- B. Install convenience receptacles 18 inches above floor, 4 inches above backsplash, or as noted, in a vertical position with grounding pole to the down.
- C. Install specific-use receptacles at heights shown on Contract Drawings.
- D. Install convenience receptacles in 4 square box in a vertical position with the ground pole down.

END OF SECTION