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ADDENDUM #3

FEBRUARY 1, 2017

TRANSMITTED VIA EMAIL: 3 pages

TO: ALL PLAN HOLDERS AND POTENTIAL BIDDERS

FROM: RON VENTURELLA, PURCHASING OFFICER *RV*

**SUBJECT: FIELD HOUSE RENOVATIONS ENKA MIDDLE SCHOOL
(RFP# 59-16)**

The following changes, revisions, additions, and/or clarifications to the plans and/or specifications are hereby made a part of the original documents. **Be sure to acknowledge this addendum on the proposal sheet.**

Addendum # 3
RFP #59-16

Enka MS Fieldhouse Renovations
Enka Middle School, Candler NC
Buncombe County Schools

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ADDENDUM NUMBER BCS07-#3

February 1, 2017

Where any article, division or subparagraph of the original contract documents or other addenda is supplemented herein, the provisions of the original documents shall remain in effect. All the supplemental provisions shall be considered as added thereto. Where any such article, division or subparagraphs are amended, voided or superseded thereby, the provisions of such article, division or subparagraph not so specifically amended, voided or superseded shall remain in effect.

The attention of each Contractor is called to the following clarifications; additions to and changes in the plans and specifications dated MAY 5, 2016 on the above job. It will be the responsibility of each Contractor to call such clarifications, additions and changes in plans and specifications to the attention of subcontractors concerned. The Architect nor Owner in no way assumes any responsibility for notifying any subcontractor, material dealers or others not having received the original contract documents from the Architect.

NOTE: Division, Section and Paragraph numbers refer to Specifications and Detail numbers refer to Drawings.

ITEM 1. ALL CONTRACTS

Clarification: The existing boiler system will remain. GC to ensure protection and shoring, or removal and replacement during the demolition process.

ITEM 2. ALL CONTRACTS

Revision: All new and existing patching and/or floors to be painted instead of sealed. Replace sealed with Paint on room finish schedule.

Floor paint to be Sherwin Williams Armorseal 18100 over a compatible primer.

ITEM 3. ALL CONTRACTS

Clarification: It has come to our attention that there may be gravel ballast underneath the existing roof membrane. Removal of the entire system is the responsibility of the General Contractor.

ITEM 4. ALL CONTRACTS

Revision: Please see attached revised sheet E401

ITEM 5. ALL CONTRACTS

Clarification: Please see attached Electrical Specifications:

1. 26 01 00 - BASIC ELECTRICAL MATERIALS AND METHODS
2. 26 05 19 - CONDUCTORS AND CABLES
3. 26 05 26 - GROUNDING
4. 26 05 29 - WIRING DEVICES
5. 26 05 33 - RACEWAY AND BOXES
6. 26 05 48.16 - SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS
7. 26 05 53 - ELECTRICAL IDENTIFICATION
8. 26 24 16 - PANELBOARDS
9. 26 28 16 - DISCONNECT SWITCHES
10. 26 51 00 - INTERIOR LIGHTING

ITEM 6. ALL CONTRACTS

Revision: Hardware Specification & Schedule:

1. See attached Hardware Specification 087100
2. See attached Hardware Schedule

ITEM 7. ALL CONTRACTS

Clarification:

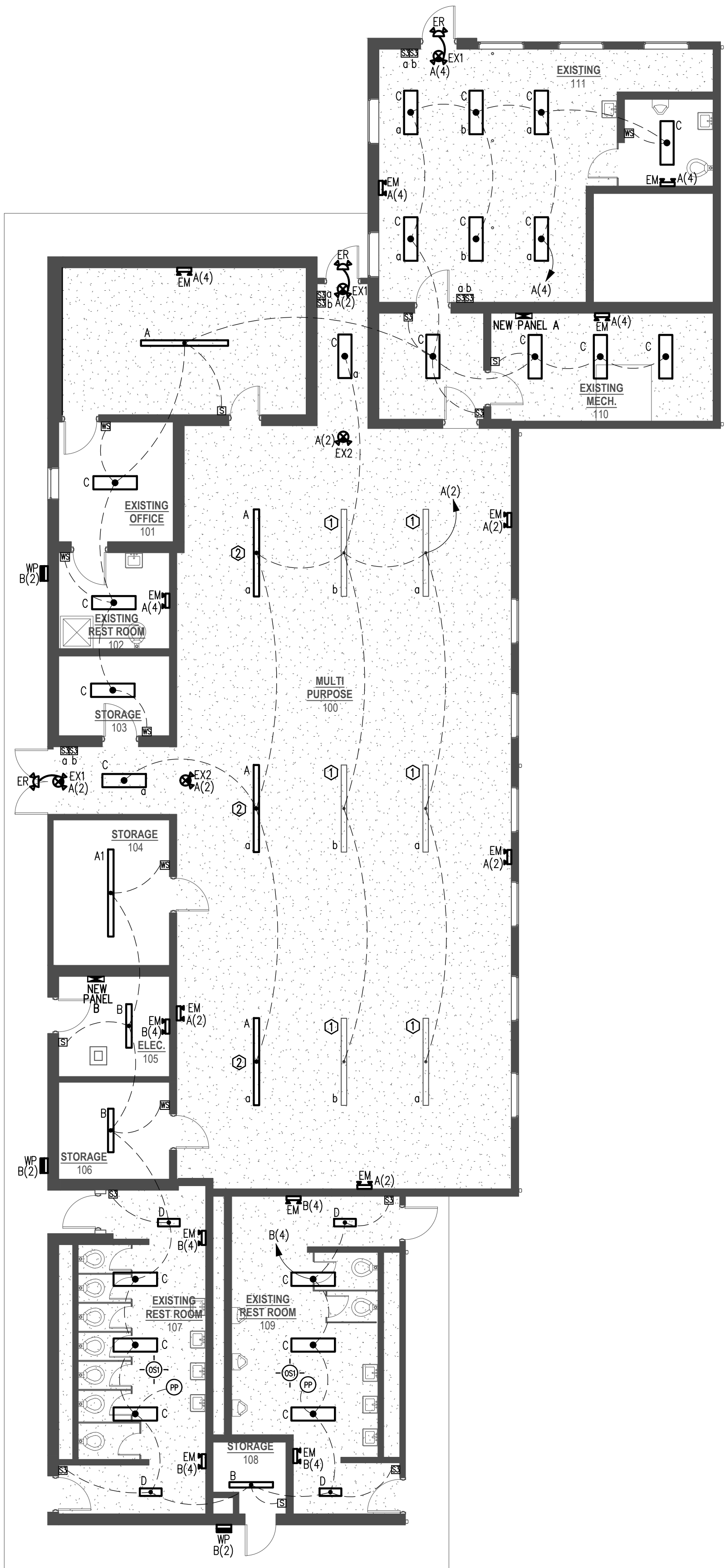
All new door frames are to be hollow metal. New double door frame #100A to have removable astragal.

ITEM 8. ALL CONTRACTS

Clarification:

At Door #100B, revise partition type A to delete gyp bd on exterior side and replace with ½" OSB sheathing with vapor barrier and cementitious panel siding w/ composite trim.

**END OF ADDENDUM NUMBER BCS01-#3
FIELD HOUSE RENOVATIONS ENKA MIDDLE SCHOOL (RFP# 59-16)**



LIGHTING PLAN
SCALE: 1/8"=1'-0

LIGHTING FIXTURE SCHEDULE							
TYPE	DESCRIPTION	LAMP	MANUFACTURER PART #	VOLTAGE	WATTAGE	MOUNTING	REMARKS
A	8' INDUSTRIAL STRIP FIXTURE WITH WIRE GUARD WITH (4)32W T8 LAMPS	(4)32W T8	COLUMBIA LIGHTING CATALOG # CS8-232-EU-CSWG4	120	112	SURFACE MOUNTED	
A1	8' INDUSTRIAL STRIP FIXTURE WITH WIRE GUARD WITH (4)32W T8 LAMPS	(4)32W T8	COLUMBIA LIGHTING CATALOG # CS8-232-EU-CSWG4-CSHC	120	112	CHAIN HUNG	
B	4' INDUSTRIAL STRIP FIXTURE WITH WIRE GUARD WITH (2)32W T8 LAMPS	(2)32W T8	COLUMBIA LIGHTING CATALOG # CS4-232-EU-CSWG4	120	56	CHAIN HUNG	
C	2x4' SURFACE MOUNTED LED FIXTURE	LED	FIXTURE-ENERGY SOLUTIONS INTERNATIONAL CATALOG # F-24LX-L4V-35-FR HOUSING-A.L.P. CATALOG # EL-2x4-SHROUD	120	44	SURFACE MOUNTED	
D	2'x2' SURFACE MOUNTED LED FIXTURE	LED	FIXTURE-ENERGY SOLUTIONS INTERNATIONAL CATALOG # F-22LX-L2V-35-FR HOUSING-A.L.P. CATALOG # EL-2x2-SHROUD	120	44	SURFACE MOUNTED	
EM	DUAL HEAD EMERGENCY LIGHT WITH BATTERY BACKUP		COMPASS LIGHTING CATALOG # CU2	120	3		
ER	2-LAMP WEATHERPROOF REMOTE HEAD POWERED BY EXIT SIGN "EX1" BELOW	LED	COMPASS LIGHTING CATALOG # CORD	6	3		
EX1	THERMOPLASTIC LED EXIT SIGN WITH HEADS, BATTERY BACKUP, AND REMOTE HEAD POWER CAPACITY	LED	COMPASS LIGHTING CATALOG # CRRRC	120	12		
EX2	THERMOPLASTIC LED EXIT SIGN WITH HEADS AND NICKEL CADMIUM BATTERY BACKUP	LED	COMPASS LIGHTING CATALOG # CCR	120	12		
WP	LED WALL PACK WITH PHOTOCCELL INTEGRAL TO FIXTURE	LED	CREE LIGHTING CATALOG # XSPW-A-0-2-F-G-1-FINISH-P	120	25	WALL MOUNTED	

LIGHTING FIXTURE SCHEDULE NOTES:

1. LIGHTING FIXTURES MANUFACTURER SHALL BE PROVIDED AS SPECIFIED, UNLESS PRE-APPROVED DURING BIDDING BY THE ARCHITECT/ENGINEER.
2. VERIFY VOLTAGE REQUIREMENTS WITH RESPECT TO FLOOR PLAN CIRCUITING AND PANEL SCHEDULES.
3. VERIFY MOUNTING HEIGHTS ON ALL WALL AND SURFACE MOUNTED FIXTURES WITH ARCHITECT PRIOR TO ROUGH-IN.
4. VERIFY ALL LUMINAIRE COLOR SELECTIONS WITH ARCHITECT PRIOR TO PURCHASING AND INSTALLING.
5. BATTERY PACKS FOR ALL EXIT AND EMERGENCY LIGHT FIXTURES SHALL BE CAPABLE OF PROVIDING EMERGENCY POWER TO THE FIXTURES FOR A MINIMUM OF 90 MINUTES.

SWITCH LEGEND

- LOCAL TOGGLE SWITCH
S.P.S.T, 20A, SPEC GRADE
- 3-WAY LOCAL TOGGLE SWITCH
S.P.S.T, 20A, SPEC GRADE
- WALL MOUNTED OCCUPANCY SENSOR
HUBBELL BUILDING AUTOMATION CATALOG# LHMDT1-COLOR
- DUAL TECHNOLOGY CEILING MOUNTED 360° OCCUPANCY SENSOR-500 SQ. FT
HUBBELL BUILDING AUTOMATION CATALOG# OMNDT-500
- POWER PACK
HUBBELL BUILDING AUTOMATION CATALOG# UV-PP

GENERAL LIGHTING NOTES:

1. ALL LIGHT FIXTURES SHALL MEET THE SEISMIC REQUIREMENTS OF ASCE 7.
2. ELECTRICAL CONTRACTOR TO WIRE ALL EXIT SIGNAGE UN-SWITCHED TO THE LOCAL LIGHTING CIRCUIT IN THE ROOM WHERE MOUNTED.
3. LOWER-CASE LETTER ADJACENT TO LIGHT FIXTURE DENOTES SWITCH DESIGNATION FOR SWITCHING IN ROWS.
4. IN ROOMS THAT HAVE BOTH OCCUPANCY SENSOR AND SWITCH/SWITCHES, WIRE OCCUPANCY SENSOR AHEAD OF AND IN SERIES WITH SWITCH/SWITCHES.
5. COORDINATE WITH OWNER FOR PREFERRED LOCATION OF SWITCHES PRIOR TO INSTALLING.

OCCUPANCY SENSOR NOTES

1. ALL SENSOR LOCATIONS ARE APPROXIMATE. REFER TO MANUFACTURER'S INSTALLATION INSTRUCTIONS PRIOR TO INSTALLATION.
2. ULTRASONIC CEILING MOUNTED SENSORS REQUIRE THAT THEY BE NO CLOSER THAN 6 FEET TO AIR SUPPLY/RETURN REGISTERS.
3. ONE POWER PACK IS REQUIRED FOR EACH CIRCUIT CONTROLLED.

KEYED LIGHTING NOTES:

- ① DENOTES EXISTING 8' FIXTURE TO BE RELOCATED FROM CURRENT LOCATION TO NEW LOCATION AS SHOWN.
- ② DENOTES NEW 8' FIXTURE TO MATCH EXISTING LIGHT FIXTURES IN MUTI-PURPOSE ROOM. SEE FIXTURE SCHEDULE FOR FIXTURE CATALOG NUMBER.

Enka Middle School
Field House Renovation
Candler, North Carolina
Division 26
Electrical Specifications Index

26 01 00 - BASIC ELECTRICAL MATERIALS AND METHODS

26 05 19 - CONDUCTORS AND CABLES

26 05 26 - GROUNDING

26 05 29 - WIRING DEVICES

26 05 33 – RACEWAY AND BOXES

26 05 48.16 – SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

26 05 53 - ELECTRICAL IDENTIFICATION

26 24 16 - PANELBOARDS

26 28 16 - DISCONNECT SWITCHES

26 51 00 - INTERIOR LIGHTING



01-16-2017

SECTION 26 01 00 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Raceways.
 - 2. Building wire and connectors.
 - 3. Supporting devices for electrical components.
 - 4. Electrical identification.
 - 5. Electricity-metering components.
 - 6. Concrete equipment bases.
 - 7. Electrical demolition.
 - 8. Cutting and patching for electrical construction.
 - 9. Touchup painting.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. RNC: Rigid nonmetallic conduit.
- F. GRS: Galvanized Rigid Steel Conduit

1.4 SUBMITTALS

- A. Shop Drawings: Dimensioned plans and sections or elevation layouts of electricity-metering equipment.

- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
 - 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- C. Coordinate electrical service connections to components furnished by utility companies.
 - 1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
 - 2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.
- D. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
- E. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

PART 2 - PRODUCTS

2.1 RACEWAYS

- A. EMT: ANSI C80.3, zinc-coated steel, with compression fittings.
- B. FMC: Zinc-coated steel.
- C. IMC: ANSI C80.6, zinc-coated steel, with threaded fittings.
- D. LFMC: Zinc-coated steel with sunlight-resistant and mineral-oil-resistant plastic jacket.
- E. RNC: NEMA TC 2, Schedule 40 PVC, with NEMA TC3 fittings.
- F. Raceway Fittings: Specifically designed for the raceway type with which used.

2.2 CONDUCTORS

- A. Conductors, No. 10 AWG and Smaller: Solid or stranded copper.
- B. Conductors, Larger Than No. 10 AWG: Stranded copper.
- C. Insulation: Thermoplastic or Thermoset, rated at 75 deg C minimum.
- D. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.

2.3 SUPPORTING DEVICES

- A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
- B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Slotted-Steel Channel Supports: Comply with Division 5 Section "Metal Fabrications" for slotted channel framing.
 - 1. Channel Thickness: Selected to suit structural loading.
 - 2. Fittings and Accessories: Products of the same manufacturer as channel supports.
- D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

- E. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- F. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.
- G. Expansion Anchors: Carbon-steel wedge or sleeve type.
- H. Toggle Bolts: All-steel springhead type.
- I. Powder-Driven Threaded Studs: Heat-treated steel.

2.4 ELECTRICAL IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals according to division 26 section 26 05 53.

2.5 EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING

- A. Meter Sockets: Comply with requirements of electrical power utility company.

2.6 CONCRETE BASES

- A. Concrete Forms and Reinforcement Materials: As specified in Division 3 Section "Cast-in-Place Concrete."
- B. Concrete: 3000-psi, 28-day compressive strength as specified in Division 3 Section "Cast-in-Place Concrete."

2.7 TOUCHUP PAINT

- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
- B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 RACEWAY APPLICATION

- A. Use the following raceways for outdoor installations:
 - 1. Exposed: IMC or GRS
 - 2. Concealed: IMC.
 - 3. Underground, Single Run: RNC.
 - 4. Underground, Grouped: RNC.
 - 5. Connection to Vibrating Equipment: LFMC.
 - 6. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.
- B. Use the following raceways for indoor installations:
 - 1. Exposed: IMC.
 - 2. Concealed: EMT.
 - 3. Connection to Vibrating Equipment: FMC; except in wet or damp locations, use LFMC.
 - 4. Damp or Wet Locations: IMC.
 - 5. Boxes and Enclosures: NEMA 250, Type 1, unless otherwise indicated.

3.3 RACEWAY AND CABLE INSTALLATION

- A. Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.

- B. Install raceways and cables at least **6 inches** away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.
- C. Use temporary raceway caps to prevent foreign matter from entering.
- D. Make conduit bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
- E. Use raceway and cable fittings compatible with raceways and cables and suitable for use and location.
- F. Install raceways embedded in slabs in middle third of slab thickness where practical, and leave at least **1-inch** concrete cover.
 - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 - 2. Space raceways laterally to prevent voids in concrete.
 - 3. Install conduit larger than **1-inch trade size** parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.
 - 4. Make bends in exposed parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for exposed parallel raceways.
- G. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than **200-lb** tensile strength. Leave at least **12 inches** of slack at each end of the pull wire.
- H. Install telephone and signal system raceways, **2-inch trade size** and smaller, in maximum lengths of **150 feet** and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements, in addition to requirements above.
- I. Connect motors and equipment subject to vibration, noise transmission, or movement with a maximum of **72-inch** flexible conduit. Install LFMC in wet or damp locations. Install separate ground conductor across flexible connections.

3.4 WIRING METHODS FOR POWER, LIGHTING, AND CONTROL CIRCUITS

- A. Feeders: **Type THHN/THWN-2 or XHHW-2 insulated conductors in raceway.**
- B. Underground Feeders and Branch Circuits: Type THWN-2 or XHHW-2..
- C. Branch Circuits: Type THHN/THWN-2 insulated conductors in raceway.

- D. Branch Circuits: Type THW or THHN/THWN-2 or XHHW-2 insulated conductors in raceway.
- E. Remote-Control Signaling and Power-Limited Circuits: Type TFN or THHN/THWN-2 insulated conductors in raceway for Classes 1, 2, and 3, unless otherwise indicated.

3.5 WIRING INSTALLATION

- A. Install splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.
- B. Install wiring at outlets with at least 12 inches of slack conductor at each outlet.
- C. Connect outlet and component connections to wiring systems and to ground. Tighten electrical connectors and terminals, according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.6 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.
- C. Support Clamps for PVC Raceways: Click-type clamp system.
- D. Selection of Supports: Comply with manufacturer's written instructions.
- E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

3.7 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install 1/4-inch diameter or larger threaded steel hanger rods, unless otherwise indicated.
- G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channels and angle supports.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Simultaneously install vertical conductor supports with conductors.
- J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.
- K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
 - 1. Wood: Fasten with wood screws or screw-type nails.
 - 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
 - 3. New Concrete: Concrete inserts with machine screws and bolts.
 - 4. Existing Concrete: Expansion bolts.
 - 5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
 - 6. Steel: Welded threaded studs or spring-tension clamps on steel.
 - a. Field Welding: Comply with AWS D1.1.

7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
8. Light Steel: Sheet-metal screws.
9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.8 UTILITY COMPANY ELECTRICITY-METERING EQUIPMENT

- A. Install equipment according to utility company's written requirements. Provide grounding and empty conduits as required by utility company.

3.9 FIRESTOPPING

- A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Firestopping".

3.10 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.11 DEMOLITION

- A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.
- C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.
- D. Remove demolished material from Project site.
- E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.12 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.13 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work, including the following:
 - 1. Raceways.
 - 2. Building wire and connectors.
 - 3. Supporting devices for electrical components.
 - 4. Electrical identification.
 - 5. Electricity-metering components.
 - 6. Concrete bases.
 - 7. Electrical demolition.
 - 8. Cutting and patching for electrical construction.
 - 9. Touchup painting.

3.14 REFINISHING AND TOUCHUP PAINTING

- A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Painting."
 - 1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
 - 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
 - 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.15 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 26 01 00

SECTION 26 05 19 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 SUBMITTALS

- A. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: In addition to requirements specified in Division 1 Section "Quality Control," an independent testing agency shall meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907; or shall be a full-member company of the InterNational Electrical Testing Association.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies, to supervise on-site testing specified in Part 3.
- B. Listing and Labeling: Provide wires and cables specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
- C. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wires and cables according to NEMA WC 26.

1.6 COORDINATION

- A. Coordinate layout and installation of cables with other installations.
- B. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by Architect.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Wires and Cables:
 - a. Encore Wire
 - b. General Cable
 - c. AFC Cable
 - d. Southwire Company
 - e. Service Wire
 - f. United Copper
 - 2. Connectors for Wires and Cables:
 - a. AMP Incorporated.
 - b. General Signal; O-Z/Gedney Unit.
 - c. Bridgeport Fittings
 - d. 3M Company; Electrical Products Division.
 - e. Arlington Fittings

2.2 BUILDING WIRES AND CABLES

- A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Wire and Insulation Applications" Article.
- B. Rubber Insulation Material: Comply with NEMA WC 70.
- C. Thermoplastic Insulation Material: Comply with NEMA WC 70.
- D. Cross-Linked Polyethylene Insulation Material: Comply with NEMA WC 70.
- E. Ethylene Propylene Rubber Insulation Material: Comply with NEMA WC 70.
- F. Conductor Material: Copper.
- G. Stranding: Stranded conductor for larger than No. 10 AWG.

2.3 CONNECTORS AND SPLICES

- A. UL-listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as specified in Part 3 "Wire and Insulation Applications" Article.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRE AND INSULATION APPLICATIONS

- A. Service Entrance: Type XHHW-2 or RHW-2 or THWN-2, in raceway.
- B. Feeders: Type THHN/THWN-2 or XHHW-2, in raceway.
- C. Fire-Pump Feeder: Type XHHW-2 or THHN/THWN-2, in raceway concrete encased.
- D. Branch Circuits: Type XHHW-2 or THHN/THWN-2, in raceway.

- E. Fire Alarm Circuits: Type XHHW-2 or THHN/THWN-2, in raceway.
- F. Class 1 Control Circuits: Type TFN or THHN/THWN-2, in raceway.
- G. Class 2 Control Circuits: Type TFN or THHN/THWN-2, in raceway.

3.3 INSTALLATION

- A. Install wires and cables as indicated, according to manufacturer's written instructions and NECA's "Standard of Installation."
- B. Pull Conductors: Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Identify wires and cables according to Division 26 Section "Electrical Identification."

3.4 CONNECTIONS

- A. Conductor Splices: Keep to minimum.
- B. Install splices and tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
- C. Use splice and tap connectors compatible with conductor material.
- D. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.
- E. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.
- F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

- A. Testing: On installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

- B. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 26 Section "Wires and Cables" for requirements for grounding conductors.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for grounding rods, connectors and connection materials, and grounding fittings.

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with UL 467.
- C. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Apache Grounding; Nashville Wire Products.
 2. Boggs: H. L. Boggs & Co.
 3. Bridgeport Fittings, Inc.
 4. Chance: A. B. Chance Co.
 5. Dossert Corp.
 6. Erico Inc.; Electrical Products Group.
 7. Galvan Industries, Inc.
 8. Hastings Fiber Glass Products, Inc.
 9. Heary Brothers Lightning Protection Co.
 10. Ideal Industries, Inc.
 11. ILSCO.
 12. Kearney.
 13. Korns: C. C. Korns Co.
 14. Lightning Master Corp.
 15. Lyncole XIT Grounding.
 16. O-Z/Gedney Co.
 17. Racor, Inc.
 18. Salisbury: W.H. Salisbury & Co., Utility.
 19. Thomas & Betts, Electrical.
 20. Utilco Co.

2.2 GROUNDING AND BONDING PRODUCTS

- A. Governing Requirements: Where types, sizes, ratings, and quantities indicated are in excess of National Electrical Code (NEC) requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

2.3 WIRE AND CABLE GROUNDING CONDUCTORS

- A. Comply with Division 26 Section "Wires and Cables." Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.
- B. Equipment Grounding Conductors: Insulated with green color insulation.
- C. Grounding-Electrode Conductors: Stranded cable.
- D. Underground Conductors: Bare, tinned, stranded, except as otherwise indicated.

E. Bare Copper Conductors: Conform to the following:

1. Solid Conductors: ASTM B 3.
2. Assembly of Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.

2.4 MISCELLANEOUS CONDUCTORS

- A. Grounding Bus: Bare, annealed-copper bars of rectangular cross section.
- B. Braided Bonding Jumpers: Copper tape, braided No. 30 AWG bare copper wire, terminated with copper ferrules.
- C. Bonding Straps: Soft copper, 0.05 inch thick and 2 inches wide, except as indicated.

2.5 CONNECTOR PRODUCTS

- A. Pressure Connectors: High-conductivity-plated units.
- B. Bolted Clamps: Heavy-duty type.
- C. Exothermic-Welded Connections: Provided in kit form and selected per manufacturer's written instructions for specific types, sizes, and combinations of conductors and connected items.

2.6 GROUNDING ELECTRODES AND TEST WELLS

- A. Grounding Rods: Sectional type; copper-clad steel.
 1. Size: 3/4 inch by 10 feet.
- B. Test Wells: Fabricate from 15-inch long, square-cut sections of 8-inch diameter, Schedule 80, PVC pipe.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Equipment Grounding Conductors: Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.
 1. Install equipment grounding conductor with circuit conductors for all circuits.

- B. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide a No. 4 AWG minimum insulated grounding conductor in raceway from grounding-electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
 - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- C. Metal Poles Supporting Outdoor Lighting Fixtures: Ground pole to a grounding electrode in addition to separate equipment grounding conductor run with supply branch circuit.

3.2 INSTALLATION

- A. General: Ground electrical systems and equipment according to NEC requirements, except where Drawings or Specifications exceed NEC requirements.
- B. Electrical Room Grounding Bus: Space 1 inch from wall and support from wall 6 inches above finished floor, except as otherwise indicated.
- C. Grounding Rods: Locate a minimum of 1-rod length from each other and at least the same distance from any other grounding electrode.
 - 1. Drive until tops are 2 inches below finished floor or final grade, except as otherwise indicated.
 - 2. Interconnect with grounding-electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make these connections without damaging copper coating or exposing steel.
- D. Grounding Conductors: Route along the shortest and straightest paths possible, except as otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- E. Underground Grounding Conductors: Use bare copper wire. Bury at least 24 inches below grade.
- F. Metal Water Service Pipe: Provide insulated copper grounding conductors, sized as indicated, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding-clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Do not install a grounding jumper across dielectric fittings. Bond grounding-conductor conduit to conductor at each end.

- G. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding-clamp connectors.

3.3 CONNECTIONS

- A. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells. Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding-Wire Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Noncontact Metal Raceway Terminations: Where metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.
- E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.
- F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- G. Moisture Protection: Where insulated grounding conductors are connected to grounding rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.4 FIELD QUALITY CONTROL

- A. Tests: Subject the completed grounding system to a megger test at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than 2 full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the 2-point method according to IEEE 81.
- B. Maximum grounding to resistance values are as follows:
 - 1. Equipment Rated 500 kVA and Less: 10 ohms.
- C. Excessive Ground Resistance: Where resistance to ground exceeds specified values, notify Owner promptly and include recommendations to reduce ground resistance and to accomplish recommended work.
- D. Report: Prepare test reports of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

3.5 ADJUSTING AND CLEANING

- A. Restore surface features, including vegetation, at areas disturbed by work of this Section. Reestablish original grades, except as otherwise indicated. Where sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 32 Section "Landscaping." Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION 26 05 26

SECTION 26 05 29 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes receptacles, connectors, switches, and finish plates.

1.3 DEFINITIONS

- A. G: Ground-fault circuit interrupter.
- B. IG: Isolated Ground Conductor

1.4 SUBMITTALS

- A. Product Data: For each product specified.
- B. Shop Drawings: Legends for receptacles and switch plates.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- B. Comply with NEMA WD 1.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Wiring Devices:
 - a. Hubbell, Inc.; Wiring Devices Div.
 - b. Pass & Seymour/Legrand; Wiring Devices Div.
 - c. Pyle-National, Inc.; an Amphenol Co.
 - d. Eagle Electric Manufacturing Co., Inc.

2.2 RECEPTACLES

- A. Straight-Blade Receptacles: Heavy-Duty grade. Type 5-20R, Ivory Plastic Face.
- B. GFCI Receptacles: Feed-through type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle arranged to protect connected downstream receptacles on same circuit. Design units for installation in a 2-3/4-inch deep outlet box without an adapter.
- C. Isolated Ground Receptacles: Ivory with orange IG triangle on the face of the receptacle.

2.3 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 - 1. Cord: Rubber-insulated, stranded-copper conductors, with type SOW-A jacket. Green-insulated grounding conductor, and equipment-rating ampacity plus a minimum of 30 percent.
 - 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.4 SWITCHES

- A. Snap Switches: Heavy-duty, quiet type rated 20 amperes, 120 V. AC. Handle: Gray Plastic.

- B. Keyed Type: Hubbell 96061, Furnish 10 keys.

2.5 WALL PLATES

- A. Single and combination types match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: 0.04-inch thick, Type 302, brushed stainless steel.
 - 3. Material for Unfinished Spaces: Galvanized steel.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install devices and assemblies plumb and secure.
- B. Install wall plates when painting is complete.
- C. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- D. Protect devices and assemblies during painting.

3.2 IDENTIFICATION

- A. Comply with Division 26 Section "Electrical Identification."

3.3 CONNECTIONS

- A. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.
- B. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

- A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.
- B. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- C. Replace damaged or defective components.

3.5 CLEANING

- A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

- 1. Raceways include the following:

- a. RMC.
 - b. IMC.
 - c. EMT.
 - d. FMC.
 - e. LFMC.
 - f. RNC.
 - g. Wireways.
 - h. Surface raceways.

- 2. Boxes, enclosures, and cabinets include the following:

- a. Device boxes.
 - b. Outlet boxes.
 - c. Pull and junction boxes.
 - d. Cabinets and hinged-cover enclosures.

- B. Related Sections include the following:

- 1. Division 7 Section "Firestopping."
 - 2. Division 26 Section "Basic Electrical Materials and Methods" for raceways and box supports.
 - 3. Division 26 Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.

- E. RMC: Rigid metal conduit.
- F. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: Include layout drawings showing components and wiring for nonstandard boxes, enclosures, and cabinets.

1.5 QUALITY ASSURANCE

- A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
- B. Comply with NECA's "Standard of Installation."
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Metal Conduit and Tubing:
 - a. Alflec Corp.
 - b. Anamet, Inc.; Anaconda Metal Hose.
 - c. Anixter Brothers, Inc.
 - d. Carol Cable Co., Inc.
 - e. Cole-Flex Corp.
 - f. Electri-Flex Co.
 - g. Flexcon, Inc.; Coleman Cable Systems, Inc.
 - h. Grinnell Co.; Allied Tube and Conduit Div.

- i. Monogram Co.; AFC.
 - j. Shamrock Metals
 - k. Spiraduct, Inc.
 - l. Triangle PWC, Inc.
 - m. Wheatland Tube Co.
- 2. Nonmetallic Conduit and Tubing:
 - a. Anamet, Inc.; Anaconda Metal Hose.
 - b. Arnco Corp.
 - c. Breeze-Illinois, Inc.
 - d. Cantex Industries; Harsco Corp.
 - e. Certainteed Corp.; Pipe & Plastics Group.
 - f. Cole-Flex Corp.
 - g. Condux International; Electrical Products.
 - h. Electri-Flex Co.
 - i. George-Ingraham Corp.
 - j. Hubbell, Inc.; Racor, Inc.
 - k. IPEX
 - l. Lamson & Sessions; Carlon Electrical Products.
 - m. R&G Sloan Manufacturing Co., Inc.
 - n. Spiraduct, Inc.
 - o. Thomas & Betts Corp.
- 3. Conduit Bodies and Fittings:
 - a. American Electric; Construction Materials Group.
 - b. Bridgeport Fittings, Inc.
 - c. Crouse-Hinds; Div. of Cooper Industries.
 - d. Emerson Electric Co.; Appleton Electric Co.
 - e. Hubbell, Inc.; Killark Electric Manufacturing Co.
 - f. IPEX
 - g. Lamson & Sessions; Carlon Electrical Products.
 - h. O-Z/Gedney; Unit of General Signal.
 - i. Scott Fetzer Co.; Adalet-PLM.
 - j. Spring City Electrical Manufacturing Co.
- 4. Metal Wireways:
 - a. Hoffman Engineering Co.
 - b. Keystone/Rees, Inc.
 - c. Square D Co.
- 5. Nonmetallic Wireways:
 - a. Hoffman Engineering Co.
 - b. Lamson & Sessions; Carlon Electrical Products.

6. Surface Metal Raceways:
 - a. American Electric; Construction Materials Group.
 - b. Butler Manufacturing Co.; Walker Division.
 - c. Wiremold Co. (The); Electrical Sales Division.
7. Surface Nonmetallic Raceways:
 - a. Anixter Brothers, Inc.
 - b. Butler Manufacturing Co.; Walker Division.
 - c. Hubbell, Inc.; Wiring Device Division.
 - d. JBC Enterprises, Inc.; Enduro Fiberglass Systems.
 - e. Lamson & Sessions; Carlon Electrical Products.
 - f. Panduit Corp.
 - g. Thermotools Co.
 - h. United Telecom; Premier Telecom Products, Inc.
 - i. Wiremold Co. (The); Electrical Sales Division.
8. Boxes, Enclosures, and Cabinets:
 - a. American Electric; FL Industries.
 - b. Butler Manufacturing Co.; Walker Division.
 - c. Crouse-Hinds; Div. of Cooper Industries.
 - d. Electric Panelboard Co., Inc.
 - e. Erickson Electrical Equipment Co.
 - f. Hoffman Engineering Co.; Federal-Hoffman, Inc.
 - g. Hubbell Inc.; Killark Electric Manufacturing Co.
 - h. Hubbell Inc.; Raco, Inc.
 - i. Lamson & Sessions; Carlon Electrical Products.
 - j. O-Z/Gedney; Unit of General Signal.
 - k. Parker Electrical Manufacturing Co.
 - l. Robroy Industries, Inc.; Electrical Division.
 - m. Scott Fetzer Co.; Adalet-PLM.
 - n. Spring City Electrical Manufacturing Co.
 - o. Thomas & Betts Corp.
 - p. Woodhead Industries, Inc.; Daniel Woodhead Co.

2.2 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
- B. IMC: ANSI C80.6.
- C. EMT and Fittings: ANSI C80.3.
 1. Fittings: Compression type.
- D. FMC: Zinc-coated steel.

- E. LFMC: Flexible steel conduit with PVC jacket.
- F. Fittings: NEMA FB 1; compatible with conduit/tubing materials.

2.3 NONMETALLIC CONDUIT AND TUBING

- A. RNC: NEMA TC 2, Schedule 40 or 80 PVC.
- B. RNC Fittings: NEMA TC 3; match to conduit type and material.

2.4 METAL WIREWAYS

- A. Material: Sheet metal sized and shaped as indicated.
- B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- C. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.
- D. Wireway Covers: As indicated
- E. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS

- A. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captivated screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.
- B. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections using plastic fasteners.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

2.6 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.
- B. Surface Nonmetallic Raceways: 2-piece construction, manufactured of rigid PVC compound with matte texture and manufacturer's standard color.
- C. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

2.7 OUTLET AND DEVICE BOXES

- A. Sheet Metal Boxes: NEMA OS 1.
- B. Cast-Metal Boxes: NEMA FB 1, Type FD, cast box with gasketed cover.

2.8 PULL AND JUNCTION BOXES

- A. Small Sheet Metal Boxes: NEMA OS 1.
- B. Cast-Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

2.9 ENCLOSURES AND CABINETS

- A. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.
- B. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRING METHODS

- A. Outdoors: Use the following wiring methods:
 - 1. Exposed: Rigid steel or IMC.
 - 2. Concealed: Rigid steel or IMC.
 - 3. Underground, Single Run: RNC.
 - 4. Underground, Grouped: RNC.
 - 5. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.
- B. Indoors: Use the following wiring methods:
 - 1. Exposed: IMC or Rigid Steel.
 - 2. Concealed: EMT.
 - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric, Solenoid, or Motor-Driven Equipment): FMC; except in wet or damp locations, use LFMC.
 - 4. Damp or Wet Locations: Rigid steel conduit.
 - 5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
 - a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.

3.3 INSTALLATION

- A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
- B. Minimum Raceway Size: [3/4-inch trade size](#).
- C. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors.
- D. Keep raceways at least [6 inches](#) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- E. Install raceways level and square and at proper elevations. Provide adequate headroom.
- F. Complete raceway installation before starting conductor installation.

- G. Support raceways as specified in Division 26 Section "Basic Electrical Materials and Methods."
- H. Use temporary closures to prevent foreign matter from entering raceways.
- I. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
- J. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
- K. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.
- L. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.
- M. Raceways Embedded in Slabs: Install in middle third of slab thickness where practical, and leave at least 1-inch concrete cover.
 - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 - 2. Space raceways laterally to prevent voids in concrete.
 - 3. Run conduit larger than 1-inch trade size parallel to or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
- N. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
 - 1. Run parallel or banked raceways together, on common supports where practical.
 - 2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- O. Join raceways with fittings designed and approved for the purpose and make joints tight.
 - 1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
 - 2. Use insulating bushings to protect conductors.

- P. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.
- Q. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.
- R. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of the pull wire.
- S. Telephone and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to the above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- T. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as the boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.
- U. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded flush plugs flush with floor for future equipment connections.
- V. Flexible Connections: Use maximum of 6 feet of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.
- W. Do not install aluminum conduits embedded in or in contact with concrete.
- X. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.4 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.5 CLEANING

- A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION 26 05 33

26 05 48.16 - SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes seismic restraints and other earthquake-damage-reduction measures for electrical components. It complements optional seismic construction requirements in the various electrical component Sections.

1.3 DEFINITIONS

- A. IBC: International Building Code.
- B. Seismic Restraint: A fixed device (a seismic brace, an anchor bolt or stud, or a fastening assembly) used to prevent vertical or horizontal movement, or both vertical and horizontal movement, of an electrical system component during an earthquake.
- C. Mobile Structural Element: A part of the building structure such as a slab, floor structure, roof structure, or wall that may move independent of other mobile structural elements during an earthquake.

1.4 SUBMITTALS

- A. Product Data: Illustrate and indicate types, styles, materials, strength, fastening provisions, and finish for each type and size of seismic restraint component used.
 - 1. Anchor Bolts and Studs: Tabulate types and sizes, complete with report numbers and rated strength in tension and shear as evaluated by an agency approved by authorities having jurisdiction.
- B. Shop Drawings: For anchorage and bracing not defined by details and charts on Drawings. Indicate materials, and show designs and calculations signed and sealed by a professional engineer.
 - 1. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
 - 2. Details: Detail fabrication and arrangement. Detail attachment of restraints to both structural and restrained items. Show attachment locations, methods, and

spacings, identifying components and listing their strengths. Indicate direction and value of forces transmitted to the structure during seismic events.

3. Preapproval and Evaluation Documentation: By an agency approved by authorities having jurisdiction, showing maximum ratings of restraints and the basis for approval (tests or calculations).

- C. Coordination Drawings: Plans and sections drawn to scale and coordinating seismic bracing for electrical components with other systems and equipment, including other seismic restraints, in the vicinity.
- D. Product Certificates: Signed by manufacturers of seismic restraints certifying that products furnished comply with requirements.
- E. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- F. Material Test Reports: From a qualified testing agency indicating and interpreting test results of seismic control devices for compliance with requirements indicated.

1.5 QUALITY ASSURANCE

- A. Comply with seismic restraint requirements in the international building code unless requirements in this Section are more stringent.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing seismic engineering services, including the design of seismic restraints, that are similar to those indicated for this Project.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated.

1.6 PROJECT CONDITIONS

- A. Project Seismic Zone and Zone Factor as Defined in IBC: **Zone 2A, Zone Factor 0.15**
Select categories and factors in two paragraphs below in coordination with structural engineer.
- B. Occupancy Category as Defined in IBC: **II**.
- C. Acceleration Factor: **0.2G**

1.7 COORDINATION

- A. Coordinate layout and installation of seismic bracing with building structural system and architectural features, and with mechanical, fire-protection, electrical, and other building features in the vicinity.

- B. Coordinate concrete bases with building structural system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amber/Booth Company, Inc.
 - 2. B-Line Systems, Inc.
 - 3. Erico, Inc.
 - 4. GS Metals Corp.
 - 5. Loos & Company, Inc.
 - 6. Mason Industries, Inc,
 - 7. Powerstrut.
 - 8. Thomas & Betts Corp.
 - 9. Unistrut Corporation.

2.2 MATERIALS

- A. Use the following materials for restraints:
 - 1. Indoor Dry Locations: Steel, zinc plated.
 - 2. Outdoors and Damp Locations: Galvanized steel.
 - 3. Corrosive Locations: Stainless steel.

2.3 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

- A. Strength: Defined in reports by agency acceptable to authorities having jurisdiction.
 - 1. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.
- B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type.
- C. Concrete Inserts: Steel-channel type.
- D. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
- E. Welding Lugs: Comply with MSS SP-69, Type 57.

- F. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.
- G. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.
- H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

2.4 SEISMIC BRACING COMPONENTS

- A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch (41-by-41-mm) cross section, formed from 0.1046-inch- (2.7-mm-) thick steel, with 9/16-by-7/8-inch (14-by-22-mm) slots at a maximum of 2 inches (50 mm) o.c. in webs, and flange edges turned toward web.
 - 1. Materials for Channel: ASTM A 570, GR 33.
 - 2. Materials for Fittings and Accessories: ASTM A 575, ASTM A 576, or ASTM A 36.
 - 3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.
 - 4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.
- B. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.
- C. Cable-Type Bracing Assemblies: Zinc-coated, high-strength steel wire rope cable attached to steel thimbles, brackets, and bolts designed for cable service.
 - 1. Arrange units for attachment to the braced component at one end and to the structure at the other end.
 - 2. Wire Rope Cable: Comply with ASTM 603. Use 49- or 133-strand cable with a minimum strength of 2 times the calculated maximum seismic force to be resisted.
- D. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Generator Sets: Comply with Division 23 Section "Vibration and Seismic Controls for HVAC."

3.2 INSTALLATION

- A. Install seismic restraints according to applicable codes and regulations and as approved by authorities having jurisdiction, unless more stringent requirements are indicated.

3.3 STRUCTURAL ATTACHMENTS

- A. Use bolted connections with steel brackets, slotted channel, and slotted-channel fittings to spread structural loads and reduce stresses.
- B. Attachments to New Concrete: Bolt to channel-type concrete inserts or use expansion anchors.
- C. Attachments to Existing Concrete: Use expansion anchors.
- D. Holes for Expansion Anchors in Concrete: Drill at locations and to depths that avoid reinforcing bars.
- E. Attachments to Solid Concrete Masonry Unit Walls: Use expansion anchors.
- F. Attachments to Hollow Walls: Bolt to slotted steel channels fastened to wall with expansion anchors.
- G. Attachments to Wood Structural Members: Install bolts through members.
- H. Attachments to Steel: Bolt to clamps on flanges of beams or on upper truss chords of bar joists.

3.4 ELECTRICAL EQUIPMENT ANCHORAGE

- A. Anchor rigidly to a single mobile structural element or to a concrete base that is structurally tied to a single mobile structural element.
- B. Anchor panelboards, motor-control centers, motor controls, switchboards, switchgear, transformers, unit substations, fused power-circuit devices, transfer switches, busways, battery racks, static uninterruptible power units, power conditioners, capacitor units, communication system components, and electronic signal processing, control, and distribution units as follows:
 - 1. Size concrete bases so expansion anchors will be a minimum of 10 bolt diameters from the edge of the concrete base.
 - 2. Concrete Bases for Floor-Mounted Equipment: Use female expansion anchors and install studs and nuts after equipment is positioned.
 - 3. Bushings for Floor-Mounted Equipment Anchors: Install to allow for resilient media between anchor bolt or stud and mounting hole in concrete.

4. Anchor Bolt Bushing Assemblies for Wall-Mounted Equipment: Install to allow for resilient media where equipment or equipment-mounting channels are attached to wall.
5. Torque bolts and nuts on studs to values recommended by equipment manufacturer.

3.5 SEISMIC BRACING INSTALLATION

- A. Install bracing according to spacings and strengths indicated by approved analysis.
- B. Expansion and Contraction: Install to allow for thermal movement of braced components.
- C. Cable Braces: Install with maximum cable slack recommended by manufacturer.
- D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to the structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

3.6 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Make flexible connections in raceways, cables, wireways, cable trays, and busways where they cross expansion and seismic control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate at electrical equipment anchored to a different mobile structural element from the one supporting them.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform the following field quality-control testing:
- B. Testing Agency: Engage a qualified testing agency to perform the following field quality-control testing:
- C. Testing: Test pull-out resistance of seismic anchorage devices.
 1. Provide necessary test equipment required for reliable testing.
 2. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 3. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
 4. Obtain Architect's approval before transmitting test loads to the structure. Provide temporary load-spreading members.
 5. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 6. Test to 90 percent of rated proof load of device.

7. If a device fails the test, modify all installations of same type and retest until satisfactory results are achieved.
8. Record test results.

END OF SECTION 26 05 48.16

SECTION 26 05 53 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes electrical identification materials and devices required to comply with ANSI C2, NFPA 70, OSHA standards, and authorities having jurisdiction.

1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Schedule of Nomenclature: An index of electrical equipment and system components used in identification signs and labels.
- C. Samples: For each type of label and sign to illustrate color, lettering style, and graphic features of identification products.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with ANSI A13.1 and NFPA 70 for color-coding.

PART 2 - PRODUCTS

2.1 RACEWAY AND CABLE LABELS

- A. Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
 - 1. Color: Black letters on orange field.
 - 2. Legend: Indicates **voltage**.

- B. Adhesive Labels: Preprinted, flexible, self-adhesive vinyl with legend overlaminated with a clear, weather- and chemical-resistant coating.
- C. Pretensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the line it identifies and arranged to stay in place by pretensioned gripping action when placed in position.
- D. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- E. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape.
 - 1. Not less than 6 inches wide by 4 mils thick.
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed legend indicating type of underground line.
- F. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
- G. Aluminum, Wraparound Marker Bands: Bands cut from 0.014-inch thick aluminum sheet, with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.
- H. Plasticized Card-Stock Tags: Vinyl cloth with preprinted and field-printed legends. Orange background, unless otherwise indicated, with eyelet for fastener.
- I. Aluminum-Faced, Card-Stock Tags: Weather-resistant, 18-point minimum card stock faced on both sides with embossable aluminum sheet, 0.002 inch thick, laminated with moisture-resistant acrylic adhesive, punched for fasteners, and preprinted with legends to suit each application.
- J. Brass or Aluminum Tags: 2 by 2 by 0.05-inch metal tags with stamped legend, punched for fastener.

2.2 NAMEPLATES AND SIGNS

- A. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.
- B. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
 - 1. Engraved legend with black letters on white face.
 - 2. Punched or drilled for mechanical fasteners.

- C. Baked-Enamel Signs for Interior Use: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for the application. 1/4-inch grommets in corners for mounting.
- D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for the application. 1/4-inch grommets in corners for mounting.
- E. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat and lock washers.

2.3 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength: 50 lb minimum.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: According to color-coding.
- B. Paint: Formulated for the type of surface and intended use.
 - 1. Primer for Galvanized Metal: Single-component acrylic vehicle formulated for galvanized surfaces.
 - 2. Primer for Concrete Masonry Units: Heavy-duty-resin block filler.
 - 3. Primer for Concrete: Clear, alkali-resistant, binder-type sealer.
 - 4. Enamel: Silicone-alkyd or alkyd urethane as recommended by primer manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.
- C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.

- D. Self-Adhesive Identification Products: Clean surfaces before applying.
- E. Color Banding Raceways and Exposed Cables: Band exposed and accessible raceways of the systems listed below:
 - 1. Bands: Pretensioned, wraparound plastic sleeves; colored adhesive tape; or a combination of both. Make each color band **2 inches** wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
 - 2. Band Locations: At changes in direction, at penetrations of walls and floors, at **50-foot** maximum intervals in straight runs, and at **25-foot** maximum intervals in congested areas.
 - 3. Apply the following colors to the systems listed below:
 - a. Fire Alarm System: Red.
 - b. Fire-Suppression Supervisory and Control System: Red and yellow.
 - c. Combined Fire Alarm and Security System: Red and blue.
 - d. Security System: Blue and yellow.
 - e. Mechanical and Electrical Supervisory System: Green and blue.
 - f. Telecommunication System: Green and yellow.
- F. Caution Labels for Indoor Boxes and Enclosures for Power and Lighting: Install pressure-sensitive, self-adhesive labels identifying system voltage with black letters on orange background. Install on exterior of door or cover.
- G. Circuit Identification Labels on Boxes: Install labels externally.
 - 1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
 - 2. Concealed Boxes: Plasticized card-stock tags.
 - 3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.
- H. Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at **6 to 8 inches** below finished grade. Where width of multiple lines installed in a common trench or concrete envelope does not exceed **16 inches** overall, use a single line marker. **Install line marker for underground wiring, both direct-buried cables and cables in raceway.**

- I. Secondary Service, Feeder, and Branch-Circuit Conductors: Color-code throughout the secondary electrical system.
 - 1. Color-code 208/120-V system as follows:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - d. Neutral: White.
 - e. Ground: Green.
 - 2. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:
 - a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
- J. Power-Circuit Identification: Metal tags or aluminum, wraparound marker bands for cables, feeders, and power circuits in vaults, pull and junction boxes, manholes, and switchboard rooms.
 - 1. Legend: 1/4-inch steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
 - 2. Tag Fasteners: Nylon cable ties.
 - 3. Band Fasteners: Integral ears.
- K. Apply identification to conductors as follows:
 - 1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
 - 2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
 - 3. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.
- L. Apply warning, caution, and instruction signs as follows:
 - 1. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where

- instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
2. Emergency Operation: Install engraved laminated signs with white legend on red background with minimum **3/8-inch** high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.
- M. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Unless otherwise indicated, provide a single line of text with **1/2-inch** high lettering on **1-1/2-inch** high label; where two lines of text are required, use labels **2 inches** high. Use white lettering on black field. Apply labels for each unit of the following categories of equipment using mechanical fasteners:
1. Panelboards, electrical cabinets, and enclosures.
 2. Access doors and panels for concealed electrical items.
 3. Disconnect switches.
 4. Motor starters.
 5. Control devices.
 6. Fire alarm master station or control panel.

END OF SECTION 26 05 53

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes lighting and power panelboards and associated auxiliary equipment rated 600 V and less.
- B. Related Sections include the following:
 - 1. Division 26 Section "Basic Electrical Materials and Methods" for general materials and installation methods.
 - 2. Division 26 Section "Electrical Identification" for labeling materials.

1.3 SUBMITTALS

- A. Product Data: For each type of panelboard, accessory item, and component specified.
- B. Shop Drawings: For panelboards. Include dimensioned plans, sections, and elevations. Show tabulations of installed devices, major features, and voltage rating. Include the following:
 - 1. Enclosure type with details for types other than NEMA 250, Type 1.
 - 2. Bus configuration and current ratings.
 - 3. Short-circuit current rating of panelboard.
 - 4. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.
 - 5. Wiring Diagrams: Details of schematic diagram including control wiring and differentiating between manufacturer-installed and field-installed wiring.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- E. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

- F. Maintenance Data: For panelboard components to include in the maintenance manuals specified in Division 1. Include manufacturer's written instructions for testing circuit breakers.

1.4 QUALITY ASSURANCE

- A. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
- B. Comply with NFPA 70.
- C. Comply with NEMA PB 1.

1.5 EXTRA MATERIALS

- A. Keys: 6 spares of each type for panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Square D Company
 - 2. General Electric
 - 3. Siemens
 - 4. Eaton

2.2 PANELBOARD FABRICATION

- A. Enclosures: Flush- or surface-mounted cabinets as indicated. NEMA PB 1, Type 1, unless otherwise indicated to meet environmental conditions at installed location.
- B. Front: Secured to box with concealed trim clamps, unless otherwise indicated. Front for surface-mounted panelboards shall be same dimensions as box. Fronts for flush panelboards shall overlap box, unless otherwise indicated.
- C. Directory Frame: Metal, mounted inside each panelboard door.
- D. Bus: Hard drawn copper of 98 percent conductivity.

- E. Main and Neutral Lugs: 1200A Panelboard - Compression type.
Remaining panelboards - Mechanical lugs
- F. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors. Bonded to box.
- G. Service Equipment Approval: Listed for use as service equipment for panelboards with main service disconnect.
- H. Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances, for the overcurrent protective device ampere ratings indicated for future installation of devices.
- I. Special Features: Include the following features for panelboards as indicated:
 - 1. Hinged Front Cover: Entire front trim hinged to box with standard door within hinged trim cover.

2.3 LOAD CENTERS

- A. Overcurrent Protective Devices: Plug-in, full-module circuit breaker.
 - 1. Circuit Breakers for Switching Lights at Panelboards: Indicated as Type SWD.
 - 2. Circuit Breakers for Equipment Marked Type HACR: Indicated as Type HACR.
- B. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- B. Doors: In panelboard front, with concealed hinges. Secure with flush catch and tumbler lock, all keyed alike.

2.5 DISTRIBUTION PANELBOARDS

- A. Doors: In panelboard front, unless otherwise indicated. Secure door with vault-type latch with tumbler lock, all keyed alike.
- B. Branch-Circuit Breakers: Where overcurrent protective devices are indicated to be circuit breakers, use bolt-on circuit breakers, except circuit breakers 225-A frame size and greater may be plug-in type where individual positive-locking device requires mechanical release for removal.

2.6 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: NEMA AB 1, handle lockable.
 - 1. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated and interrupting capacity rating to meet available fault current.
 - 2. Application Listing: Appropriate for application, including Type SWD for switching fluorescent lighting loads and Type HACR for heating, air-conditioning, and refrigerating equipment.
 - 3. Circuit Breakers, 200 A and Larger: Trip units interchangeable within frame size.
 - 4. Circuit Breakers, 400 A and Larger: Field-adjustable short-time and continuous current settings.
 - 5. Lugs: Mechanical lugs and power-distribution connectors for number, size, and material of conductors indicated. 1200A. panelboard shall have compression lugs.
 - 6. Shunt Trip: Where indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards and accessory items according to NEMA PB 1.1.
- B. Mounting Heights: Top of trim 74 inches above finished floor, unless otherwise indicated.
- C. Mounting: Plumb and rigid without distortion of box. Mount flush panelboards uniformly flush with wall finish.
- D. Circuit Directory: Type directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing.
- E. Install filler plates in unused spaces.
- F. Provision for Future Circuits at Flush Panelboards: Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
- G. Wiring in Panelboard Gutters: Arrange conductors into groups, and bundle and wrap with wire ties after completing load balancing.

3.2 IDENTIFICATION

- A. Identify field-installed wiring and components and provide warning signs as specified in Division 26 Section "Electrical Identification."
- B. Panelboard Nameplates: Label each panelboard with engraved laminated-plastic or metal nameplates mounted with corrosion-resistant screws.

3.3 GROUNDING

- A. Make equipment grounding connections for panelboards as indicated.
- B. Provide ground continuity to main electrical ground bus as indicated.

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

- A. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.
- B. Balancing Loads: After Substantial Completion, but not more than 2 months after Final Acceptance, conduct load-balancing measurements and make circuit changes as follows:
 - 1. Perform measurements during period of normal working load as advised by Owner.
 - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility. Make special arrangements with Owner to avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - 3. Recheck loads after circuit changes during normal load period. Record all load readings before and after changes and submit test records.

4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as required to meet this minimum requirement.

3.6 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.7 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

END OF SECTION 26 24 16

SECTION 26 28 16 - DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes individually mounted switches and circuit breakers used for the following:
 - 1. Motor disconnect switches.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 26 Section "Wiring Devices" for attachment plugs and receptacles, and snap switches used for disconnect switches.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for disconnect switches and accessories specified in this Section.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain disconnect switches and circuit breakers from one source and by a single manufacturer.
- B. Comply with NFPA 70 for components and installation.
- C. Listing and Labeling: Provide disconnect switches and circuit breakers specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide disconnect switches by one of the following:
 - 1. Square D
 - 2. General Electric
 - 3. Siemens
 - 4. Eaton

2.2 DISCONNECT SWITCHES

- A. Enclosed, Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle.
- B. Enclosure: NEMA KS 1, Type 1, unless otherwise specified or required to meet environmental conditions of installed location.
 - 1. Outdoor Locations: Type 3R.
 - 2. Other Wet or Damp Indoor Locations: Type 4.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install disconnect switches in locations as indicated, according to manufacturer's written instructions.
- B. Install disconnect switches level and plumb.
- C. Connect disconnect switches to wiring system and to ground as indicated and instructed by manufacturer.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- D. Identify each disconnect switch according to requirements specified in Division 26 Section "Electrical Identification."

3.2 FIELD QUALITY CONTROL

- A. Testing: After installing disconnect switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5 for disconnect switches. Certify compliance with test parameters.
- B. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

3.3 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, and abrasions.

END OF SECTION 26 28 16

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes interior lighting fixtures, lighting fixtures mounted on exterior building surfaces, lamps, ballasts, emergency lighting units, and accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, and the following:
 - 1. Dimensions of fixtures.
 - 2. Certified results of independent laboratory tests for fixtures and lamps for electrical ratings and photometric data.
 - 3. Emergency lighting unit battery and charger.
 - 4. Fluorescent and high-intensity-discharge ballasts.
 - 5. Types of lamps.
 - 6. LED driver type with AC input wattage
- B. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, method of field assembly, components, features, and accessories.
 - 1. Wiring Diagrams: Detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.
- C. Maintenance Data: For lighting fixtures to include in maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

- A. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- B. Comply with NFPA 70.

- C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.5 COORDINATION

- A. Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

1.6 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Warranty for Batteries: Written warranty, executed by manufacturer agreeing to replace rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - 1. Special Warranty Period for Batteries: Manufacturer's standard, but not less than 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for last nine years.
- C. Special Warranties for Fluorescent Ballasts: Written warranty, executed by manufacturer agreeing to replace fluorescent ballasts that fail in materials or workmanship within specified warranty period.
 - 1. Special Warranty Period for Electronic Ballasts: Five years from date of manufacture, but not less than four years from date of Substantial Completion.
- D. Special Warranties for LED drivers: Written warranty, executed by manufacturer agreeing to replace LED drivers that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Lighting Fixture Schedule on drawings.

2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL

- A. Metal Parts: Free from burrs, sharp corners, and edges.

- B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.
- D. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
 - 4. Laminated Silver Metallized Film: 90 percent.
- E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.
 - 1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
 - 2. Lens Thickness: 0.125 inch minimum, unless greater thickness is indicated.

2.5 EXIT SIGNS

- A. General Requirements: Comply with UL 924 and the following:
 - 1. Sign Colors and Lettering Size: Comply with authorities having jurisdiction.
- B. Internally Lighted Signs: As follows:
 - 1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum rated lamp life.

2.6 LAMPS

- A. Fluorescent Color Temperature and Minimum Color-Rendering Index: 3500 K and 85 CRI, unless otherwise indicated.
- B. Noncompact Fluorescent Lamp Life: Rated average is 20,000 hours at 3 hours per start when used on rapid-start circuits.

2.7 FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Basic Electrical Materials and Methods," for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: **1/2-inch** steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, **1/2-inch** steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.
- D. Rod Hangers: **3/16-inch** minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
- F. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

2.8 FINISHES

- A. Fixtures: Manufacturer's standard, unless otherwise indicated.
 - 1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
 - 2. Metallic Finish: Corrosion resistant.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each fixture.
- B. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.
 - 1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than **6 inches** from fixture corners.
 - 2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner.
 - 3. Fixtures of Sizes Less Than Ceiling Grid: Arrange as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two **3/4-inch** metal channels spanning and secured to ceiling tees.

C. Suspended Fixture Support: As follows:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.

D. Recessed Fluorescents:

1. Install 1/2" metal flex to fixture from adjacent 4" x 4" junction box with 90 degree C., #12 AWG wire plus green ground wire. Junction box shall be located within 48" of fixture. No more than 4 fixtures shall be connected to common junction box.

3.2 CONNECTIONS

A. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Advance Notice: Give dates and times for field tests.

C. Provide instruments to make and record test results.

D. Tests: As follows:

1. Verify normal operation of each fixture after installation.
2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.
3. Verify normal transfer to battery source and retransfer to normal.
4. Report results in writing.

E. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

F. Corrosive Fixtures: Replace during warranty period.

3.4 CLEANING AND ADJUSTING

A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.

B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION 26 51 00

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Finish hardware for doors as specified and as listed in "Hardware Groups" and required by actual conditions.
 - 1. Include screws, special screws, bolts, special bolts, expansion shields, and other devices for proper application of hardware.
- B. Related Sections:
 - 1. Division 6: Carpentry
 - 2. Section 08 11 00, Section 08 12 00, and Section 08 21 00 - Certain hardware items installed with doors.
 - 3. Division 16: Electrical.

1.02 GENERAL REQUIREMENTS

- A. Provide items, articles, materials, operations and methods listed, mentioned or scheduled herein or on drawings, in quantities as required to complete project. Provide hardware that functions properly. Prior to furnishing hardware, advise Architect of items that will not operate properly, are improper for conditions, or will not remain permanently anchored.

1.03 SUBMITTALS

- A. Hardware Schedule: Submit 3 copies of hardware schedule in vertical format as illustrated by the Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Schedules which do not comply will be returned for correction before checking.
- B. Hardware schedule shall clearly indicate architect's hardware group and manufacturer of each item proposed.
- C. **The schedule shall be reviewed prior to submission by a certified Architectural Hardware Consultant (AHC), who shall affix his or her seal attesting to the completeness and correctness of the schedule.**
 - 1. Provide 2 copies of illustrations from manufacturer's catalogs and data in brochure form.
 - 2. Check specified hardware for suitability and adaptability to details and surrounding conditions. Indicate unsuitable or incompatible items and proposed substitutions in hardware schedule.
 - 3. Provide listing of manufacturer's template numbers for each item of hardware in hardware schedule.
 - 4. Furnish other Contractors and Subcontractors concerned with copies of final approved hardware schedule. Submit necessary templates and schedules as soon as possible to hollow metal, wood door, and aluminum door fabricators in accordance with schedule they require for fabrication.
 - 5. Samples: Lever design or finish sample: Provide 3 samples if requested by architect.

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- D. Installation Instructions: Provide manufacturer's written installation and adjustment instructions for finish hardware. Send installation instructions to site with hardware.
- E. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.
- F. Contract Closeout Submittals: Comply with Section 01700 including specific requirements indicated below.
 - 1. Operating and maintenance manuals: Submit 3 sets containing the following:
 - 2. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
 - 3. Catalog pages for each product.
 - 4. Name, address, and phone number of local representative for each manufacturer.
 - 5. Parts list for each product.
 - 6. Copy of final approved hardware schedule, edited to reflect "As installed".
 - 7. Copy of final keying schedule.
 - 8. As installed "Wiring Diagrams" for each opening connected to power, both low voltage and 110 volts.
 - 9. One complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.04 QUALITY ASSURANCE

- A. Manufacturer: Obtain each type of hardware (ie. latch and locksets, hinges, closers) from single manufacturer, although several may be indicated as offering products complying with requirements.
- B. Supplier: Recognized architectural finish hardware supplier, with warehousing facilities, who has been providing hardware for period of not less than 3 years. The supplier shall be, or employ, a certified Architectural Hardware Consultant (AHC), who is registered in the continuing education program as administered by the Door and Hardware Institute. The hardware schedule shall be prepared and signed by a certified AHC.
- C. Installer: Firm with 3 years' experience in installation of similar hardware to that required for this project, including specific requirements indicated.
- D. Regulatory Label Requirements: Provide nationally recognized testing agency label or stamp on hardware for labeled openings. Where UL requirements conflict with drawings or specifications, hardware conforming to UL requirements shall be provided. Conflicts and proposed substitutions shall be clearly indicated in hardware schedule.
- E. Handicapped Requirements: Doors to stairs (other than exit stairs), loading platforms, boiler rooms, stages and doors serving other hazardous locations shall have knurled or other similar approved marking of door lever handles or cross bars in accordance with local building codes.
- F. Pre-Installation Conference: Prior to the installation of hardware, manufacturer's representatives for locksets, closers, and exit devices shall arrange and hold a jobsite meeting to instruct the installing contractor's personnel on the proper installation of their respective products. A letter of compliance, indicating when this meeting is held and who is in attendance, shall be sent to the Architect and Owner.

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1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver hardware to jobsite in manufacturer's original packaging, marked to correspond with approved hardware schedule. Do not deliver hardware until suitable locked storage space is available. Check hardware against reviewed hardware schedule. Store hardware to protect against loss, theft or damage.
- B. Deliver hardware required to be installed during fabrication of hollow metal, aluminum, wood, or stainless steel doors prepaid to manufacturer.

1.06 WARRANTY

- A. Guarantee workmanship and material provided against defective manufacture. Repair or replace defective workmanship and material appearing within period of one year after Substantial Completion.
- B. Provide ten year factory warranty on door closer body against defects in material and workmanship from date of occupancy of Project.
- C. Replace shortages and incorrect items with correct material at no additional cost to Owner.
- D. At completion of project, qualified factory representative shall inspect closer installations. After this inspection, letter shall be sent to Architect reporting on conditions, verifying that closers have been properly installed and adjusted.

PART 2 PRODUCTS

2.1 BUTTS AND HINGES

A. Acceptable Manufacturers and Types:

Type	Ives	Hager	Stanley
Type 1	5BB1SCHW	BB1262	FBB268
Type 2	5BB1	BB1279	FBB179
Type 3	5BB1	BB1191	FBB191
Type 4	5BB1HW	BB1168	FBB168
Type 5	5BB1HW	BB1199	FBB199

B. Application:

- 1. Exterior outswinging doors Type 5 x NRP
- 2. Exterior inswinging doors and vestibule doors Type 4
- 3. Interior doors with closers Type 2 or 4
- 4. Interior doors over 36 inches wide Type 4
- 5. Interior doors 36 inches or less without closer Type 2
- 6. Provide NRP (non-removable pins) at out-swinging lockable doors.

C. Size:

- 1. 1-3/4 inch Doors 4-1/2 inch by 4-1/2 inch

D. Quantity:

- 1. Two hinges per leaf for openings through 60 inches high.

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2. One additional hinge per leaf for each additional 30 inches in height or fraction thereof.
 3. Four hinges for Dutch doors up to 90 inches in height.
- E. Drill 5/32 inch hole and use No. 12, 1-1/4 inch steel threaded to the head wood screws for hinges on wood doors.

2.2 FLUSH BOLTS AND DUSTPROOF STRIKES

A. Acceptable manufacturers:

Ives	Trimco	Door Controls
FB31P	3810	842
FB41P	3815	942
FB51P	----	845
FB358 / 458	3915	780F
DP2	3910	82

- B. Non-labeled Openings: Provide 2 flush bolts FB457 for inactive leaf of pairs of locked and latched doors. Locate centerline of top bolt not more than 78 inches from finished floor. Provide dustproof strike DP1 for bottom bolt.
- C. Labeled Openings: Provide automatic flush bolt set FB31P or FB41P, as applicable, for inactive leaf of pairs of doors. Provide dustproof strike DP1 for bottom bolt.

2.3 LOCKSETS – CYLINDRICAL

A. Acceptable Manufacturer and Series:

Manufacturer	Series
Schlage	ND Series x TLR
Sargent	10-Line x LJ

- B. Cylinders: Manufacturer's conventional non-removable core cylinders with Schlage Everest D keyway.
- C. Backsets: 2-3/4 inches.
- D. Strikes: Provide wrought boxes and strikes with proper lip length to protect trim but not to project more than 1/8 inch beyond trim, frame or inactive leaf. Where required, provide open back strike and protected to allow practical and secure operation.

2.4 ACCESS CONTROL CYLINDRICAL LOCKS

A. Acceptable Manufacturers and Products:

Manufacturer	Series
Schlage	AD-CY

- B. Provide access control mortise lock series, type, and function where specified in hardware groups, with the provisions below.
1. Cylinders: Refer to 2.04 KEYING, keying requirements.
 2. Backsets: 2-3/4 inches.

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3. Strikes: Provide wrought boxes and strikes with proper lip length to protect trim but not to project more than 1/8 inch beyond trim, frame or inactive leaf. Where required, provide open back strike and protected to allow practical and secure operation.

- C. Provide access control products with non-volatile memory.
- D. Doors to stairs (other than exit stairs), loading platforms, boiler rooms, stages and doors serving other hazardous locations shall have knurled or other similar approved marking of door lever handles or cross bars in accordance with local building codes.

2.5 ACCESS CONTROL EXIT DEVICES

- A. Acceptable Manufacturers and Products:

Manufacturer	Rim Series	Mortise Series
Von Duprin	AD-993R	AD-993M

- B. Provide access control exit device series, type, and function where specified in hardware groups.
- C. All exit devices shall be UL listed for panic. Exit devices for labeled doors shall be UL listed as "Fire Exit Hardware".
- D. Provide exit devices factory cut to door width and height. Locate exit devices at a height recommended by the exit device manufacturer, allowable by governing building codes, and approved by the Architect.
- E. Provide access control products with non-volatile memory.

2.6 KEYING

- A. Master key or Grand master key cylinders and key in groups, unless otherwise specified. Factory masterkey with manufacturer retaining permanent keying records.
- B. Provide 6 masterkeys for each masterkey set. Provide 3 change keys for each lock. Provide 2 control keys for core removal. Stamp keys "DO NOT DUPLICATE."
- C. Submit proposed keying schedule to Architect. If requested, meet with Owner and Architect to review schedule.
- D. Provide conventional cylinders for each lock with construction masterkeying with Schlage Everest D keyway.

2.7 DOOR TRIM

- A. Acceptable Manufacturers and Types:

Ives	Trimco	Quality
8200	1001-9	40-6
8303	1018-3B	40-5
9100	1741	473
8190	1191-3	521
8103-0	1195-2	163-10
8102-8	1194-2	161-8

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B. Push Plates:

1. Ives type 8200 6 inches by 16 inch unless otherwise indicated.
2. Where width of door stile prevents use of 6 inch wide plate, provide push plate one inch less than width of stile but not less than 4 inches wide.

C. Pull Plates:

1. Ives type 8303 4 inches by 16 inches unless otherwise indicated.

D. Push Bars:

1. Ives type 9100, unless otherwise indicated.

E. Pulls:

1. Ives Series 8190, unless otherwise indicated.
2. Where required, mount back to back with push bars.

F. Kick Plates and Armor Plates: Ives 8400 Series, minimum of 0.050 inch thick, beveled 4 edges.

1. At single doors provide width two inches less than door width on stop side and one inch less than door width on pull side.
2. At pairs of doors provide width one inch less than door width on both sides.
3. Height of 10 inches, unless otherwise indicated.

2.8 DOOR CLOSERS

A. Acceptable Manufacturers and Types of Exposed Closers:

LCN	Sargent	Corbin Russwin
4011 / 4111	281 / 281-P10	DC6200 / DC6210 x A3

- B. Closers shall have fully hydraulic, full rack and pinion action with a high strength cast iron cylinder.
- C. Provide non-sized closers, continuously adjustable over the full range of closer sizes, and allow for reduced opening force to meet opening force requirements of ANSI A117.1
- D. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, swing speed, and back check.
- E. Provide closers with solid forged steel main arms (and forearms for parallel arm closers) and where specified to have a cast-in solid stop on the closer shoe ("CUSH"). Parallel arm mounted closers shall have "EDA" type arms or, where specified, "CUSH" or "SCUSH" type arms.
- F. Surface closers shall be certified to exceed ten million full load cycles by a recognized independent testing laboratory.
- G. Provide drop plates, brackets, or adapters for arms as required to suit details.
- H. Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- I. Provide back-check for closers.
- J. Provide hold-open arms where indicated.

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- K. Provide closers for doors as noted in Hardware Groups and, in addition, provide closers for labeled doors whether or not specifically noted in group.
- L. Provide closers meeting the requirements of UBC 7-2, 1997 and UL 10C positive pressure tests.
- M. Pressure relief valves (PRV's) will not be permitted.

2.9 CLOSER/HOLDERS

- A. Acceptable Manufacturers Types of Exposed Closer/Holders:

LCN	Corbin Russwin
4040SE	DC62900
4310ME/4410M E	----

- B. Closers shall have fully hydraulic, full rack and pinion action with a high strength cast iron cylinder.
- C. Provide non-sized closers, continuously adjustable over the full range of closer sizes, and allow for reduced opening force to meet opening force requirements of ANSI A117.1
- D. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, swing speed, and back check.
- E. Provide closers with solid forged steel main arms (and forearms for parallel arm applications).
- F. Provide drop plates, brackets, or adapters for arms as required to suit details.
- G. Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- H. Provide single-point or multi-point hold-open arms as specified.
- I. Provide closer/holders meeting the requirements of UBC 7-2, 1997 and UL 10C positive pressure tests.

2.10 OVERHEAD STOPS

- A. Acceptable Manufacturers

Glynn Johnson	ABH
450	3300
410	3000
90	9000
100	1000

- B. Provide 450 Series overhead stops for interior doors equipped with regular arm surface type closer that swing more than 140 degrees before striking wall, and for doors that open against equipment, casework, sidelights, other objects that would make wall stops inappropriate.

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- C. Provide 100 series overhead stops at exterior doors where specified.
- D. Provide sex bolt attachments for mineral core door application.

2.11 WALL STOPS AND HOLDERS

- A. Acceptable Manufacturers and Types:

Ives	Trimco	Door Controls
WS407CCV	1270WXCP	3211
WS443	1205	3260X
WS445	1207	3267X
FS436	W1211	3310X
WS40	1254	3487X

- B. Provide WS407CVX Series wall stop as applicable, for each door leaf except where wall stops DS20 are specified in Hardware Groups, or where conditions require the use of an overhead stop.
- C. Provide 450 Series overhead stops for doors that swing more than 140 degrees before striking a wall.
- D. Floor or base stops shall be used only where definitely specified or absolutely unavoidable.

2.12 THRESHOLDS

- A. Acceptable Manufacturers and Product:

Zero	National Guard	Reese
655A	S425A	S205A

- B. Where thresholds are specified in hardware groups, provide 655A thresholds unless detailed otherwise.
- C. Refer to drawings for special details. Provide accessories, shims and fasteners.
- D. Where thresholds occur at openings with one or more mullions, they shall be cut for the mullions and extended continuously for the entire opening.

2.13 WEATHERSTRIPPING

- A. Acceptable Manufacturers and Product:

	Zero	National Guard	Reese
Sweeps	39A	201NA	323C
Jambs	429A	700SA	755C
Rain Drips	142A	16A	R201C

- B. Where weatherstripping is specified in hardware groups, provide 429A unless detailed otherwise.

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- C. Provide self-tapping fasteners for weatherstripping being applied to hollow metal frames.
- D. Where sweeps are specified in hardware groups, provide 39A unless detailed otherwise.
- E. Where rain drips are specified in hardware groups, provide 142A x full frame width, unless detailed otherwise.

2.14 GASKETING

- A. Acceptable Manufacturers: Zero, National Guard, and Reese Enterprises. Refer to drawings for special details. Provide accessories, shims and fasteners.

Zero	National Guard	Reese
188S	5050	F-797B

- B. Where smoke gasket is specified in hardware groups, provide 188S, unless detailed otherwise.
- C. Provide gaskets for 20-minute doors and doors designated for smoke and draft control.
- D. Where frame applied intumescent seals are required by the manufacturer, provide gaskets that comply with UBC 7-2, 1997 and UL 10C positive pressure tests.

2.15 SOUND GASKETING

- A. Acceptable Manufacturers:
 - 1. Acoustical gasketing and door bottoms:

	Zero	National Guard	Reese
Automatic Door Bottoms	365AA	520NA	330C
Jambs	170AA	104NA	599C

- B. Where sound gasketing is specified in hardware groups, provide 170AA and 365AA unless detailed otherwise.
 - 1. Provide self-tapping fasteners being applied to hollow metal doors and frames.
 - 2. Cutting or notching of sound gasket for stop mounted hardware shall not be permitted.

2.16 MAGNETIC HOLDERS

- A. Acceptable Manufacturers and Types:

LCN	Rixson-Firemark	ABH
SEM 7850	FM-998	2100 (w/1" extension)

- B. Where magnetic holders are specified in the Hardware Groups, provide LCN SEM 7850, unless detailed otherwise.
 - 1. Verify voltage with Electrical Contractor.

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2.17 DOOR POSITION SWITCHES

A. Acceptable Manufacturers and Types:

Schlage	Sentrol
679-05HM	1078W
679-05WD	1078W
674-OH	2202

B. Coordinate door and frame preparations with door and frame suppliers.

C. Switches shall be installed in frame head approximately 4" from latching door edge.

2.18 PIR MOTION SENSORS

A. Acceptable Manufacturers and types:

Schlage		
SCAN II-W		

B. Provide motion sensors as specified in hardware groups.

2.19 SILENCERS

A. Acceptable Manufacturers and types:

Ives	Steelcraft	Don-Jo
SR64	Q146	1608

B. Provide grey rubber silencers featuring pneumatic design that, once installed, forms an air pocket to absorb shock and reduce noise of door closing.

C. Provide three (3) silencers per hollow metal strike jamb; two (2) per hollow metal double door head. Omit at doors scheduled to receive perimeter weatherstripping or smoke gasket.

D. Silencers shall meet ANSI/BHMA A156.16, L03011

2.20 FASTENERS

A. Including, but not limited to, wood or machine screws, bolts, nuts, anchors, etc. of proper type, material, and finish required for installation of hardware.

B. Use phillips head for exposed screws. Do not use aluminum screws to attach hardware.

C. Provide self-tapping (TEC) screws for attachment of sweeps and stop-applied weatherstripping only.

2.21 TYPICAL FINISHES AND MATERIALS

A. Finishes, unless otherwise specified:

1. Butts: Outswinging Exterior Doors

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- a. US32D (BHMA 630) on Stainless Steel
2. Butts: Interior Doors and Inswinging Exterior Doors
 - a. US26D (BHMA 652) on Steel
3. Flush Bolts:
 - a. US26D (BHMA 626) on Brass or Bronze
4. Exit Devices:
 - a. US32D (BHMA 630) on Stainless Steel
5. Locks and Latches:
 - a. US26D (BHMA 626) on Brass or Bronze
6. Push Plates, Pulls and Push Bars:
 - a. US32D (BHMA 630) on Stainless Steel
7. Coordinators:
 - a. USP (BHMA 600) on Steel
8. Kick Plates, Armor Plates, and Edge Guards:
 - a. US32D (BHMA 630) on Stainless Steel
9. Overhead Stops and Holders:
 - a. US26D (BHMA 626) on Brass or Bronze
10. Closers: Surface mounted.
 - a. Sprayed Aluminum Lacquer.
11. Latch Protectors:
 - a. US32D (BHMA 630) on Stainless Steel
12. Miscellaneous Hardware:
 - a. US26D (BHMA 626) on Brass or Bronze

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine doors, frames, and related items for conditions that would prevent the proper application of finish hardware. Do not proceed until defects are corrected.

3.2 INSTALLATION

- A. Install finish hardware in accordance with reviewed hardware schedule and manufacturer's printed instructions. Pre-fit hardware before finish is applied, remove and reinstall after finish is completed. Install hardware so that parts operate smoothly, close tightly and do not rattle.
- B. Installation of hardware shall comply with NFPA 80 and NFPA 101 requirements.
- C. Set units level, plumb and true to line and location. Adjust and reinforce attachment to substrate as necessary for proper installation and operation.
- D. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant, forming tight seal between threshold and surface to which set. Securely and permanently anchor thresholds, using countersunk non-ferrous screws to match color of thresholds (stainless steel screws at aluminum thresholds).

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- F. Lead Protection: Lead wrap hardware penetrating lead-lined doors. Levers and roses to be lead lined. Apply kick and armor plates with 3M adhesive #1357, as recommended by 3M Co., on lead-lined doors.

3.3 FIELD QUALITY CONTROL

- A. After installation has been completed, provide services of qualified hardware consultant to check Project to determine proper application of finish hardware according to schedule. Also check operation and adjustment of hardware items.
- B. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

3.4 ADJUSTING AND CLEANING

- A. At final completion, hardware shall be left clean and free from disfigurement. Make final adjustment to door closers and other items of hardware. Where hardware is found defective repair or replace or otherwise correct as directed.
- B. Adjust door closers to meet opening force requirements of Uniform Federal Accessibility Standards.
- C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of space or area, return to work during week prior to acceptance or occupancy, and make final check and adjustment of hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors.
- D. Instruct Owner's personnel in proper adjustment and maintenance of door hardware and hardware finishes.
- E. Clean adjacent surfaces soiled by hardware installation.

3.5 PROTECTION

- A. Provide for proper protection of items of hardware until Owner accepts Project as complete.

HARDWARE SET 01: EXTERIOR HM DOOR W/ PANIC BAR (DOOR #100B)

Each assembly to have:

3ea	HINGES	TA2714 4-1/2x4-1/2	32D	McKINNEY
1ea	STOP	*GL90-S SERIES	32D	GLYNN-JOHNSON
2ea	K. PLATE	K1062-B3E-CSKx16"	ST. STEEL	ROCKWOOD
1ea	CLOSER	4010-M	689	LCN
1ea	LOCKSET	D70PD	26D	SCHLAGE
1ea	LOCKGUARD	LG10	26D	IVES
2ea	FLUSH BOLTS	555	26D	ROCKWOOD
1ea	RIM EXITS	**99L-FX994LXUS26D	26D	VON DUPRIN
1ea	RIM CYLINDERS	KEY TO EXIST MASTER	26D	SCHLAGE
5ea	SILENCERS	608		ROCKWOOD
1ea	SADDLE THRESHOLD	8425	ALUM.	NATIONAL GUARD
1ea	GASKETING	160SDKB	NA	NATIONAL GUARD

HARDWARE SET 02: FOR PAIR HM DOORS W/ REMOVABLE HM ASTRAGAL IN NEW HM FRAME W/ PANIC HARDWARE (DOOR #100A)

Each assembly to have:

2	3ea	HINGES	TA2714 4-1/2x4-1/2	32D	McKINNEY
2	1ea	STOP	*GL90-S SERIES	32D	GLYNN-JOHNSON
2	2ea	K. PLATE	K1062-B3E-CSKx16"	ST. STEEL	ROCKWOOD
2	1ea	CLOSER	4010-M	689	LCN
1	1ea	LOCKSET	D70PD	26D	SCHLAGE
2	1ea	LOCKGUARD	LG10	26D	IVES
2	2ea	FLUSH BOLTS	555	26D	ROCKWOOD
2	1ea	RIM EXITS	**99L-FX994LXUS26D	26D	VON DUPRIN
2	1ea	RIM CYLINDERS	KEY TO EXIST MASTER	26D	SCHLAGE
10	5ea	SILENCERS	608		ROCKWOOD
2	1ea	SADDLE THRESHOLD	8425	ALUM.	NATIONAL GUARD
2	1ea	GASKETING	160SDKB	NA	NATIONAL GUARD

HARDWARE SET 03: SINGLE HM DOOR IN NEW HM FRAME (DOOR #101A,104A,106A)

Each assembly to have:

3	3ea	HINGE	TA2714 4-1/2x4-1/2	32D	McKINNEY
1	1ea	STOP	GL90-S SERIES	32D	GLYNN-JOHNSON
2	2ea	K. PLATE	K1062-B3E-CSKx16"	ST. STEEL	ROCKWOOD
1	1ea	*CLOSER	4010-M	689	LCN
5	5ea	SILENCERS	608		ROCKWOOD
1	1ea	LOCKSET	D70PD	26D	SCHLAGE
1	1ea	RIM CYLINDER	KEY TO EXIST MASTER	26D	SCHLAGE