

DIVISION 16

SPECIFICATIONS

ATHENS MEDICAL PLAZA I
ATHENS, GEORGIA

TABLE OF CONTENTS

	PAGES
Section 16010 Basic Electrical Requirements	2
Section 16111 Conduit	6
Section 16123 Building Wire and Cable	4
Section 16130 Boxes	5
Section 16141 Wiring Devices	5
Section 16170 Grounding and Bonding	3
Section 16180 Equipment Wiring Systems	3
Section 16190 Supporting Devices	2
Section 16195 Electrical Identification	2
Section 16421 Utility Service Entrance	2
Section 16426 Distribution Switchboards	6
Section 16441 Enclosed Switches	3
Section 16470 Panelboards	5
Section 16476 Enclosed Circuit Breakers	4
Section 16477 Fuses	4
Section 16485 Clock Timers/Contactors/Photoelectric Controls	3
Section 16510 Interior Luminaires	6
Section 16530 Site Lighting	4
Section 16670 Lightning Protection Systems	4
Section 16672 Transient Voltage Surge Suppression	3
Section 16721 Fire Alarm System	9
Section 16741 Telephone Service, Pathways, and Wiring	3

SECTION 16010

BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Basic Electrical Requirements specifically applicable to Division 16 Sections, in addition to Division 1 - General Requirements.

1.2 WORK SEQUENCE

- A. Install work in phases to accommodate Owner's occupancy requirements; during the construction period coordinate electrical schedule and operations with Architect/Engineer. Phasing of work is as shown on drawings and as indicated in architectural specifications.

1.3 SUBMITTALS

- A. Submit under provisions of DIVISION 1 where specified in this Division.
- B. Electrical Layout Drawings: Switchboard, panelboard, transformer, standby electrical system, circuit breaker and disconnect switch submittals shall be accompanied by electrical room, generator room and electrical closet layouts, dimensioned or drawn to minimum 1/2 inch scale and showing code required clearances and access. Where electrical equipment is installed in mechanical rooms, the mechanical room layouts required under Division 15 shall include all electrical equipment with code required clearances and access.
- C. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittals.
- D. Mark dimensions and values in units to match those specified.

1.4 REGULATORY REQUIREMENTS

- A. Applicable codes as follows:
 1. NFPA 70 (NEC) - 2005
 2. NFPA 99 - 1990
 3. NFPA 101 (LSC) - 1997
 4. International Building Code - 2006
 5. NFPA 72 - 1990
 6. NFPA 90A - 1993
 7. International Energy Conservation Code - 2009

- B. All electrical equipment shall be listed by UL and installed in accordance with that listing.
- C. Obtain permits, and request inspections from authority having jurisdiction.

1.5 PROJECT/SITE CONDITIONS

- A. Install Work in locations shown on Drawings, unless prevented by Project conditions.
- B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Architect/Engineer before proceeding.

END OF SECTION

SECTION 16111

CONDUIT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Metal conduit.
- B. Flexible metal conduit.
- C. Liquidtight flexible metal conduit.
- D. Electrical metallic tubing.
- E. Nonmetal conduit.
- F. Fittings and conduit bodies.

1.2 RELATED SECTIONS

- A. Section 07270 - Fire Stopping.
- B. Division 7 - Roofing Penetrations.
- C. Section 16130 - Boxes.
- D. Section 16170 - Grounding and Bonding.
- E. Section 16190 - Supporting Devices.
- F. Section 16195 - Electrical Identification.

1.3 REFERENCES

- A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
- B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
- C. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
- D. ANSI/NFPA 70 - National Electrical Code.

- E. NECA "Standard of Installation."
- F. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
- G. NEMA TC2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
- H. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.4 DESIGN REQUIREMENTS

- A. Conduit Size: ANSI/NFPA 70.

1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1.
- B. Accurately record actual routing of conduits larger than 2 inches and all panelboard and transformer feeders.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle Products to site under provisions of Division 1.
- B. Accept conduit on site. Inspect for damage.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.

1.7 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Verify routing and termination locations of conduit prior to rough-in.
- C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system. Unless noted otherwise, all conduit shall be concealed.

PART 2 PRODUCTS

2.1 CONDUIT REQUIREMENTS

- A. Minimum Size: ½ inch unless otherwise specified.
- B. Underground Installations:
 - 1. More than Five Feet from Foundation Wall: Use rigid steel conduit, intermediate metal conduit or plastic coated conduit, nonmetallic conduit.
 - 2. Within Five Feet from Foundation Wall: Use rigid steel conduit or intermediate metal conduit.
 - 3. In or Under Slab on Grade: Use rigid steel conduit, intermediate metal conduit or nonmetallic.
 - 4. Emerging from slab: Use rigid steel or intermediate metal conduit.
- C. Outdoor Locations, Above Grade: Use rigid steel.
- D. In Slab Above Grade:
 - 1. Use rigid steel conduit, intermediate metal conduit, electrical metallic tubing and nonmetallic conduit.
- E. Wet and Damp Locations: Use rigid steel, intermediate metal conduit or electrical metallic tubing.
- F. Dry Locations:
 - 1. Concealed (including block walls above slab): Use rigid steel conduit, intermediate metal conduit and electrical metallic tubing.
 - 2. Exposed: Use rigid steel conduit, intermediate metal conduit and electrical metallic tubing.

2.2 METAL CONDUIT

- A. Manufacturers:
 - 1. American Electric.
 - 2. Youngstown.
 - 3. Allied Tube.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. Intermediate Metal Conduit (IMC): Rigid steel.
- D. Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit.

2.3 FLEXIBLE METAL CONDUIT

- A. Manufacturers:
 - 1. Anamet.
 - 2. Electriflex.
 - 3. Arnco.
- B. Description: Interlocked steel construction.
- C. Fittings: ANSI/NEMA FB 1.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Manufacturers:
 - 1. Anamet.
 - 2. Electriflex.
 - 3. Hubbell.
- B. Description: Interlocked steel construction with PVC jacket.
- C. Fittings: ANSI/NEMA FB 1.

2.5 ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
 - 1. Allied Tube.
 - 2. Anixter.
 - 3. Wheatland.
- B. Description: ANSI C80.3; galvanized tubing.
- C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel compression or set screw type.

2.6 NONMETALLIC CONDUIT

- A. Manufacturers:
 - 1. Carlon.
 - 2. Arnco.
 - 3. Electriflex.
- B. Description: NEMA TC 2; Schedule 80 PVC.
- C. Fittings and Conduit Bodies: NEMA TC 3.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install conduit in accordance with NECA "Standard of Installation."
- B. Install nonmetallic conduit in accordance with manufacturer's instructions.
- C. Arrange supports to prevent misalignment during wiring installation.
- D. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- E. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.
- F. Fasten conduit supports to building structure and surfaces under provisions of Section 16190.
- G. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
- H. Do not attach conduit to ceiling support wires or ceiling grids.
- I. Arrange conduit to maintain headroom and present neat appearance.
- J. Route exposed conduit parallel and perpendicular to walls.
- K. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
- L. Route conduit in and under slab from point-to-point.
- M. Do not cross conduits in slab.
- N. Maintain minimum 6 inch clearance between conduit and piping.
- O. Maintain 12 inch (300 mm) clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).
- P. Cut conduit square using saw or pipecutter; de-burr cut ends.
- Q. Bring conduit to shoulder of fittings; fasten securely.

- R. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- S. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- T. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2 inch (50 mm) size.
- U. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- V. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control and expansion joints.
- W. Provide suitable pull string in each empty conduit except sleeves and nipples.
- X. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- Y. Ground and bond conduit under provisions of Section 16170.
- Z. Identify conduit under provisions of Section 16195.

3.2 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements. Where multiple penetrations occur, provide a 2" separation between sides of conduit.
- B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation specified.
- C. Do not route conduit within corrugations of metal floor deck or metal roof deck.

END OF SECTION

SECTION 16123

BUILDING WIRE AND CABLE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Building wire and cable.
- B. Wiring connectors and connections.

1.2 RELATED SECTIONS

- A. Section 16111 - Conduit.
- B. Section 16130 - Boxes.
- C. Section 16195 - Identification.

1.3 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Wire and cable routing indicated is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions. Include wire and cable lengths within 10 feet of length shown.
- C. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.4 COORDINATION

- A. Coordinate Work under provisions of Division 1.
- B. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

PART 2 PRODUCTS

2.1 BUILDING WIRE

- A. Manufacturers:
 - 1. American.
 - 2. Southwire.
 - 3. Rome.
- B. Description: Single conductor insulated wire.
- C. Conductor: Copper.
- D. Insulation Voltage Rating: 600 volts.

2.2 NONMETALLIC-SHEATHED CABLE - NOT APPROVED

2.3 DIRECT BURIAL CABLE - NOT APPROVED

2.4 SERVICE ENTRANCE CABLE - NOT APPROVED

2.5 ARMORED CABLE - NOT APPROVED

2.6 METAL CLAD CABLE

- A. Manufacturers:
 - 1. Rome.
 - 2. Southwire.
 - 3. Triangle.
- B. Description: NFPA 70, Type M.C.
- C. Conductor: Copper.
- D. Insulation Voltage Rating: 600 volts.
- E. Insulation Temperature Rating: 75 degrees C.
- F. Insulation Material: Thermoplastic.
- G. Armor Material: Steel.
- H. Armor Design: Interlocked metal tape.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that mechanical work likely to damage wire and cable has been completed.
- C. Verify that raceway installation is complete and supported.

3.2 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.3 WIRING METHODS

- A. All Locations: Use metal clad cable for interior 20 Amp, 120 Volt branch circuits only (as allowed by local codes). All other branch circuits and feeders shall use building wire, Type THHN/THWN insulation, in raceway.
- B. Underground Installations: Use only building wire, Type THHN/THWN insulation, in raceway, except where noted otherwise in specifications.
- C. Use wiring methods indicated. Unless otherwise noted, all wiring shall be installed in conduit.

3.4 INSTALLATION

- A. Install products in accordance with manufacturers instructions.
- B. Use solid conductor for feeders and branch circuits 10 AWG and smaller.
- C. Use stranded conductors for control circuits.
- D. Use conductor not smaller than 12 AWG for power and lighting circuits.
- E. Use conductor not smaller than 16 AWG for control circuits.
- F. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.
- G. Pull all conductors into raceway at same time.

- H. Use suitable wire pulling lubricant for building wire 4 AWG and larger.
- I. Protect exposed cable from damage.
- J. Support cables above accessible ceiling, using spring metal clips or plastic cable ties to support cables from structure. Do not rest cable on ceiling panels.
- K. Use suitable cable fittings and connectors.
- L. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- M. Clean conductor surfaces before installing lugs and connectors.
- N. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- O. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- P. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
- Q. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- R. Identify wire and cable under provisions of Section 16195. Identify each conductor with its circuit number or other designation indicated.

3.5 FIELD QUALITY CONTROL

- A. Perform field inspection and testing under provisions of Division 1.
- B. Inspect wire and cable for physical damage and proper connection.
- C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
- D. Verify continuity of each branch circuit conductor.
- E. Verify continuity of all system and control wiring.
- F. Inspect and test in accordance with NETA and ATS, except Section 4.

END OF SECTION

SECTION 16130

BOXES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wall and ceiling outlet boxes.
- B. Floor boxes.
- C. Pull and junction boxes.

1.2 RELATED SECTIONS

- A. Division 7 - Firestopping.
- B. Division 8 - Access Doors.
- C. Section 16141 - Wiring Devices.
- D. Section 16180 - Equipment Wiring Systems.

1.3 REFERENCES

- A. NECA - Standard of Installation.
- B. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.
- C. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
- D. ANSI/NFPA 70 - National Electrical Code.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.4 SUBMITTALS FOR CLOSEOUT

- A. Submit under provisions of Division 1.
- B. Accurately record actual locations and mounting heights of outlet, pull, and junction boxes.

PART 2 PRODUCTS

2.1 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized steel.
 - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include ½ inch (13 mm) male fixture studs where required.
 - 2. Concrete Ceiling Boxes: Concrete type.
- B. Cast Boxes: NEMA FB 1, Type FD, cast ferrous alloy. Provide gasketed cover by box manufacturer. Provide threaded hubs.
- C. Wall Plates for Finished Areas: As specified in Section 16141.

2.2 FLOOR BOXES

- A. Floor Boxes: ANSI/NEMA OS 1, fully adjustable.
- B. Material: Cast metal.
- C. Shape: Round.
- D. Conform to regulatory requirements for concrete-tight floor boxes.
- E. Covers:
 - 1. Single gang, Brass with duplex flip cover for duplex receptacles.
 - 2. Carpet flanges: Multi-gang, Aluminum.
 - 3. Fittings: High-tension (15A-125 VAC), Aluminum.
 - 4. Low-tension (telephone), Aluminum.
- F. Service Fittings: As specified in Section 16140.

2.3 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- B. Surface-Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface-mounted junction box.
 - 1. Material: Galvanized cast iron.
 - 2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

- C. In-Ground Cast Metal Box: NEMA 250, Type 6, inside flanged, recessed cover box for flush mounting.
 - 1. Material: Galvanized cast iron.
 - 2. Cover: Smooth cover with neoprene gasket and stainless steel cover screws.
 - 3. Cover Legend: ELECTRIC.

- D. Fiberglass Handholes: Die-molded glass fiber hand holes:
 - 1. Cable Entrance: Pre-cut 6 inch x 6 inch cable entrance at center bottom of each side.
 - 2. Cover: Glass fiber weatherproof cover with nonskid finish.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify locations of floor boxes and outlets prior to rough-in.

3.2 INSTALLATION

- A. Install boxes in accordance with NECA "Standard of Installation."
- B. Set wall mounted boxes at elevations to accommodate mounting heights indicated and specified.
- C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Adjust box location up to 10 feet if required to accommodate intended purpose.
- D. Orient boxes to accommodate wiring devices oriented as specified in Section 16141.
- E. Maintain headroom and present neat mechanical appearance.
- F. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- G. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches (150 mm) from ceiling access panel or from removable recessed luminaire.
- H. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 7.

- I. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- J. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- K. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- L. Use flush mounting outlet box in finished areas.
- M. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- N. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches (150 mm) separation. Provide minimum 24 inches (600 mm) separation in acoustic and fire rated walls.
- O. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- P. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- Q. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- R. Use adjustable steel channel fasteners for hung ceiling outlet box.
- S. Do not fasten boxes to ceiling support wires.
- T. Support boxes independently of conduit.
- U. Use separate boxes for emergency outlets.
- V. For normal circuits use gang box where more than one device is mounted together. Do not use sectional box.
- W. Use gang box with plaster ring for single device outlets.
- X. Use cast outlet box in exterior locations (exposed to the weather) and wet locations.
- Y. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.

Z. Set floor boxes level.

AA. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Coordinate installation of outlet box for equipment connected under Section 16180.

3.4 ADJUSTING

A. Adjust floor box flush with finish flooring material.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused box openings.

3.5 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 16141
WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wall switches.
- B. Receptacles.
- C. Device plates and decorative box covers.
- D. Poke-through service fittings.
- E. Access floor boxes.

1.2 REFERENCES

- A. NEMA WD 1 - General Purpose Wiring Devices.
- B. NEMA WD 6 - Wiring Device Configurations.

1.3 SUBMITTALS

- A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

PART 2 PRODUCTS

2.1 WALL SWITCHES

- A. Manufacturers:
 - 1. Hubbell.
 - 2. Leviton.
 - 3. Arrow Hart.
 - 4. General Electric.
 - 5. Pass & Seymour.
 - 6. Sylvania.
 - 7. Eagle.
- B. Description: NEMA WD 1, general-duty, AC only snap switch, quiet operating.

- C. Device Body: Ivory plastic with full size toggle handle.
- D. Voltage Rating: 120 volts, AC.
- E. Current Rating: 15 amperes.
- F. Ratings: Match branch circuit and load characteristics when controlling an entire branch circuit load.

2.2 RECEPTACLES

- A. Manufacturers:
 - 1. Hubbell.
 - 2. Leviton.
 - 3. Arrow Hart.
 - 4. General Electric.
 - 5. Pass & Seymour.
 - 6. Sylvania.
 - 7. Eagle.
- B. Description: NEMA WD 1; heavy-duty receptacle, hospital grade.
- C. Device Body: Ivory plastic.
- D. Configuration: NEMA WD 6; type as specified and indicated.
- E. Convenience Receptacle: Type 5-15.
- F. GFCI Receptacle: Hospital-Grade receptacle with integral ground fault circuit interrupter to meet regulatory requirements.
- G. Telephone Jack: Modular jack, flush mount, conductors as required (4-pair minimum).

2.3 WALL PLATES

- A. Decorative Cover Plate: Ivory smooth high impact, hard thermal plastic, Smooth stainless steel.
 - 1. Hubbell.
 - 2. Leviton.
 - 3. Arrow Hart.
 - 4. General Electric.
 - 5. Pass & Seymour.
 - 6. Sylvania.
 - 7. Eagle.

- B. Weatherproof Cover Plate: Gasketed cast metal with hinged gasketed device cover.
 - 1. Hubbell.
 - 2. Leviton.
 - 3. Arrow Hart.
 - 4. General Electric.
 - 5. Pass & Seymour.
 - 6. Sylvania.
 - 7. Eagle.

- C. Receptacles in wet locations shall be installed with an outlet enclosure clearly marked "Suitable For Wet Locations While In Use". There must be a gasket between the enclosure and the mounting surface, and between the cover and base to assure a proper seal. The enclosure must employ stainless steel mounting hardware and be constructed in impact resistant polycarbonate. The outlet enclosure shall be listed by Underwriters Laboratories, Inc. Enclosure must be manufactured by TayMac Corporation or equal.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify outlet boxes are installed at proper height.
- B. Verify wall openings are neatly cut and will be completely covered by wall plates.
- C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean debris from outlet boxes.

3.3 INSTALLATION

- A. Install products in accordance with manufacturer's instructions and NECA "Standard of Installation".
- B. Install devices plumb and level.
- C. Install switches with OFF position down.

- D. Connect wiring device grounding terminal to outlet box with bonding jumper and to branch circuit equipment grounding conductor.
- E. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- F. Connect wiring devices by wrapping conductor around screw terminal.
- G. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.4 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under Section 16130 to obtain mounting heights specified and indicated on Drawings.
- B. Install wall switch 48 inches above finished floor, to centerline. Where located near doors, install switches on the lock side and clear of door trim a minimum of 2 inches and a maximum of 10 inches.
- C. Install convenience receptacle 18 inches above finished floor, to centerline.
- D. Install convenience receptacle 2 inches above backsplash of counter, to bottom.
- E. Install telephone outlet 18 inches above finished floor, to centerline.
- F. Install telephone outlet for wall telephone 48 inches above finished floor, to centerline.

3.5 FIELD QUALITY CONTROL

- A. Inspect each wiring device for defects.
- B. Operate each wall switch with circuit energized and verify proper operation.
- C. Verify that each receptacle device is energized.
- D. Test each receptacle device for proper polarity.
- E. Test each GFCI receptacle device for proper operation.
- F. Verify that each telephone jack is properly connected and circuit is operational.

3.6 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

END OF SECTION

SECTION 16170

GROUNDING AND BONDING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Grounding electrodes and conductors.
- B. Equipment grounding conductors.
- C. Bonding.

1.2 REFERENCES

- A. NFPA 70 - National Electrical Code.
- B. NFPA 99 - Health Care Facilities.
- C. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association).

1.3 GROUNDING ELECTRODE SYSTEM

- A. Metal underground water pipe.
- B. Metal frame of the building.
- C. Rod electrode.

1.4 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 10 ohms.

1.5 SUBMITTALS FOR CLOSEOUT

- A. Test Reports: Indicate overall resistance to ground and resistance of each electrode.
- B. Accurately record actual locations of grounding electrodes.

PART 2 PRODUCTS

2.1 ROD ELECTRODE

- A. Material: Copper or Copper-clad steel.
- B. Diameter: 3/4 inch.
- C. Length: 10 feet.

2.2 MECHANICAL CONNECTORS

- A. Manufacturers:
 - 1. Burndy, Hy-Ground.
- B. Material: Bronze.
- C. Listing: U.L.

2.3 EXOTHERMIC CONNECTIONS

- A. Manufacturers:
 - 1. Cadweld.

2.4 WIRE

- A. Material: Stranded copper.
- B. Grounding Electrode Conductors: Size to meet NFPA 70 Requirements. See plans for minimum sizes.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 INSTALLATION

- A. Install Products in accordance with manufacturer's instructions.
- B. Install rod electrodes at locations required by local authority. Install additional rod electrodes as required to achieve specified resistance to ground.

- C. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing. Bond steel together.
- D. Provide bonding to meet Regulatory Requirements.
- E. Bond together metal siding not attached to grounded structure; bond to ground.
- F. Bond transformer neutrals to adjacent metal structure with “grounding electrode conductors” per NEC Article 250.
- G. Provide bonding of the above ground portion of the gas piping system inside the building to meet the requirements of NFPA 54 and NFPA 70.
- H. Provide bonding of shielding cable serving fire alarm addressable adapter modules on all exterior equipment. Provide bonding of exterior equipment device lugs.
- I. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

3.3 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- B. Perform inspections and test listed in NEA ATS, Section 7.13.

END OF SECTION

SECTION 16180
EQUIPMENT WIRING SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Electrical connections to equipment specified under other sections.

1.2 RELATED SECTIONS

- A. Division 1 - Summary of Work.
- B. Division 14 - Electric Elevators - Passenger.
- C. Section 15450 - Plumbing Equipment.
- D. Section 16111 - Conduit.
- E. Section 16123 - Building Wire and Cable.
- F. Section 16130 - Boxes.

1.3 COORDINATION

- A. Coordinate work under provisions of Division 1 and Division 15. Responsibility for furnishing and installing components, material, conduit, wiring, etc., is as assigned in those Divisions. Control wiring at 120 volts or higher shall be furnished and installed by Division 16. Where responsibility is not specifically assigned, labor and materials shall be furnished by Division 16. Installer shall meet requirements of this Section.
- B. Obtain and review shop drawings, product data, manufacturers wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
- C. Determine connection locations and requirements, based on Division 15 installation requirements.
- D. Sequence rough-in of electrical connections to coordinate with installation of equipment.
- E. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 PRODUCTS

2.1 CORDS AND CAPS

- A. Attachment Plug Construction: Conform to NEMA WD 1.
- B. Configuration: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
- C. Cord Construction: NFPA 70, Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
- D. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify conditions under provisions of Division 1 and Division 15.
- B. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use Liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Provide receptacle outlet to accommodate connection with attachment plug.
- E. Provide cord and cap where field-supplied attachment plug is required.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

- G. Install disconnect switches, controllers, control stations, and control devices to

complete equipment wiring requirements. These devices shall not be mounted to equipment, only to adjacent structural elements.

- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION

SECTION 16190
SUPPORTING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Conduit and equipment supports.
- B. Anchors and fasteners.

1.2 REFERENCES

- A. NECA - National Electrical Contractors Association.
- B. ANSI/NFPA 70 - National Electrical Code.

PART 2 PRODUCTS

2.1 PRODUCT REQUIREMENTS

- A. Materials and Finishes: Corrosion resistance.
- B. Select materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit, including weight of wire in conduit.
- C. Anchors and Fasteners:
 - 1. Concrete Structural Elements: Use precast inserts, expansion anchors, powder actuated anchors and preset inserts.
 - 2. Steel Structural Elements: Use beam clamps, steel ramset fasteners and welded fasteners.
 - 3. Concrete Surfaces: Use self-drilling anchors and expansion anchors.
 - 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
 - 5. Solid Masonry Walls: Use expansion anchors and preset inserts.
 - 6. Sheet Metal: Use sheet metal screws.
 - 7. Wood Elements: Use wood screws.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Locate and install anchors, fasteners, and supports in accordance with NECA "Standard of Installation".
 - 1. Do not fasten supports to pipes, ducts, mechanical equipment, T-bars, T-bar supports or conduit.
 - 2. Do not use spring steel clips and clamps.
 - 3. Obtain permission from Architect/Engineer before using powder-actuated anchors.
 - 4. Obtain permission from Architect/Engineer before drilling or cutting structural members.

- B. Fabricate supports from structural steel or formed steel members. Rigidly weld members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

- C. Install surface-mounted cabinets and panelboards with minimum of four anchors.

- D. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch (25 mm) off wall.

- E. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION

SECTION 16195

ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

- A. Division 9 - Painting.

PART 2 PRODUCTS

2.1 NAMEPLATES AND LABELS

- A. Nameplates: Engraved three-layer laminated plastic, white letters on black background. Use white letters on red background for emergency devices.
- B. Locations:
 - 1. Each electrical distribution and control equipment enclosure.
 - 2. Communication cabinets.
- C. Letter Size:
 - 1. Use 1/8 inch letters for identifying individual equipment and loads.
 - 2. Use 1/4 inch letters for identifying grouped equipment and loads.
- D. Labels: Engraved coverplates with 3/16 inch letters. Use only for identification of individual wall switches and receptacles and control device stations on emergency systems.

2.2 WIRE MARKERS

- A. Description: Cloth, tape, split sleeve, or tubing type wire markers.
- B. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes and each load connection.

- C. Legend:
 - 1. Power and Lighting Circuits: Branch circuit or feeder number indicated.
 - 2. Control Circuits: Control wire number indicated on shop drawings.

2.3 UNDERGROUND WARNING TAPE

- A. Description: 4 inch wide plastic tape, detectable type, colored yellow with suitable warning legend describing buried electrical lines.

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive nameplates and labels.

3.2 APPLICATION

- A. Install nameplate and label parallel to equipment lines.
- B. Secure nameplate to equipment front using screws, rivets or permanent adhesive.
- C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.
- D. Secure wall plate labels using screws, rivets or permanent adhesive.
- E. Identify conduit using field painting under provisions of Division 9, or provide plastic tape.
- F. Install or paint colored band on each conduit longer than 10 feet.
- G. Provide conduit bands 20 feet on center or use painted fittings.
- H. Color:
 - 1. 208 Volt System: Blue.
 - 2. Fire Alarm System: Red.
 - 3. Telephone System: Gray.
- I. Identify underground conduits using underground warning tape. Install one tape per trench at 3 inches below finished grade.

END OF SECTION

SECTION 16421

UTILITY SERVICE ENTRANCE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Arrangement with Utility Company for permanent electric service, including payment of Utility Company charges for service.
- B. Underground service entrance.
- C. Metering equipment.

1.2 RELATED SECTIONS

- A. Division 2 - Excavating, Backfilling, Trenching.
- B. Division 3 - Cast-in-Place Concrete: Transformer pads.
- C. Section 16111 - Conduit.
- D. Section 16170 - Grounding and Bonding.
- E. Section 16426 - Distribution Switchboards.

1.3 SYSTEM DESCRIPTION

- A. Utility Company: Georgia Power. Phone: 888-655-5888.
- B. System Characteristics: 208 volts, three phase, four-wire, 60 Hertz.
- C. Service Entrance: Underground.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with Utility Company written requirements.
- B. Maintain one copy of each document on site.

1.5 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on Utility Company drawings.

PART 2 PRODUCTS

2.1 UTILITY METERS

- A. Meters will be furnished by Utility Company.

2.2 UTILITY METER BASE

- A. Provide a meter base per Utility Company specifications.

2.3 TRANSFORMER PAD

- A. Description: Reinforced concrete sized and constructed in accordance with utility requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that service equipment is ready to be connected and energized.

3.2 PREPARATION

- A. Make arrangements with Utility Company to obtain permanent electric service to the Project. Include all fees.
- B. Coordinate location of Utility Company's facilities to ensure proper access is available.

3.3 INSTALLATION

- A. Install service entrance conduits in concrete envelope from Utility Company's pad-mounted transformer to building service entrance equipment.

END OF SECTION

SECTION 16426

DISTRIBUTION SWITCHBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Main switchboard.
- B. Distribution switchboard.

1.2 RELATED SECTIONS

- A. Division 3 - Cast-in-Place Concrete: Concrete pads.
- B. Division 9 - Painting.
- C. Section 16421 - Utility Service Entrance: Utility metering equipment.
- D. Section 16672 - Transient Voltage Surge Suppression.

1.3 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.
- B. ANSI/IEEE C12.1 - Code for Electricity Metering.
- C. ANSI C39.1 - Electrical Analog Indicating Instruments.
- D. ANSI C57.13 - Instrument Transformers.
- E. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
- F. NEMA KS 1 - Enclosed Switches.
- G. NEMA PB 2 - Deadfront Distribution Switchboards.
- H. NEMA PB 2.1 - Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.

1.4 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; and switchboard instrument details.
- C. Product Data: Provide electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of all equipment and components.
- D. Test Reports: Indicate results of factory production tests.
- E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 1.
- B. Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Division 1.
- B. Deliver in 48 inch maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.
- C. Accept switchboards on site. Inspect for damage.
- D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

- E. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Conform to NEMA PB 2 service conditions during and after installation of switchboards.

1.8 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings instructed by manufacturer.

1.9 MAINTENANCE MATERIALS

- A. Provide maintenance materials under provisions of Division 1.
- B. Provide two of each key.

1.10 EXTRA MATERIALS

- A. Furnish under provisions of Division 1.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Square D Model Power-Style QED.
- B. General Electric Spectra Series - SCP Plus.
- C. Siemens Model SB.

2.2 SWITCHBOARD

- A. Description: NEMA PB 2 with electrical ratings and configurations as indicated.
- B. Main Section Devices: Group mounted.
- C. Distribution Section Devices: Group mounted.
- D. Auxiliary Section Devices: Group mounted.

- E. Bus Material: Aluminum with tin plating, standard size.
- F. Bus Connections: Bolted, accessible from front for maintenance.
- G. Fully insulate load side bus bars.
- H. Ground Bus: Extend length of switchboard.
- I. Molded Case Circuit Breakers: NEMA AB 1, integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
- J. Molded Case Circuit Breakers with Current Limiters: NEMA AB 1, molded case circuit breakers with replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole.
- K. Current Limiting Molded Case Circuit Breakers: NEMA AB 1, molded case circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 rms amperes symmetrical let-through current and energy level less than permitted for same size Class RK-5 fuse.
- L. Solid-state Molded Case Circuit Breakers: NEMA AB 1, provide with electronic sensing, timing and tripping circuits for adjustable current settings; ground fault trip; instantaneous trip; and adjustable short time trip. Provide zero sequence type ground fault sensor.
- M. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials and sizes indicated.
- N. Ground Fault Sensor: Zero sequence type.
- O. Ground Fault Relay: Adjustable ground fault sensitivity from 200 to 1200 amperes, time delay adjustable from 0 to 15 seconds. Provide monitor panel with lamp to indicate relay operation, TEST and RESET control switches.
- P. Pull Section: 18 inch width, depth and height to match switchboard. Arrange as shown on Drawings.
- Q. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.

- R. Enclosure: Type 1 - General Purpose.
 - 1. Align sections at front and rear.
 - 2. Switchboard Height: 90 inches excluding floor sills, lifting members and pull boxes.
 - 3. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.
 - 4. Mimic Bus: Show bussing, connections and devices in single line form on the front panels of the switchboard using black color factory painting.
- S. Provide service entrance label.

2.3 ELECTRONIC POWER METER

- A. ANSI C12.16 and CSA CAN-C17-M84, multi-function electronic power meter capable of the following measurements to +/- 0.5% accuracy.
 - 1. Voltage on Phase A, B, C (L-L, L-N).
 - 2. Amperage on Phase A, B, C, and Neutral.
 - 3. Frequency.
 - 4. Power factor (per phase and total).
 - 5. kW, kVA, and kvar (per phase and total).
- B. Meter shall provide CT and VT transformer ratios and shall be programmable to give a "Direct Reading" value.
- C. Meter display shall be minimum (6 digit alphanumeric LCD dot matrix type).

2.4 SURGE SUPPRESSION

- A. Transient Voltage Suppressors (TVSS) shall be installed within the switchboard(s) by the manufacturer of the switchboard(s). Suppressors shall be listed in accordance with UL 1449. Standard for Safety, Transient Voltage Surge Suppressors.
- B. Suppressors shall meet requirements of Section 16672.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surface is suitable for switchboard installation.

3.2 PREPARATION

- A. Provide concrete housekeeping pad under the provisions of Division 3.

3.3 INSTALLATION

- A. Install switchboard in locations shown on Drawings, in accordance with manufacturer's written instructions and NEMA PB 2.1.
- B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

3.4 FIELD QUALITY CONTROL

- A. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.
- B. Measure insulation resistance of each bus section phase to phase and phase to ground for one minute each, at test voltage of 1000 volts; minimum acceptable value for insulation resistance is 2 megohms.
- C. Check tightness of accessible bolted bus joints using calibrated torque wrench.
- D. Physically test key interlock systems to insure proper function.

3.5 ADJUSTING

- A. Adjust all operating mechanisms for free mechanical movement.
- B. Tighten bolted bus connections in accordance with manufacturer's instructions.
- C. Adjust circuit breaker trip and time delay settings to values indicated or as instructed by the Architect/Engineer.

3.6 CLEANING

- A. Touch up scratched or marred surfaces to match original finish.

END OF SECTION

SECTION 16441
ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fusible switches.
- B. Non fusible switches.
- C. Manual motor switches.

1.2 RELATED SECTIONS

- A. Section 16477 - Fuses.

1.3 REFERENCES

- A. NECA - Standard of Installation (published by the National Electrical Contractors Association).
- B. NEMA FU1 - Low Voltage Cartridge Fuses.
- C. NEMA KS1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- D. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (published by the International Electrical Testing Association).
- E. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS FOR REVIEW

- A. Division 1 - Submittals: Procedures for submittals.
- B. Product Data: Provide switch ratings and enclosure dimensions.

1.5 SUBMITTALS FOR CLOSEOUT

- A. Division 1 - Submittals for project closeout.

- B. Record actual locations of enclosed switches in project record documents.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

1.7 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories, Inc.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Division 1 - Material and Equipment: Product options and substitutions.
- B. Square D.
- C. General Electric.
- D. Siemens.
- E. Substitutions: Permitted.

2.2 FUSIBLE SWITCH ASSEMBLIES

- A. Description: NEMA KS 1, Type HD, enclosed load interrupter knife switch. Handle lockable in OFF position.
- B. Fuse clips: Designed to accommodate NEMA FU1, Class R and/or Class J fuses.

2.3 NON FUSIBLE SWITCH ASSEMBLIES

- A. Description: NEMA KS 1, Type HD enclosed load interrupter knife switch. Handle lockable in OFF position.

2.4 MANUAL MOTOR STARTERS

- A. Description: Manual motor starting switches complete with thermal overload protection sized to match motor horsepower.

2.5 ENCLOSURES

- A. Fabrication: NEMA KS 1.
 - 1. Interior Dry Locations: Type 1.
 - 2. Exterior Locations: Type 3R.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with NECA "Standard of Installation."
- B. Install fuses in fusible disconnect switches, sized as per nameplate data of equipment served.
- C. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.2 FIELD QUALITY CONTROL

- A. Division 1: Field inspection, testing, and adjusting.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.5.

END OF SECTION

SECTION 16470

PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Distribution panelboards.
- B. Branch circuit panelboards.

1.2 RELATED SECTIONS

- A. Section 16170 - Grounding and Bonding.
- B. Section 16195 - Electrical Identification.

1.3 REFERENCES

- A. NECA Standard of Installation (published by the National Electrical Contractors Association).
- B. NEMA AB1 - Molded Case Circuit Breakers.
- C. NEMA ICS 2 - Industrial Control Devices, Controllers and Assemblies.
- D. NEMA KS1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- E. NEMA PB 1 - Panelboards.
- F. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- G. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment (published by the International Electrical Testing Association).
- H. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS FOR REVIEW

- A. Division 1 - Submittals: Procedures for submittals.

- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, short circuit ampere rating, circuit breaker arrangement and sizes.

1.5 SUBMITTALS FOR CLOSEOUT

- A. Division 1: Submittals for project closeout.
- B. Record actual locations of panelboards and record actual circuiting arrangements in project record documents.
- C. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

1.7 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories, Inc.

1.8 MAINTENANCE MATERIALS

- A. Division 1 - Contract Closeout.
- B. Furnish two of each panelboard key.

PART 2 PRODUCTS

2.1 DISTRIBUTION PANELBOARDS

- A. Division 1 - Material and Equipment: Product Options and Substitutions.
- B. Manufacturers:
 1. Square D Model I-Line.
 2. General Electric Model SCP.
 3. Siemens Model P5.
 4. Cutler-Hammer Model PRL5P/PRL4.

- C. Description: NEMA PB 1, circuit breaker type.
- D. Service Conditions:
 - 1. Temperature: 104 degrees F (40 degrees C).
 - 2. Altitude: Less than 6,000 feet (1830 m).
- E. Panelboard Bus: Aluminum, ratings as indicated. Provide copper ground bus in each panelboard.
- F. Minimum short circuit rating: As indicated. Series rating is not acceptable.
- G. Molded Case Circuit Breakers: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
- H. Circuit Breaker Accessories: Trip units and auxiliary switches as indicated.
- I. Enclosure: NEMA PB 1, Type 1, 12 inches deep, 42 inches wide, cabinet box.
- J. Cabinet Front: Surface type, fastened with hinged door with flush lock, finished in manufacturer's standard gray enamel.
- K. Provide service entrance label where required.

2.2 BRANCH CIRCUIT PANELBOARDS

- A. Division 1 - Material and Equipment: Product Options and Substitutions.
- B. Manufacturers:
 - 1. Square D Model NQOD/NF.
 - 2. General Electric Model AQ/AE.
 - 3. Siemens Model P1.
 - 4. Cutler-Hammer Model PRL 1a/2a/3a.
- C. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.
- D. Panelboard Bus: Aluminum, ratings as indicated. Provide copper ground bus in each panelboard; provide insulated ground bus where indicated.
- E. Minimum Short Circuit Rating: As indicated. Series rating is not acceptable.

- F. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers. Visual trip indicators are required.
- G. Enclosure: NEMA PB 1, Type 1.
- H. Cabinet Box: 6 inches deep, 20 inches wide. All double section panelboards shall be of equal height.
- I. Cabinet Front: Flush or Surface cabinet front as indicated with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.
- J. Provide lock-on devices for installation of circuits required by local authorities.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install panelboards in accordance with NEMA PB 1.1 and the NECA "Standard of Installation."
- B. Install panelboards plumb.
- C. Height: 6 feet (1800 mm) to top of panelboard; install panelboards taller than 6 feet (1800 mm) with bottom no more than 4 inches (100 mm) above floor.
- D. Provide filler plates for unused spaces in panelboards.
- E. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads. Revise directory to reflect changes in room names and numbering as required by Owner. Also, identify the panelboard source on the directory card.
- F. Provide engraved plastic nameplates under the provisions of Section 16195.
- G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling below floor. Minimum spare conduits: 5 empty 1 inch. Identify each as SPARE.
- H. Ground and bond panelboard enclosure according to Section 16170.

3.2 FIELD QUALITY CONTROL

- A. Division 1: Field inspection, testing, and adjusting.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.4 for switches, Section 7.5 for circuit breakers.

3.3 ADJUSTING

- A. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION

SECTION 16476

ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Molded case enclosed circuit breakers.
- B. Insulated case enclosed circuit breakers.

1.2 RELATED SECTIONS

- A. Section 16190 - Supporting Devices.
- B. Section 16195 - Electrical Identification: Engraved nameplates.

1.3 REFERENCES

- A. NECA Standard of Installation (National Electrical Contractors Association).
- B. NEMA AB 1 - Molded Case Circuit Breakers.
- C. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association).
- D. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS FOR REVIEW

- A. Section 01300 - Submittals: Procedures for submittals.
- B. Product Data: Provide catalog sheets showing ratings, trip units, time current curves, dimensions, and enclosure details.

1.5 SUBMITTALS FOR INFORMATION

- A. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

1.7 EXTRA PRODUCTS

- A. Section 01700 - Contract Closeout.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Square D.
- B. General Electric.
- C. Cutler-Hammer.
- D. Siemens.

2.2 MOLDED CASE CIRCUIT BREAKER

- A. Circuit Breaker: NEMA AB 1.

2.3 TRIP UNITS

- A. Field-Adjustable Trip Circuit Breaker: Circuit breakers with frame sizes 100 amperes and larger have mechanism for adjusting long time continuous current setting for automatic operation.
- B. Field-Changeable Ampere Rating Circuit Breaker: Circuit breakers with frame sizes 200 amperes and larger have changeable trip units.
- C. Current Limiting Circuit Breaker: Circuit breaker indicated as current-limiting have automatically-resetting current limiting elements in each pole. Let-through Current and Energy: Less than permitted for same size Class RK-5 fuse.
- D. Solid-State Circuit Breaker: Electronic sensing, timing, and tripping circuits for adjustable current settings; ground fault trip with zero sequence type ground fault sensor; instantaneous trip; and adjustable short time trip.

2.4 CURRENT LIMITERS

- A. Current Limiter: Designed for application with molded case circuit breaker.

- B. Coordinate limiter size with trip rating of circuit breaker to prevent nuisance tripping and to achieve interrupting current rating specified for circuit breaker.
- C. Interlocks trip circuit breaker and prevent closing circuit breaker when limiter compartment cover is removed or when one or more limiter is not in place or has operated.

2.5 PRODUCT OPTIONS AND FEATURES

- A. Accessories: As scheduled. Conform to NEMA AB 1.
- B. Shunt Trip Device: 120 volts, AC.
- C. Undervoltage Trip Device: 120 volts, AC.
- D. Auxiliary Switch: 120 volts, AC.
- E. Alarm Switch: 120 volts, AC.
- F. Electrical Operator: 120 volts, AC.
- G. Handle Lock: Provisions for padlocking.
- H. Grounding Lug: In each enclosure.
- I. Products suitable for use as service entrance equipment where so applied.

2.6 ENCLOSURE

- A. Enclosure: NEMA AB 1, type as noted on plans.
- B. Fabricate enclosure from steel.
- C. Finish using manufacturer's standard enamel finish.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with NECA "Standard of Installation."
- B. Install enclosed circuit breakers plumb. Provide supports in accordance with Section 16190.

- C. Height: 5 ft (1500 mm) to operating handle.
- D. Locate and install engraved plastic nameplates under the provisions of Section 16195.

3.2 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.6.1.1.

3.3 ADJUSTING

- A. Adjust trip settings so that circuit breakers coordinate with other overcurrent protective devices in circuit.
- B. Adjust trip settings to provide adequate protection from overcurrent and fault currents.

END OF SECTION

SECTION 16477

FUSES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fuses.

1.2 RELATED SECTIONS

- A. Section 16010 - Basic Electrical Requirements.
- B. Section 16441 - Enclosed Switches.
- C. Section 16470 - Panelboards.

1.3 REFERENCES

- A. NFPA 70 - National Electric Code.
- B. NEMA FU 1 - Low Voltage Cartridge Fuses.

1.4 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Product Data: Provide data sheets showing electrical characteristics including time-current curves, AIC rating and UL classification. Also, show manufacturer's name, catalog number and voltage.
- C. Submit a dimension drawing showing the location of the spare fuse cabinet.

1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1.
- B. Record actual fuse sizes.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three (3) years documented experience. Use only fuses made by the one manufacturer.

1.7 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.8 MAINTENANCE MATERIALS

- A. Provide two fuse pullers.

1.9 EXTRA MATERIALS

- A. Furnish under provisions of Division 1.
- B. Provide three of each size and type fuse installed in the spare fuse cabinet prior to final inspection.

PART 2 PRODUCTS

2.1 FUSE REQUIREMENTS

- A. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.
- B. Voltage: Provide fuses with voltage rating suitable for circuit phase-to-phase voltage.
- C. Power Load Feeder Switches Larger than 600 amperes: Class L (fast-acting).
- D. Power Load Feeder Switches: Class RK1 (dual element/time delay). RK5 (time delay).
- E. Motor Load Feeder Switches: Class (dual element/time delay).
- F. Lighting Load Feeder Switches Larger than 600 amperes: Class L fast-acting.
- G. Lighting Load Feeder Switches: Class RK1 (dual element/time delay).
- H. Other Feeder Switches Larger than 600 amperes: Class L fast-acting.
- I. Other Feeder Switches: Class RK1 (dual element/time delay).
- J. Power Branch Circuits: Class RK1 (dual element/time delay).
- K. Motor Branch Circuits: Class RK5 (dual element/time delay).

2.2 CLASS RK1 (DUAL ELEMENT/TIME DELAY) FUSES

- A. Manufacturers:
 1. Bussman Model LPN/LPS.
 2. Gould-Shawmut Model A2D/A6D.
 3. CEFCO Model LON/LOS.

2.3 CLASS RK1 (FAST ACTING) FUSES

- A. Manufacturers:
 1. Bussman Model KTN/KTS.
 2. Gould-Shawmut Model A2K/A6K.
 3. CEFCO Model CTN/CTS.

2.4 CLASS RK5 (DUAL ELEMENT/TIME DELAY) FUSES

- A. Manufacturers:
 1. Bussman Model FRN/FRS.
 2. Gould-Shawmut Model TR/TRS.
 3. CEFCO Model CRN/CRS.

2.5 CLASS J (DUAL ELEMENT/TIME DELAY) FUSES

- A. Manufacturers:
 1. Bussman Model LPJ.
 2. Gould-Shawmut Model AJT.

2.6 CLASS J (FAST ACTING) FUSES

- A. Manufacturers:
 1. Bussman Model JKS.
 2. Gould-Shawmut Model A4J.
 3. CEFCO Model CJS.

2.7 CLASS T FUSES

- A. Manufacturers:
 1. Bussman Model JJN/JJS.
 2. Gould-Shawmut Model A3T.

2.8 CLASS L (FAST-ACTING) FUSES

- A. Manufacturers:
 1. Bussman Model KTU.
 2. Gould-Shawmut Model A4BY.
 3. CEFCO Model CLU.

2.9 CLASS L (TIME DELAY) FUSES

- A. Manufacturers:
 1. Bussman Model KRP/KLU.
 2. Gould-Shawmut Model A4BQ/A4BT/A4BY.
 3. CEFCO Model CLL.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install fuses in accordance with manufacturer's instructions and with all applicable codes.
- B. Install fuse with label oriented such that manufacturer, type, and size are easily read.
- C. Fuses with bolt mount terminals shall be bolted in place using brass bolts/nuts. Place a bronze or brass spring type washer (similar to Belleville cupped washer) between the bolt head/nut and the fuse blade. Tighten using torque as recommended by ASTM Standard for the type bolt and diameter. Affix a label inside the fuse compartment door showing recommended torque - do not cover instructions or label on door.
- D. Do not ship switches in electrical equipment with fuses already installed. Do not deliver fuses to the job site until the equipment is ready to be energized.

END OF SECTION

SECTION 16485

CLOCK TIMERS/CONTACTORS/PHOTOELECTRIC CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Lighting Contactors.
- B. Clock Timers.
- C. Photoelectric Controls.

1.2 REFERENCES

- A. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
- B. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
- C. ANSI/NFPA 70 - National Electrical Code.

1.3 SUBMITTALS FOR REVIEW

- A. Division 1 - Submittals: Procedures for submittals.
- B. Shop Drawings: Indicate outline and support point dimensions, specifications and listings. Indicate operation and programming information. Provide manufacturers and ratings.

1.4 SUBMITTALS FOR CLOSEOUT

- A. Division 1: Submittals for project closeout.
- B. Record actual settings and record actual circuiting arrangements in project record documents.
- C. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.
- D. Provide operational and programming information.

PART 2 PRODUCTS

2.1 MANUFACTURERS - LIGHTING CONTACTORS

- A. Square D.
- B. General Electric.
- C. ASCO.

2.2 LIGHTING CONTACTORS

- A. Description: NEMA ICS 2, magnetic lighting contactor.
- B. Configuration: Mechanically held, 2 wire control for photoelectric or time clock, 3 wire control for switches.
- C. Coil Voltage: As indicated or to match circuit controlled.
- D. Poles: As indicated, plus 2 spare.
- E. Contact Rating: 20 ampere minimum or as indicated. Match branch circuit overcurrent protection, considering derating for continuous loads.
- F. Enclosure: ANSI/NEMA ICS 6, Type 1.

2.3 MANUFACTURERS - TIME CLOCKS

- A. Tork 7200ZL or 7302ZL.
- B. Paragon.
- C. Intermatic.

2.4 CLOCK TIMERS

- A. Description: NEMA ICS 2, 7-day timer with astronomical dial and 12-hour spring carry-over.
- B. Voltage: As indicated or to match circuit controlled.
- C. Poles: 3 PST.
- D. Contact Rating: 40 amperes.

E. Enclosures: ANSI/NEMA ICS 6, Type 1.

2.5 MANUFACTURERS - PHOTOELECTRIC CONTROLS

A. Tork 2101 or 2104.

B. Paragon.

C. Intermatic.

2.6 PHOTOELECTRIC CONTROLS

A. Description: Fixed mounted, adjustable, 2 minute delay.

B. Voltage: As indicated or to match circuit controlled.

C. Poles: SPST.

D. Contact Rating: 2000 watts.

E. Enclosure: Die Cast, weatherproof, conduit mounting.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 16510
INTERIOR LUMINAIRES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Interior luminaires and accessories.
- B. Exit signs.
- C. Ballasts.
- D. Fluorescent lamp emergency power supply.
- E. Lamps.
- F. Luminaire accessories.

1.2 RELATED SECTIONS

- A. Section 16130 - Boxes.

1.3 REFERENCES

- A. ANSI C78.379 - Electric Lamps - Incandescent and High-Intensity Discharge Reflector Lamps - Classification of Beam Patterns.
- B. ANSI C82.1 - Ballasts for Fluorescent Lamps - Specifications.
- C. ANSI C82.4 - Ballasts for High-Intensity Discharge and Low Pressure Sodium Lamps (Multiple Supply Type).
- D. ANSI/NFPA 70 - National Electrical Code.
- E. ANSI/NFPA 101 - Life Safety Code.
- F. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.4 SUBMITTALS

- A. Submit under provisions of Division 1.

- B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- C. Product Data: Provide dimensions, ratings, and performance data.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 1.
- B. Maintenance Data: Include replacement parts list.

PART 2 PRODUCTS

2.1 LUMINAIRES

- A. Furnish products as specified on Drawings. For fire rated ceiling assemblies, furnish products listed for installation in the assembly.
- B. Substitutions: Under provisions of Division 1. Where three or more manufacturers are shown, substitutions will not be considered.

2.2 EXIT SIGNS

- A. Description: Exit sign fixture suitable for use as emergency lighting unit.
- B. Face and Housing: As scheduled by manufacturer's catalog data.
- C. Directional Arrows: Universal type for field adjustment.
- D. Mounting: Universal, for field selection.
- E. Battery: As scheduled, with 1.5 hour capacity.
- F. Battery Charger: Dual-rate type, with sufficient capacity to recharge discharged battery to full charge within twelve hours.
- G. Lamps: Manufacturers standard.

2.3 BALLASTS

- A. Fluorescent Ballast:
 - 1. Description: Electronic ballast. UL listed, class P, non PCB ballast.
 - 2. Voltage: Match luminaire voltage.

3. Source Quality Control: Certify ballast design and construction by Certified Ballast Manufacturers, Inc. Meet FCC Part 18, 15J for EMI/RFI and Federal Efficacy Standard Law 100-357.
4. Temperature: 60 degrees F - energy saving lamps; 50 degrees F - standard lamps.
5. Minimum line transient as shown in IEE 587, category A and ANSI-62.41.
6. Power factor equal to .95 or greater.
7. Maximum lamp crest factor 1.7.
8. Minimum documented 3 year ballast manufacturer's warranty.
9. 20% Total Harmonic Distortion (THD).

B. High Intensity Discharge (HID) Ballast:

1. Description: ANSI C82.4, HID lamp ballast to match lamp specified.

2.4 FLUORESCENT LAMP EMERGENCY POWER SUPPLY

- A. Description: Emergency battery power supply suitable for installation in ballast compartment of fluorescent luminaire.
- B. Lamp Ratings: One lamp as scheduled on the plans providing 1100-1400 lumens, minimum.
- C. Battery: Sealed nickel cadmium type, rated for 10 year life.
- D. Include TEST switch and AC ON indicator light, installed to be operable and visible from the outside of an assembled luminaire.
- E. Warranty: Three year total customer satisfaction.

2.5 LAMPS

- A. Provide lamp type specified for luminaire. Use energy saving lite white lamps in florescent luminaires unless specified otherwise.
- B. Reflector Lamp Beam Patterns: ANSI C78.379.
- C. Fluorescent Four Foot Lamp: T-8, 32 watt.
 1. 3050 initial lumens (2850 Design Lumens).
 2. Med Bi Pin.
 3. Tri-Phosphorus.
 4. 20,000 average hours life at 3 hours per start.
 5. Electrode Guard.
 6. CRI of 85.
 7. Color Temperature: 3500K.

- D. Compact Fluorescent Lamp: Triple Tube, 32 watt.
 - 1. 2400 initial lumens.
 - 2. 4-pin base.
 - 3. CRI of 82.
 - 4. Color Temperature: 3500K.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrate and supporting grids for luminaires.
- B. Examine each luminaire to determine suitability for lamps specified.

3.2 INSTALLATION

- A. Install in accordance with manufacturers instructions.
- B. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- C. Support luminaires larger than 2 x 4 foot (600 x 1 200 mm) size independent of ceiling framing.
- D. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
- E. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.
- F. Exposed Grid Ceilings: Provide auxiliary members spanning ceiling Ts to support surface mounted luminaires. Fasten surface mounted luminaires to ceiling T using bolts, screws, rivets, or suitable clips. For seismic areas, support surface mounted luminaires on grid ceiling directly from building structure.
- G. Install recessed luminaires to permit removal from below.
- H. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- I. Install clips to secure recessed grid-supported luminaires in place. Install seismic support where indicated on plans.

- J. Install wall mounted luminaires, emergency lighting units and exit signs at height as indicated on Drawings. Outlet boxes are required.
- K. Install accessories furnished with each luminaire.
- L. Connect luminaires, emergency lighting units and exit signs to branch circuit outlets provided under Section 16130 using flexible conduit.
- M. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- N. Bond products and metal accessories to branch circuit equipment grounding conductor.
- O. Install specified lamps in each luminaire, emergency lighting unit and exit sign.
- P. Mount fixtures as called for in schedule on drawings. Determine type of ceiling to be installed in each space from the architectural drawings and schedules and furnish fixtures suitable for the exact type.
- Q. Lighting fixtures shall be structurally supported. Fluorescent fixtures mounted in suspended ceiling shall be supported by, and attached to, the ceiling suspension system as required by N.E.C. 410-16(b). Incandescent fixtures mounted in suspended ceilings shall be supported by fixture channels, furnished under this Division, laid across ceiling support channels. Surface mounted fixtures shall be supported from the building structural system by rods, or rods and clamps, or by the fixture outlet box, which in turn shall be supported by rods. Provide fixture studs as required.
- R. Wall mounted fixtures shall be secured to masonry walls with bolts and lead anchors, and to metal stud, dry wall partitions by sheetmetal screws driven into metal studs.

3.3 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.4 ADJUSTING

- A. Aim and adjust luminaires as indicated on Drawings and as directed.
- B. Adjust exit sign directional arrows as indicated.

C. Relamp luminaires that have failed lamps at Substantial Completion.

3.5 CLEANING

A. Clean Work under provisions of Division 1.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosure.

D. Clean photometric control surfaces as recommended by manufacturer.

E. Clean finishes and touch up damage.

END OF SECTION

SECTION 16530

SITE LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Exterior luminaires and accessories.
- B. Poles.

1.2 RELATED SECTIONS

- A. Division 3 - Cast-in-Place Concrete: Foundations for poles.

1.3 REFERENCES

- A. ANSI C78.379 - Electric Lamps - Incandescent and High-Intensity Discharge Reflector Lamps - Classification of Beam Patterns.
- B. ANSI/NFPA 70 - National Electrical Code.
- C. ANSI/IES RP-8 - Recommended Practice for Roadway Lighting.
- D. ANSI/IES RP-20 - Lighting for Parking Facilities.

1.4 PERFORMANCE REQUIREMENTS

- A. Roadway: Provide illumination levels and uniformity to match design intent as indicated on Drawings.
- B. Parking Area: Provide illumination levels and uniformity to match design intent as indicated on Drawings.

1.5 SUBMITTALS

- A. Shop Drawings: Indicate dimensions and components for each luminaire which is not a standard product of the manufacturer.
- B. Product Data: Provide dimensions, ratings, and performance data.
- C. Design Data: Include lighting calculations based on design shown.

- D. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.6 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of each luminaire.

1.7 OPERATION AND MAINTENANCE DATA

- A. Maintenance Data: Include instructions for maintaining luminaires.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Division 1.
- B. Accept products on site. Inspect for damage.
- C. Protect poles from finish damage by handling carefully.

1.9 COORDINATION

- A. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

1.10 EXTRA MATERIALS

- A. Provide two of each lamp type and wattage installed.

PART 2 PRODUCTS

2.1 LUMINAIRES

- A. Furnish products as specified in schedule on Drawings.
- B. Substitutions: Under provisions of Division 1. Where three or more manufacturers are shown, substitutions will not be considered.

2.2 BALLASTS

- A. High Intensity Discharge (HID) Ballast:
 - 1. Description: ANSI C82.4, HID high power factor lamp ballast to match lamps indicated.
 - 2. Voltage: Match luminaire voltage.

2.3 LAMPS

- A. Provide lamp type specified for luminaire.
- B. Reflector Lamp Beam Patterns: ANSI C78.379.

2.4 POLES

- A. Shape, Material, and Finish: As specified on drawings.
- B. Height: As indicated on drawings.
- C. Accessories:
 - 1. Handhole.
- D. Loading Capacity Ratings:
 - 1. Steady Wind: 120 miles per hour, minimum.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine excavation and concrete foundation for lighting poles.
- B. Examine each luminaire to determine suitability for lamps specified.

3.2 INSTALLATION

- A. Install in accordance with manufacturers' instructions.
- B. Install lighting poles at locations indicated.
- C. Install poles plumb. Provide shims and double nuts to adjust plumb. Grout around each base. Refer to base details on drawings.
- D. Install lamps in each luminaire.
- E. Bond luminaires, metal accessories and metal poles to branch circuit equipment grounding conductor. Provide supplementary grounding electrode at each pole.

3.3 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

- B. Measure illumination levels to verify conformance with performance requirements.
- C. Take measurements during night sky, without moon or with heavy overcast clouds effectively obscuring moon.

3.4 ADJUSTING

- A. Aim and adjust luminaires to provide illumination levels and distribution as directed.
- B. Relamp luminaires which have failed lamps at Date of Substantial Completion.

3.5 CLEANING

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosure.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finishes and touch up damage.

END OF SECTION

SECTION 16670

LIGHTNING PROTECTION SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Air terminals and interconnecting conductors.
- B. Grounding and bonding for lightning protection.

1.2 RELATED SECTIONS

- A. Division 1: Roofing system.

1.3 REFERENCES

- A. LPI-175 - Lightning Protection Installation Standard.
- B. LPI-176 - Lightning Protection System Material and Components Standard.
- C. LPI-177 - Inspection Guide for LPI Certified Systems.
- D. NFPA 780 - Lightning Protection Code.
- E. UL 96 - Lightning Protection Components.
- F. UL 96A - Installation Requirements for Lightning Protection Systems.

1.4 SYSTEM DESCRIPTION

- A. Lightning Protection System: Conductor system protecting roof structure, consisting of air terminals on roofs, roof-mounted mechanical equipment, and parapets; bonding of structure and other metal objects; grounding electrodes; and interconnecting conductors.

1.5 SUBMITTALS FOR REVIEW

- A. Division 1 - Submittals: Procedures for submittals.
- B. Shop Drawings: Indicate layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details.

- C. Product Data: Provide dimensions and materials of each component, and include indication of listing in accordance with UL 96.

1.6 SUBMITTALS FOR INFORMATION

- A. Division 1 - Submittals: Submittals for information.
- B. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.
- C. Submit certificate of compliance from Underwriter's Laboratories indicating approval of lightning protection systems.

1.7 PROJECT CLOSEOUT SUBMITTALS

- A. Record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors in project record documents.
- B. Provide UL certification documents.

1.8 QUALITY ASSURANCE

- A. Perform Work in accordance with NFPA 780.
- B. Perform Work in accordance with UL 96A and provide UL Master Label and L.P.I. certification.
- C. Maintain one copy of each document on site.
- D. Class I materials required for structures 75 feet and less in height. Class II materials for above 75 feet. All connections shall be of bolted cast connection.
- E. Aluminum materials not to be embedded in concrete or masonry or installed on copper surfaces. Bare copper materials not to be installed on aluminum surfaces.

1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in lightning protection equipment with minimum three (3) years documented experience.
- B. Installer: Authorized installer of manufacturer with minimum three (3) years documented experience.

- C. Materials listed and labeled in accordance with Underwriter's Laboratories requirements.

1.10 REGULATORY REQUIREMENTS

- A. Product Listing: UL 96.

1.11 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

1.12 COORDINATION

- A. Division 1 - Coordination and Meetings.
- B. Coordinate work with roofing and exterior and interior finish installations.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. A-C Lightning Security or approved equal.

2.2 COMPONENTS

- A. Air Terminals: Copper, with adhesive bases for roof installations.
- B. Air Terminal for Chimney: Lead-coated copper.
- C. Grounding Rods: Solid copper or stainless steel.
- D. Ground Plate: Copper.
- E. Conductors: Copper
- F. Connectors and Splicers: Bronze.

2.3 LIGHTNING ARRESTERS

- A. Provide on electrical and telephone service entrances.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with NFPA 780, UL 96A, and LPI-175.
- B. Connect conductors using mechanical connectors or exothermic welding process. Protect adjacent construction elements and finishes from damage. Provide fasteners at three feet on center and as necessary to maintain position and hold permanently in place on concealed runs of conductor.
- C. Bond exterior metal bodies on building to lightning protection system. Provide ground loop with grounding electrodes and connected to the electrical system electrodes.
- D. Coordinate all roof mounting and penetrations. Penetration device shall be created by a solid mechanical connection consisting of proper length all thread rod of proper material for system design with cable connectors on both ends and sealed with EPDM flashing and sealing components.

3.2 FIELD QUALITY CONTROL

- A. Obtain the services of Underwriters Laboratories, Inc. to provide inspection and labeling of the lightning protection system in accordance with UL 96A.
- B. Install U.L. Master "C" and manufacturer's nameplate near a down conductor.

END OF SECTION

SECTION 16672

TRANSIENT VOLTAGE SURGE SUPPRESSION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. TVSS Equipment.

1.2 RELATED SECTIONS

- A. Section 16130 - Boxes.
- B. Section 16170 - Grounding and Bonding.

1.3 SYSTEM DESCRIPTION

- A. Transient voltage surge suppressions (TVSS) for the protection of all AC electrical circuits and exterior signal circuits.

1.4 REFERENCES

- A. UL 1449 - Standard for safety, transient voltage surge suppressors.

1.5 SUBMITTALS FOR REVIEW

- A. Shop Drawings: Indicate electrical characteristics and connection requirements. Show installation details and system configuration.
- B. Product Data: Provide dimensions and materials of each component, and include indication of listing in accordance with UL 1449.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 PROJECT RECORD DOCUMENTS

- A. Record actual locations of TVSS devices.

1.7 QUALITY ASSURANCE

- A. Submit under provisions of Division 1.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three (3) years documented experience, and with service facilities within 100 miles of project.
- B. Supplier: Authorized distributor of specified manufacturer with minimum three (3) years documented experience.
- C. Installer: Authorized installer of specified manufacturer with service facilities within 100 miles of project.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Advanced Protection Technologies.
- B. Liebert.
- C. Current Technologies.
- D. Innovative Technologies.
- E. LEA International.
- F. United Power.

2.2 COMPONENTS

- A. Suppression Elements: Between each phase conductor and the system neutral and between the neutral conductor and ground.
- B. Indicator Lights: Visible indication of proper suppressor connection and operation.
- C. Maximum single per phase impulse current rating (L-N, L-G, N-G): 200,000 Amps for service entrance, 80,000 Amps per phase (L-N, L-G, N-G) for distribution panels and 25,000 Amps per phase for 120V hard wired suppressors.

- D. The TVSS UL1449 Clamping voltage and the Category C3 clamping voltage (ANSI/IEEE c.62.41 - 1991 (20KV - 1.2/50 us., 10KA - 8/20 us) for any suppression mode shall not exceed 500 volts for 120/208V electrical systems.
- E. Pulse Life Rating: 1,000 occurrences with no clamping drift for service entrance and secondary distribution panels; 3,000 amperes every thirty (30) seconds for 200 occurrences for hard-wired suppressors.
- F. Turn-on And Turn-Off Times: Less than one nanosecond.
- G. Construction: Surge current modules (MOV based).
- H. Alarm: Visual and/or alarm shall actuate when any surge current module has failed. If alarm is audible an on/off switch shall silence the alarm and a push-to-test switch shall be provided to test the alarm.

PART 3 EXECUTION

3.1 SERVICE ENTRANCE

- A. Install one primary suppressor at each utility service entrance to the facility, according to manufacturer's recommendations.
- B. Suppressors shall be installed on the line side of the service entrance with proper protection.
- C. Conductors between suppressor and point of attachment shall be kept as short and straight as possible.
- D. Suppressors ground shall be bonded to the service entrance ground.

3.2 ELECTRONIC EQUIPMENT AC POWER SUPPLY

- A. Install one hard-wired circuit suppressor between each equipment item and its power supply conductors and between each equipment item and all exterior incoming lines as follows:
 - 1. Fire alarm control panel (including incoming telephone lines and alarm lines).
 - 2. TV head-end equipment.
 - 3. Telephone switch (receptacles and incoming business lines).
- B. Install suppressor according to manufacturers recommendations.

END OF SECTION

SECTION 16721
FIRE ALARM SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fire alarm control and annunciator panels.
- B. Manual fire alarm stations.
- C. Automatic smoke and heat detectors.
- D. Fire alarm signaling appliances.
- E. Auxiliary fire alarm equipment.

1.2 RELATED SECTIONS

- A. Division 8 - Sectional Overhead Doors.
- B. Division 14: Elevators.
- C. Section 15325 - Sprinkler Systems.
- D. Section 16111 - Conduit.
- E. Section 16123 - Building Wire and Cable.

1.3 REFERENCES

- A. NFPA 70 - National Electrical Code.
- B. NFPA 72 - Installation, Maintenance, and Use of Protective Signaling Systems.
- C. NFPA 101 - Life Safety Code.
- D. Americans with Disabilities Act (ADA).
- E. ASME/ANSI A17.1 - Safety Code for Elevators and Escalators.

1.4 SYSTEM DESCRIPTION

- A. Fire Alarm System: NFPA 72, manual and automatic local fire alarm system (addressable analog) with connections to a central system, as required by the local authority.

1.5 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Shop Drawings: Provide annunciator layout and system wiring diagram showing each device and wiring connection required. Provide nominal 11 x 17 CADD generated building map indicating zones, devices and connections. Map to be in aluminum frame with plexiglass cover, color per Division 9.
- C. Product Data: Provide electrical characteristics and connection requirements.
- D. Test Reports: Indicate satisfactory completion of required tests and inspections, including detector sensitivity and all requirements of the regulatory agencies.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of products.
- F. Submit Power Supply and Battery sizing calculations.
- G. A certification report, signed by the installing contractor shall be submitted at the final inspection listing each smoke detector and the test method used to obtain the manufacturer's calibrated sensitivity. Testing shall be accomplished in accordance with NFPA-72.

1.6 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1.
- B. Record actual locations of initiating devices, signaling appliances, and end-of-line devices.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 1.

- B. Operation Data: Operating instructions.
- C. Maintenance Data: Maintenance and repair procedures.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three (3) years documented experience, and with service facilities within 100 miles of Project.
- B. Contractor: The fire alarm contractor must be certified as required by the local authority having jurisdiction.

1.9 MAINTENANCE SERVICE

- A. Furnish service and maintenance of fire alarm system for one year from Date of Substantial Completion.

1.10 EXTRA MATERIALS

- A. Furnish under provisions of Division 1.
- B. Provide ten manual station break-glass rods.
- C. Provide six keys of each type.
- D. Provide three of each type of automatic smoke detector without base.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Simplex Model MapNet II-4100.
- B. Edwards Systems Technology Model EST3.
- C. Pyrotronics Model MXL.
- D. Notifier Model AFP-400.

2.2 FIRE ALARM AND SMOKE DETECTION CONTROL PANEL

- A. Control Panel: Modular construction with flush wall-mounted enclosure.

- B. Power supply: Adequate to serve control panel modules, remote detectors, remote annunciators, door holders, smoke dampers, relays, and alarm signaling devices. Include battery-operated emergency power supply with capacity for operating system in standby mode for 24 hours followed by alarm mode for 5 minutes.
- C. System Supervision: Component or power supply failure places system in trouble mode.
- D. Initiating Device Circuits: Supervised zone module with alarm and trouble indication; occurrence of single ground or open condition places circuit in trouble mode but does not disable that circuit from initiating an alarm.
- E. Indicating Appliance Circuits: Supervised march time signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition places circuit in trouble mode but does not disable that circuit from signaling an alarm.
- F. Remote Station Signal Transmitter: Electrically supervised digital alarm communicator transmitter, capable of transmitting alarm and trouble signals over telephone lines to central station receiver. Locate the remote station signal transmitter in the fire alarm panel. Annunciate trouble signal at the control panel and at the remote annunciator. Equal to Silent Knight 5104.
- G. Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts for each detection zone to provide accessory functions specified. All normally open and normally closed contacts shall perform in the fail safe mode. Reference Division 15 control diagrams for fire alarm connections and HVAC unit shutdown requirements.
- H. Provide TROUBLE ACKNOWLEDGE, DRILL, and ALARM SILENCE switch.
- I. Trouble Sequence of Operation: System or circuit trouble places system in trouble mode, which causes the following system operations:
 - 1. Visual and audible trouble alarm indicated by zone at fire alarm control panel.
 - 2. Visual and audible trouble alarm indicated at remote annunciator panel.
 - 3. Trouble signal transmitted to central station.
 - 4. Manual acknowledge function at fire alarm control panel silences audible trouble alarm; visual alarm is displayed until initiating failure or circuit trouble is cleared.

- J. Alarm Sequence of Operation: Actuation of initiating device places circuit in alarm mode, which causes the following system operations:
1. Sound and display local fire alarm signaling devices with march time signal.
 2. Transmit zone-coded signal to central station.
 3. Indicate location of alarm zone and device on fire alarm control panel and on remote annunciator panel.
 4. Transmit signal by zone to building smoke removal system.
 5. Transmit signal to building mechanical systems to initiate shutdown of fans and damper operation.
 6. Transmit signal to release door hold-open devices.
 7. Transmit signal to release smoke curtain hold-open devices.
 8. Transmit signal to release door locking system.
- K. The activation of the elevator machine room heat detector or any hoistway heat detector shall, in addition to the operation listed above (Paragraph J), operate the elevator machine circuit breaker shunt trip utilizing auxiliary contacts.
- L. The activation of any elevator lobby, elevator machine room, or top of hoistway smoke detector shall, in addition to the operation listed above (Paragraph J), operate the elevator recall utilizing auxiliary contacts.
- M. The activation of the elevator machine room smoke detector shall also initiate a separate zone to flash a "DO NOT USE ELEVATOR" sign at the main level of egress as per plans.
- N. Alarm Reset: System remains in alarm mode until manually reset with key-accessible reset function; system resets only if initiating circuits are out of alarm mode.
- O. Lamp Test: Manual lamp test function causes alarm indication at each zone at fire alarm control panel and at annunciator panel.
- P. Drill Sequence of Operation: Manual drill function causes alarm mode operation as described above.
- Q. Zoning: As indicated.
- R. Surge Protection: Provide type required by Section 16672 and regulatory agency.

2.3 INITIATING DEVICES

- A. Manual Station: Semi-Flush mounted, addressable type, single action manual station with break-glass rod. Provide manufacturer's standard backbox.
- B. Spot Heat Detector: Combination rate-of-rise and fixed temperature (addressable type), rated 135 degrees F, and temperature rate of rise of 15 degrees F addressable.
- C. Elevator Machine Room and Hoistway Heat Detectors: 190 degrees F fixed, addressable.
- D. Ceiling Mounted Smoke Detector: NFPA 72, photoelectric addressable type with adjustable sensitivity, plug-in base, auxiliary relay contact, integral thermal element rated 135 degrees F (57 degrees C), and visual indication of detector actuation, suitable for mounting on 4 inch (102 mm) outlet box. Provide two-wire detector with common power supply and signal circuits.
- E. Duct Mounted Smoke Detector: NFPA 72, photoelectric addressable type with auxiliary SPDT relay contact or addressable relay module, key-operated NORMAL-RESET-TEST switch, duct sampling tubes extending width of duct, and visual indication of detector actuation, in duct-mounted housing. Provide two-wire detector with common power supply and signal circuits.
- F. Water flow and Tamper Switches: By Division 15. Install addressable adapter modules as required.
- G. Hood Suppression Micro Switches: By Division 15. Install addressable adapter and control devices as required.

2.4 SIGNALING APPLIANCES

- A. Alarm Lights: ADA and NFPA 72, strobe lamp and flasher with red lettered "FIRE" on white lens.
- B. Alarm Horn/Strobe: ADA and NFPA 72, flush type fire alarm horn. Sound Rating: 87 dB at 10 feet (3M). Provide integral lamp and flasher with red lettered "FIRE" on white lens.
- C. Remote Annunciator: Provide supervised remote annunciator including audible and visual indication of fire alarm by zone, and audible and visual indication of system trouble. Install in surface wall-mounted enclosure.

- D. Machine Room Smoke Detector Sign: Back lighted type, flashing message, minimum 1/2" letter height "DO NOT USE ELEVATOR".

2.5 AUXILIARY DEVICES

- A. Door Holders: Magnetic door holder with integral diodes to reduce buzzing. Coil voltage: Match system.
- B. Door Release/Closer: Combination closer and holder hardware to match requirements of Division 8. Voltage to match system.
- C. Building Zone Map: Located adjacent to fire alarm control panel. Provide a nominal 14" x 36" building location map indicating each zone. Provide map in extruded aluminum frame with plexiglass cover.
- D. Install addressable adapter modules for sprinkler switch, hood suppression switch and each HVAC unit for shutdown as per Division 15 control drawings. Provide "total building" shutdown or "per zone" shutdown as required by local authority.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install manual station with operating handle 48 inches above floor, to centerline. Install audible and visual signal devices 6 feet 8 inches above floor, to centerline.
- C. Use 14 AWG minimum size conductors for fire alarm detection and signal circuit conductors. Install wiring in conduit. For exterior lines serving addressable adapter modules, use shielded cable in conduit. The installation method shall conform with Class B wiring.
- D. Mount end-of-line device in separate box flush in ceiling adjacent to last device in circuit. Provide engraved label on plate.
- E. Mount outlet box for electric door holder to withstand 80 pounds pulling force.
- F. Make conduit and wiring connections to door release devices, sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control panels, duct and ceiling smoke detectors, HVAC unit controls and telephone lines for central station reporting.

G. Automatic Detector Installation: Conform to NFPA 72.

3.2 FIELD QUALITY CONTROL

A. Test in accordance with NFPA 72 and local fire department requirements.

3.3 MANUFACTURER'S FIELD SERVICES

A. Prepare and start systems under direct supervision of the manufacturer's representative.

B. Include services of manufacturer's technician to supervise installation, adjustments, final connections, and system testing.

C. Coordinate signal requirements by the DACT with Owner's central station provider.

3.4 FIRE ALARM WIRE AND CABLE COLOR CODE

A. Provide fire alarm circuit conductors with insulation color coded as follows, or using colored tape at each conductor termination and in each junction box.

B. Power Branch Circuit Conductors: Black, red, white.

C. Initiating Device Circuit: Black, red.

D. Detector Power Supply: Violet, brown.

E. Signal Device Circuit: Blue (positive), white (negative).

F. Door Release: Gray, gray.

G. Central Station Trip Circuit: Orange, orange.

H. Central Station Fire Alarm Loop: Black, white.

3.5 DEMONSTRATION

A. Provide systems demonstration under provisions of Division 1 and (all local, state, and federal) regulatory agencies having jurisdiction. Vendor must be present at all such demonstrations.

B. Demonstrate normal and abnormal modes of operation, and required responses to each.

- C. At the beginning of each demonstration, furnish all required documentation and equipment required for testing the system to the regulatory agency present at that test.

END OF SECTION

SECTION 16741

TELEPHONE SERVICE, PATHWAYS, AND WIRING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Telephone service entrance raceway.
- B. Equipment and terminal backboards.
- C. Telephone cabinets.
- D. Premises wiring and outlets.

1.2 RELATED SECTIONS

- A. Section 16111 - Conduit.
- B. Section 16141 - Wiring Devices: Telephone outlet jacks.

1.3 SYSTEM DESCRIPTION

- A. Telephone Service Entrance Pathway: Nonmetallic conduit from point of telephone utility connection at property line to building service terminal backboard. See Section 16111 for turn up requirements.
- B. Backbone Pathway: Conform to EIA/TIA 569 using conduit as indicated.
- C. Horizontal Pathway: Conform to EIA/TIA 569, using raceway, backboards, and cabinets as indicated.
- D. Premises Wiring: By Owner.
- E. Install a ½ inch conduit with a No. 6 AWG insulated stranded copper ground wire from service TTB to main electrical service grounding electrode.

1.4 PROJECT RECORD DOCUMENTS

- A. Record actual locations and sizes of pathways and outlets.

1.5 QUALITY ASSURANCE

- A. Telephone Utility: Coordinate with Owner.
- B. Perform Work in accordance with telephone utility's rules and regulations.

PART 2 PRODUCTS

2.1 TELEPHONE TERMINATION BACKBOARDS

- A. Material: Plywood.
- B. Size: 4 x 8 feet, 3/4 inch thick.

2.2 TELEPHONE TERMINATION CABINETS

- A. Cabinet Boxes: Galvanized steel with removable endwalls, 24 inches wide, 36 inches high, 6 inches deep. Provide plywood backboard inside cabinet for mounting telephone termination devices.
- B. Cabinet Fronts: Steel, flush surface type with concealed trim clamps, concealed hinge and flush lock keyed to match branch circuit panelboard.
- C. Finish: Gray baked enamel.

2.2 SURGE SUPPRESSION

- A. Provide type required by Section 16672 and regulatory agency.

2.3 CONDUIT

- A. ½ inch minimum size of same stock used generally throughout the building, stubbed above ceiling.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Finish paint termination backboards with durable gray enamel under the provisions of Division 9 prior to installation of telephone equipment.
- B. Support raceways, backboards, and cabinets under the provisions of Section 16190.

- C. Install termination backboards and cabinets plumb, and attach securely to building wall at each corner. Install cabinet trim plumb.
- D. Install recessed cabinets flush with wall finishes, and stub 5 empty 1 inch conduits to accessible location above ceiling at each location.
- E. Install polyethylene pulling string in each empty telephone conduit over ten feet in length or containing a bend.
- F. Mark all backboards and cabinets with the legend "TELEPHONE" under the provisions of Section 16195.
- G. Mark all telephone wiring at TTB indicating Room Name and Number at which the cable is terminated.
- H. Identify each conductor at termination point as to location of jack or outlet served.

END OF SECTION