PART 1 - GENERAL

1.1 SCOPE
A. This section supplements all sections of this division and shall apply to all phases of work hereinafter specified, shown on the drawings, or required to provide a complete installation of electrical systems for the Project. The work required under this division is not limited to the Electrical Drawings. Refer to Site, Architectural, Structural, and Mechanical Drawings which may designate Work to be accomplished. The intent of the Specifications is to provide a complete electrical system which includes all documents which are a part of the Contract.

1. Work included: Furnish all labor, material, tools, equipment, facilities, transportation, skilled supervision necessary for, and incidental to, performing operations in connection with furnishing, delivery, and installation of the work in this section complete as shown or noted on the Drawings and specified herein.

B. Related Work Specified Elsewhere: Refer to all sections in Division 0, Contract Requirements and Division 1, General Requirements.

1.2 GENERAL REQUIREMENTS

A. WARRANTY.

1. Except as may be specified under other Sections in the specification, guarantee equipment furnished under the specifications for a period of one year, except for equipment required to have a longer guaranty period, from date of Substantial Completion against defective workmanship and material, and improper installation. Upon notification of failure, correct deficiency immediately and without cost to the Owner.

2. Standard warranty of manufacturer shall apply for replacement of parts after expiration of the above period. Manufacturer shall furnish replacement parts to the Owner or his service agency as approved. Furnish to the Owner, printed manufacturer's warranties complete with material included and expiration dates, upon completion of project. Conform to Section 01 70 00 – Execution and Closeout Requirements.

B. EQUIPMENT SAFETY.
All electrical materials and equipment shall be new and shall be listed by Underwriters Laboratories and bear their label, or listed and certified by a nationally recognized testing authority where UL does not have an approval. Custom made equipment must have complete test data submitted by the manufacturer attesting to its safety. Provide signage at all electrical rooms and on each exterior electrical enclosure access door or gate. Sign shall read "DANGER-HIGH VOLTAGE".

C. CODES AND REGULATIONS.

Design, manufacture, testing and method of installation of all apparatus and materials furnished under the requirements of these specifications shall conform to the latest publications or standard rules of the following:

Institute of Electrical and Electronic Engineers - IEEE
National Electrical Manufacturers' Association - NEMA
Underwriters' Laboratories, Inc. - UL
National Fire Protection Association - NFPA
American Society for Testing and Materials - ASTM
American National Standards Institute – ANSI
California Electrical Code - CEC
California Code of Regulations, Title 8, Subchapter 5
California Building Code State & Municipal Codes in Force in the Specific Project Area
Occupational Safety & Health Administration - OSHA
California State Fire Marshal -CSFM

The term "Code", when used within the specifications, shall refer to the Publications, Standards, ordinances and codes, listed above. In the case where the codes have different levels of requirements the most stringent rules shall apply.

D. REQUIREMENTS OF REGULATORY AGENCY.

1. Codes, Permits, and Fees: Where the Contract Documents exceed minimum requirements, the Contract Documents take precedence. Where code conflicts occur, the most stringent shall apply unless variance is approved.
   a). Comply with all requirements for permits, licenses, fees and Code. Permits, licenses, fees, inspections and arrangements required for the work shall be obtained by the Contractor at his expense, unless otherwise specified.
   b) Comply with the requirements of the applicable utility companies serving the Project. Make all arrangements with the utility companies for proper coordination of the Work.

E. SHOP DRAWINGS.

1. See Section 01 33 00 – Submittal Procedures for additional requirements.
2. Time Schedules for Submission and Ordering: The Contractor shall prepare, review and coordinate his schedule of submissions carefully, determining the
necessary lead time for preparing, submitting, checking, ordering and delivery of materials and equipment for timely arrival. The Contractor shall be responsible for conformance with the overall construction schedule.

3. Submittals will be checked for general compliance with specifications only. The Contractor shall be responsible for deviations from the drawings or specifications and for errors or omissions of any sort in submittals.

4. Submit a complete list of materials and equipment proposed for the job, including manufacturer's names and catalog numbers.

5. Shop drawings shall be submitted in completed groups of materials (i.e., lighting fixtures or switchgear). The Contractor shall add and sign the following paragraph on equipment and materials submitted for review. "It is hereby certified that the (equipment) (material) shown and marked in this submittal is that proposed to be incorporated into the project; is in compliance with the Contract Drawings and specifications and can be installed in the allocated spaces". Failure to add the above written statement for compliance will result in return of submittals to be reviewed.

6. Contractor shall prepare coordinated drawings when required by Section 01 33 00- Submittal Procedures.

All equipment arrangement within the room with all affected trades to provide all code clearances and proper arrangements prior to rough-in. Equipment that grossly exceeds the space allocated and would require an increase in room size is not acceptable.
F. Interpretations: Requests for interpretations of drawings and specifications must be made by the Contractor through the Owner. Any such requests made by equipment manufacturers or suppliers will be referred to the Contractor.

G. Substitutions: Permitted.

H. Submit comprehensive material list, shop drawings and complete technical data for the following equipment and materials:
   1) General Requirements:
      a) Main service and distribution switchboards.
      b) Panelboards.
      c) Conduits
      d) Conductors, include selected insulation type.
      e) Fuses
      f) Disconnect switches.
      g) Pullboxes, manholes and handholes.
      h) Standard lighting fixtures, specially fabricated fixtures, ballasts and lamps, with samples and sample of standard finish available (where requested).
      i) Integrated electronic system.
      j) Control devices, standard and special receptacles, switches, plug strips and finish device plates.
      k) Cabinets for signal and telephone system, special terminals and cabinets.
      l) Access panels.
      m) Fire alarm system.
      n) Security system.
      o) Telephone/data network system.
      p) Master antenna television.
      q) Autonomous Public Address System.

I. Utility Service:
   1. Contractor shall verify the locations shown on the drawings and shall include extensions of lines to service locations which are acceptable to the utility companies costs levied by the serving utility must be borne by the Contractor.
   2. Verify electrical, civil, architectural and structural, dimensional and other requirements with the serving utility companies.
   3. Should any major modifications to the work indicated be necessary to comply with the utility requirements, notify the Owner.
   4. Within five days after award of Contract, notify serving utilities that the project is under construction and furnish them the dates on which the various services will be required.

J. Record Drawings: Refer to Section 01 70 00 – Execution and Closeout Requirements.

K. Work Responsibilities:
   1. The drawings indicate diagrammatically the desired locations or arrangement of
conduit runs, outlets and equipment and are to be followed. Execute the work so as to secure the best possible installation in the available space and to overcome local difficulties due to space limitations. The Contractor is responsible for the correct placing of his work.

2. Locations shown on architectural plan or on wall elevations shall take precedence over electrical plan locations, but where a major conflict is evident, notify the Owner before installing any rough-in conduit underground or above ground.

3. In the event changes in the indicated locations or arrangement are necessary due to developed conditions in the building construction or rearrangement of furnishings or equipment, such changes shall be made without extra cost.

4. Verify dimensions and the correct location of Owner-Furnished equipment before proceeding with the roughing-in of connections.

5. Lighting fixtures in mechanical spaces and elevator machine rooms are shown in their approximate locations only. Do not install light outlets or fixtures until mechanical piping and ductwork are installed; then lights shall be installed in locations best suited for equipment arrangement as directed by the Owner. Verify locations of fixtures in elevator machine rooms with the elevator company before installation.

6. All scaled and figured dimensions are approximate of typical equipment of the class indicated. Before proceeding with work carefully check and verify dimensions and sizes with the drawings to see that the equipment will fit into the spaces provided without violation of applicable Codes.

7. Should any changes to the work indicated on the drawings or described in the specifications be necessary in order to comply with the above requirements, notify the Architect.

8. Be responsible for coordination of coordinated drawings.

9. Replace or repair, without additional compensation, any work which does not comply with these requirements.

1. Installation General: For special requirements, refer to specific equipment under these requirements.

1. Unless otherwise specified elsewhere in the specifications, do all excavating necessary for the proper installation of the electrical work.

2. Locations of Openings: Locate chases, shafts and openings required for the installation of the electrical work during framing of the structure. Do any additional cutting and patching required. Cutting or drilling in any structural member is prohibited without approval of the Owner. Furnish access panels as required.

3. Location of Sleeves: Where conduits pass through concrete walls, suspended slabs or metal deck floors, install sleeves of adequate size to permit installation of conduit. Sleeves shall be installed prior to pouring of concrete and shall have ends flush with the wall or extend 2 inches above floor surfaces. Verify locations.

4. Type of Sleeves: Sleeves shall be steel pipe or galvanized sheet steel.

5. Finish Around Sleeves: Rough edges shall be finished smooth. Space between conduit and sleeves where conduit passes through exterior walls shall be sealed to permit movement of conduit, but prevent entrance of water. Space between conduit and sleeves, where conduit passes fire rated interior walls and slabs
shall be sealed with approved materials to provide a fire barrier conforming to the requirements of the governing authorities having jurisdiction, using UL Approved Firestopping Systems.

6. Wherever conduit extends through roof, install flashings in accordance with drawings and details.

7. Be responsible for cutting and patching which may be required for the proper installation of the electrical work.

8. Protect work, materials and equipment cause whatever and provide adequate and proper storage facilities during the progress of the work.

9. Storage outdoors shall be weather protected and shall include space heaters to prevent condensation. Provide for the safety and good condition of all work until final acceptance of the work. Replace all damaged or defective work, materials and equipment before requesting final acceptance.

10. Conduit and Equipment to be Installed: Clean thoroughly to remove plaster, spattered paint, cement and dirt on both exterior and interior.

11. Conduit and Equipment to be Painted: Clean conduit exposed to view in completed structure by removing plaster and dirt. Remove grease, oil and similar material from conduit and equipment by wiping with clean rags and suitable solvents in preparation for paint.

12. Items with Factory Finish: Remove cement, plaster, grease and oil, and leave surfaces, including cracks and corners, clean and polished. Touch up scratched or bare spots to match finish.

13. Site Cleaning: Remove from site all packing cartons, scrap materials and other rubbish.

14. Electrical equipment and materials exposed to public and in finished areas shall be finish-painted after installation in accordance with the Painting Section. All exposed screw-type fasteners, exterior, or interior in restrooms, shall be vandal-resistant spanner type; include tool.

M. Excavation, Cutting and Patching:

1. Excavating, trenching and backfilling required for the work of this Division in accordance with the applicable requirements of Division 2. Excavating and backfilling connected with electrical work, repaving cuts and providing and maintaining protective measures for the electrical work excavation required by the governing authorities having jurisdiction shall be performed as a part of the work of this Division.

2. Verify openings indicated on the drawings. Additional cutting, patching and reinforcement of the construction of the building as required.

N. Tests:

1. Equipment and systems, for which the National Electrical Testing Association (NETA) has an approved or recommended procedure, shall be tested in accordance with that procedure. Test values shall equal values recommended by NETA. Copies of test reports shall be submitted as required under shop drawing submittals.
2. Resistance to ground tests shall be accomplished by a qualified independent testing firm to measure resistance to ground at grounding electrodes. Make tests before slabs or affected areas are poured in order that corrective measures, if required, may be taken. Submit a report showing the results of these measurements. If the resistances exceed values specified elsewhere or NETA test procedure recommendations, perform corrective measures required to reduce resistance to acceptable values.

3. Prior to energizing any motor, measure the service voltage for phase balance and report if unbalance exceeds 1% from mean.

4. Measure the three-phase voltage at no load and at maximum load conditions and submit to the report showing the results of these measurements.

5. Upon completion of the work and adjustment of all equipment, conduct an operating test. Conduct the test in the presence of an authorized representative of the Architect. Demonstrate system and equipment to operate in accordance with requirements of the Contract Documents and to be free from electrical and mechanical defects. Provide systems free from short circuits and grounds and show an insulation resistance between phase conductors and ground not less than the requirements of the governing electric code. Test circuits for proper neutral connection.

6. Complete tests prior to final inspection of project, including corrective work based on the results of the tests.

7. Perform special tests on systems and equipment as specified herein using personnel qualified to perform such tests.

8. Submit a report showing test voltage of line to neutral on the secondaries of transformers.

9. Measure voltage on secondary side of transformers with full load connected and adjust taps to provide rated secondary voltage.

10. Refer to Section 01 40 00 – Quality Requirements for other testing requirements.

O. Protection: Protect finish parts of the materials and equipment against damage during the progress of the work and until final completion and acceptance. Cover materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred. Keep moving parts clean, dry and lubricated.

P. Cleaning Up:

1. Upon completion of the work and at various time during the progress of the work, remove from the building all surplus materials, rubbish and debris resulting from the work of this Division.

2. Thoroughly clean switchgear including busses, apparatus, exposed conduit, metal work including the exterior and interior, and accessories for the work of this Division, of cement, plaster and other deleterious materials; remove grease and oil spots with cleaning solvent; carefully wipe surfaces and scrape cracks and corners clean.

3. Thoroughly polish chromium or plated work. Remove dirt and stains from lighting fixtures.

4. Leave the entire installation in a clean condition.
Q. Completion:
1. The work will not be reviewed for final acceptance until operating and maintenance data, manufacturer's literature, panel directories and nameplates specified herein have been approved and properly posted or installed and final cleaning of equipment and premises has been completed.
2. When the installation is complete and adjustments have been made, operate the system for a period of one week, during which time demonstrate that systems are completed and operating in conformance with the specifications.
3. Refer to Section 01 70 00 – Execution and Closeout Requirements for other system starting requirements.

R. Operating and Maintenance Data: Submit complete and at one time, prior to acceptance of the installation, 4 copies of manufacturer's instructions for operation and maintenance of electrical equipment, including replacement parts lists. As specified in Section 01 70 00 – Execution and Closeout Requirements.

S. Inspection and Acceptance Procedures: The Architect will submit observation reports periodically during the construction phase detailing Contract deficiencies. The Contractor is responsible for making corrections immediately. Notice of Completion of the project will not be made until all items have been corrected.

T. Substantial Completion of Electrical Systems:
1. Prior to Substantial Completion of operating electrical systems, the Contractor shall:
   a) Provide materials of the type and quality specified and as necessary for proper operation, tested and ready for use.
   b) Deliver to the Owner, the Record Drawings.
   c) Furnish the required Operating and Maintenance Data/Manuals.
   d) Clean up of the project pertaining to this Division of the work.
   e) After installation has been completed and adjustments made, operate the system for a period of one week, during which time, demonstrate to the Owner that systems are complete and operating in conformance with Contract Documents.
   f) Conduct tests required and as specified in this Division and submit test reports and corrective actions taken.
   g) Submission of warranties and guarantees.
2. Substantial Completion of Work Shall be Contingent On:
   a) Contractor replacing defective materials and workmanship.
   b) Upon completion of work and adjustments made, Contractor shall conduct an operating test for each system for approval at such time as Owner directs. Conduct test in presence of authorized representative of Architect and demonstrate that systems and equipment do operate in accordance with requirements of the Contract Documents and are free from electrical and mechanical defects.
   c) Contractor shall provide the necessary training programs and instructions to the Owner's representative. Number of hours or days as required under separate Sections of these Specifications.
d. Submit copies of manufacturer's instructions and maintenance of electrical equipment including replacement parts lists. Each set shall include one set of shop drawings of equipment installed.

U. The Contractor at a time convenient to the Owner shall provide instruction to the Owner's operating personnel in the proper operation and maintenance of the equipment and systems. The instructors shall have received factory training and shall be thoroughly familiar with the equipment installed. The operating personnel shall receive the number of days instruction as indicated in other sections.

Part 2 -PRODUCTS.
Not Used

Part 3 -EXECUTION.
Not Used

END OF SECTION 260500
SECTION 260513 - MEDIUM-VOLTAGE CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes medium voltage cables and cable terminations for systems rated above 600 Volts to 25,000 Volts.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:
   1. IEEE 48 - Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV.

B. National Electrical Manufacturers Association:
   1. NEMA WC 8 - Ethylene Propylene Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

C. Underwriter Laboratories (UL):

D. International Electrical Testing Association:

1.3 SUBMITTALS

A. Product Data: Submittal for cable, terminations, and accessories are required.

B. Test Reports: Indicate results of cable test in tabular form and in plots of current versus voltage for incremental voltage steps, and current versus time at 30 second intervals at maximum voltage.

PART 2 - PRODUCTS

2.1 MEDIUM VOLTAGE CABLE

A. Manufacturers:
   1. Aetna Insulated Wire, Inc.
   2. Kerite, Co.
   3. The Okonite, Co.
   4. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: NEMA WC74/ICEA S-93-639, ethylene-propylene rubber insulated power cable, shielded, Type MV-105 and 133% insulation level.

C. Voltage: 5 kV or 8 kV, grounded.
D. Conductor Material: Copper, stranded and single conductor.

E. Conductor Construction: Stranded copper conductors with extruded semi-conducting shield, insulated with solid dielectric ethylene-propylene rubber, a copper shield and overall jacket of polyvinylchloride (PVC).

F. Jacket: Heavy duty PVC, sunlight and ozone resistant.

G. Jacket continuous marker: Manufacturer’s name, insulation thickness and type (shielded), jacket type, conductor type and size (AWG or kCMIL), rated voltage and year of manufacture.

2.2 CABLE TERMINATIONS

A. Product Description: IEEE 48, Class2, porcelain insulator cable terminator in kit form.

2.3 CAST-EPOXY CABLE TERMINATIONS

A. Product Description: IEEE 48, Class1, cast epoxy cable termination in kit form with stress cone, shield ground connection, wet porcelain rain shield for outdoor units, epoxy resin molding material, and accessories and molds required for proper application.

2.4 MODULAR CABLE TERMINATIONS

A. Product Description: IEEE 48, Class1, molded-rubber cable termination in kit form with stress cone, ground clamp, non tracking rubber skirts, load break connector, rubber cap, and aerial lug.

2.5 TAPE TERMINATIONS

A. Product Description: IEEE 48, Class1, tape termination kit with semi-conductive tape, stress control tape, splicing tape, vinyl plastic tape, stress cone, mechanical ground straps, and cable preparation kit.

2.6 FIREPROOFING TAPE

A. Manufacturers:
   1. 3M Electrical Products Division.
   2. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Flexible, conformable fabric, coated on one side with flame retardant, flexible polymeric or chlorinated elastomer. Non-corrosive to and compatible with cable sheaths jackets. Arc proof and fireproof. Does not support combustion.

2.7 UNDERGROUND CABLE MARKERS

A. Manufacturers:
   1. Electromark.
   2. Substitutions: Permitted.
B. Product Description: Metal-detectable plastic ribbon tape, red colored, continuously printed with black letters indicating “CAUTION ELECTRIC LINE BURIED BELOW”, minimum 4 inches wide by 5 mil thick, polyethylene detectable tape, manufactured for direct burial service.

C. Install all 5 KV cables in conduits or ducts. Provide a #1/0 AWG, 600 volts THWN equipment grounding conductor in each conduit of medium voltage (5KV) feeder.

D. All cables shall be identified as to phase leg in all pull boxes and at all points of termination with 3/4-inch (19mm) wide bands of plastic tape; red for Phase A, black (or no band if cable is black) for Phase B, and yellow for Phase C.

PART 3 EXECUTION
Not Used.

END OF SECTION 260513
SECTION 260519 – LOW VOLTAGE POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes building wire and cable; nonmetallic-sheathed cable; direct burial cable; service entrance cable; armored cable; metal clad cable; and wiring connectors and connections.

1.2 SYSTEM DESCRIPTION

A. Product Requirements: Provide products as follows:
   1. Solid conductor for feeders and branch circuits 10 AWG and smaller.
   2. Stranded conductors for control circuits.
   3. Conductor not smaller than 12 AWG for power and lighting circuits.
   4. Conductor not smaller than 14 AWG for control circuits.
   5. 10 AWG conductors for 120Volt, 20 Amp branch circuits longer than 75 feet.
   6. 10 AWG conductors for 277Volt, 20 Amp branch circuits longer than 200 feet.
   7. 8 AWG conductors for 120Volt, 20 Amp branch circuits longer than 150 feet.

B. Wiring Methods: Provide the following wiring methods:
   1. Concealed Dry Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.
   2. Exposed Dry Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.
   3. Above Accessible Ceilings: Use only building wire, Type THHN/THWN insulation, in raceway.
   4. Wet or Damp Interior Locations: Use only building wire, Type THWN, THW insulation, in raceway.
   5. Exterior Locations: Use only building wire, Type THWN, THW insulation, in raceway.
   6. Underground Locations: Use only building wire, Type THWN, THW, XHHW insulation, in raceway.
   7. At Extreme Temperatures such as on or near boilers: Use only building wire, Type XHHW insulation, in raceway.

1.3 DESIGN REQUIREMENTS

A. Conductor sizes are based on copper. Aluminum conductor shall not be used.

B. Raceway and boxes are located where required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements.

C. Raceway Products:
1. Underground More than 5 feet outside Foundation Wall: Provide concrete encased, thickwall nonmetallic conduit. Provide cast metal boxes or nonmetallic handhole.
2. Underground Within 5 feet from Foundation Wall: Provide PVC tape coated rigid steel conduit. Provide cast metal or nonmetallic boxes.
3. Under Slab on Grade: Provide thickwall nonmetallic conduit. Provide cast or nonmetallic metal boxes.
4. Outdoor Locations, Above Grade: Provide rigid steel conduit. Provide cast metal or nonmetallic outlet, pull, and junction boxes.
5. Wet and Damp Indoor Locations: Provide rigid steel conduit or intermediate metal conduit. Provide cast metal or nonmetallic outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.

D. Minimum Raceway Size: 3/4 inch, above grade and one inch below grade unless otherwise specified.

1.4 SUBMITTALS

A. Product Data: Submittal is required.

1.5 QUALITY ASSURANCE.

A. Provide wiring materials located in plenums with flame travel and smoke peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

A. Manufacturers:
   1. American Insulated Wire Corp.
   2. General Cable Corp.
   3. Southwire Co.
   4. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Single conductor insulated wire.

C. Conductor: Copper.
D. Insulation Voltage Rating: 600 volts.

E. Insulation Temperature Rating: 90 degrees C.

F. Insulation Material: NFPA 70: Type THW, THHN/THWN, XHHW insulation for feeders and branch circuits larger than 8 AWG; Type THHN/THWN insulation for feeder and branch circuits 8AWG and smaller.

2.2 WIRING CONNECTORS

A. Spring Wire Connectors:
   1. Ideal: Super Nut.
   2. 3M Product: Scotchlok.
   3. Substitutions: Section 01 60 00 - Product Requirements.

B. Compression Connectors:
   1. Tyco Electronics Corp.: Utilux Copper Compression Connectors.
   2. Thomas & Betts: Color-Keyed Copper Connectors.
   3. Substitutions: Section 01 60 00 - Product Requirements.

2.3 TERMINATIONS

A. Terminal Lugs for Wires 6 AWG and Smaller: Solderless, compression type copper.

B. Lugs for Wires 4 AWG and Larger: Color keyed, compression type copper, with insulating sealing collars.

PART 3 EXECUTION

Not Used

END OF SECTION 260519
SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rod electrodes.
   2. Wire.
   3. Grounding well components.
   4. Mechanical connectors.
   5. Exothermic connections.

1.2 SYSTEM DESCRIPTION

A. Grounding systems use the following elements as grounding electrodes:
   1. Metal underground water pipe.
   2. Metal building frame.
   3. Concrete-encased electrode.
   4. Ground ring.
   5. Plate electrode.

1.3 DESIGN REQUIREMENTS

A. Construct and test grounding systems for access flooring systems on conductive floors accordance with IEEE 1100.

1.4 PERFORMANCE REQUIREMENTS


1.5 SUBMITTALS

A. Product Data: Submittal required.
B. Test Reports: Required.
C. Manufacturer's Installation Instructions: Required.
D. Manufacturer's Certificate: Required.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and grounding electrodes.

1.7 QUALITY ASSURANCE

A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.
1.8 COORDINATION

A. Complete grounding and bonding of building reinforcing steel prior concrete placement.

PART 2 - PRODUCTS

2.1 ROD ELECTRODES

A. Product Description:
   1. Material: Copper-clad steel.
   2. Diameter: 3/4 inch (19mm).
   3. Length: 10 feet (3.0mm).

B. Manufacturer:
   1. Thomas & Betts, Electrical.
   2. Erico – Eritech.

C. Connector: U-bolt Clamp.

2.2 WIRE

A. Material: Stranded copper.

B. Foundation Electrodes: 2/0 AWG.

C. Grounding Electrode Conductor: Copper conductor bare.

D. Bonding Conductor: Copper conductor insulated.

2.3 GROUNDING WELL COMPONENTS

A. Well Pipe: 8 inches NPS by 24 inches (600 mm) long concrete pipe with belled end.

B. Well Cover: Cast iron with legend "GROUND" embossed on cover.

2.4 MECHANICAL CONNECTORS

A. Manufacturers:
   1. Erico, Inc.
   2. ILSCO Corporation.
   3. O-Z Gedney Co.

B. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

2.5 EXOTHERMIC CONNECTIONS

A. Manufacturers:
2. Substitutions: Permitted

B. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

PART 3 - EXECUTION
Not Used

END OF SECTION 260526
SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Conduit supports.
   2. Formed steel channel.
   3. Sleeves.
   4. Firestopping relating to electrical work.
   5. Firestopping accessories.
   6. Equipment bases and supports.
   7. sts of Building Construction and Materials.
   9. UL 1479 - Fire Tests of Through-Penetration Firestops.

1.2 SYSTEM DESCRIPTION

A. Firestopping Materials: ASTM E119, UL 1479 to achieve fire rating as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.

B. Firestopping Materials: ASTM E119, UL 1479 to achieve fire rating of adjacent construction, in accordance with UL Design Numbers noted on Drawings.

C. Firestop interruptions to fire rated assemblies, materials, and components.

1.3 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to CSFM and UL for fire resistance ratings and surface burning characteristics.

1.4 SUBMITTALS

A. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

B. Product Data:
   1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
   2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

C. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

D. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.
E. Manufacturer's Installation Instructions:
   1. Hangers and Supports: Submit special procedures and assembly of components.
   2. Firestopping: Submit preparation and installation instructions.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Engineering Judgements: For conditions not covered by UL or WH listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements

1.5 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
   1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1 hour.
   2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
      a) Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.
   2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: L 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

E. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience approved by manufacturer.
1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.8 ENVIRONMENTAL REQUIREMENT.

A. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

B. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

C. Provide ventilation in areas to receive solvent cured materials.

PART 2 - PRODUCTS

2.1 CONDUIT SUPPORTS

A. Manufacturers:
   1. Allied Tube & Conduit Corp.
   2. Electroline Manufacturing Company.
   3. O-Z Gedney Co.

B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

D. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

E. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.

F. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self locking.

2.2 FORMED STEEL CHANNEL

A. Manufacturers:
   1. Allied Tube & Conduit Corp.
   2. B-Line System.
3. Unistrut Corp.

B. Product Description: Galvanized 12 gage (2.8 mm) thick steel. With holes 1-1/2 inches (38 mm) on center.

2.3 SLEEVES
A. Sleeves for conduit Through Non-fire Rated Floors: 18 gage (1.2 mm) thick galvanized steel.
B. Sleeves for conduit Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage (1.2 mm) thick galvanized steel.
C. Sleeves for conduit Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

2.4 FIRESTOPPING
A. Manufacturers:
1. Hilti Corp.
2. Dow Corning Corp.
3. 3M Fire Protection Products.
B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
C. Various Types:
1. Silicone Firestopping Elastomeric Firestopping: Multiple component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Multiple component foam compound
3. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.

2.5 FIRESTOPPING ACCESSORIES
A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.
B. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
C. General:
1. Furnish UL listed products [or products tested by independent testing laboratory].
2. Select products with rating not less than rating of wall or floor being penetrated.
D. Non-Rated Surfaces:
1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 – EXECUTION

Not Used

END OF SECTION
SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.

1.2 SYSTEM DESCRIPTION

A. Raceway and boxes required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

B. Underground or Under Slab: Use rigid steel conduit, concrete encased PVC Schedule 40, minimum size 3/4 inch, unless otherwise noted.

C. Under Slab 90 degree bends: Use rigid conduit with bond bushing, and with compression fittings.

D. Outdoor Locations, Above Grade: Provide rigid steel conduit (with corrosion resistant fittings). Provide cast metal or nonmetallic outlet, pull, and junction boxes.

E. Wet and Damp Locations: Provide rigid steel conduit. Provide cast metal or nonmetallic outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.


G. Exposed Dry Locations within buildings above grade: Provide rigid steel conduit (where exposed less than 7'-6" (2.30 m) above floor), electrical metallic tubing (where exposed at not less than 7'-6" (2.30 m) above floor, for sizes 2" (50 mm) or smaller). Provide hinged enclosure for large pull boxes.

H. Metallic conduits (feeders) shall be joined with compression type fittings. Set screw type fittings may be used only for branch circuits.

I. Use flexible conduits only as follows:

1. Final connections to motors, vibrating equipment, and where required for equipment servicing.

2. Connection to recessed lighting fixtures from nearby accessible junction boxes.

3. Concealed runs in dry location where structural conditions prevent the use of other types of conduit and where such runs do not exceed 6 feet (1.80 m).
4. In damp locations or areas exposed to weather, flexible conduit where required shall be of the liquid tight type provided the jacket temperature limitations will not be exceeded.

1.3 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4 inch (19 mm) for underground, below grade, slab or in slab unless otherwise specified.

B. Provide, whether indicated on Drawings or not, a green insulated ground conductor of size as required by Code in all feeders, and in flexible and PVC conduit runs. Increase conduit size to accommodate the ground wires where necessary.

1.4 SUBMITTALS

A. Product Data: Submittal is required

B. Submit for the following:
   1. Flexible metal conduit.
   2. Liquidtight flexible metal conduit.
   3. Nonmetallic conduit.
   4. Flexible nonmetallic conduit.
   5. Raceway fittings.
   6. Conduit bodies.
   7. Surface raceway.
   8. Wireway.
   9. Pull and junction boxes.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents:
   1. Record actual routing of conduits larger than 2 inch (50 mm) trade size.
   2. Record actual locations and mounting heights of outlet, pull, and junction boxes.
PART 2 - PRODUCTS

2.1 METAL CONDUIT

A. Manufacturers:
   1. Allied Tube
   2. Thomas & Betts Corp

B. Rigid Steel Conduit: ANSI C80.1.

C. Fittings and Conduit Bodies: NEMA FB 1 all steel fittings.

2.2 FLEXIBLE METAL CONDUIT

A. Manufacturers:
   1. Allied Tube
   2. Thomas & Betts Corp

B. Product description: Interlocked aluminum construction.

C. Fittings: NEMA FB 1.

2.3 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Manufacturers:
   1. Carlon Electric Products
   2. Thomas & Betts Corp

B. Product description: Interlocked steel construction with PVC jacket.

C. Fittings: NEMA FB 1.

2.4 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. Allied Tube
   2. Thomas & Betts Corp

B. Product description: ANSI C80.3; galvanized tubing.

C. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron, compression type.
2.5 NONMETALLIC CONDUIT

A. Manufacturers:
   1. Carlon Electric Products
   2. Thomas & Betts Corp

B. Product Description: NEMA TC 2; Schedule 40 PVC.

C. Fittings and Conduit Bodies: NEMA TC 3.

2.6 SURFACE METAL RACEWAY

A. Manufacturers:
   1. Walker Systems Inc.
   2. Hubbell Wiring Devices.

B. Product Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway. Finish: Buff enamel.

C. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories; match finish on raceway.

2.7 WIREWAY

A. Manufacturers:
   1. Thomas & Betts Corp.
   2. Walker Systems Inc.
   3. The Wiremold Co.

B. Product Description: General purpose type wireway, oiltight, dusttight and rain tight type wireway.

C. Knockouts: Manufacturer's standard.

D. Size: depth, width and length as indicated on Drawings.

E. Cover: Hinged cover with full gaskets.

F. Connector: Slip-in or flanged.

G. Fittings: Lay-in type with removable top, bottom, and side; captive screws.

H. Finish: Rust inhibiting primer coating with gray enamel finish.
2.8 OUTLET BOXES

A. Manufacturers:
   1. Hubbell Wiring Devices.
   2. Thomas & Betts Corp.

B. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
   1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch (13 mm) male fixture studs where required.
   2. Concrete Ceiling Boxes: Concrete type.

C. Nonmetallic Outlet Boxes: Not permitted.

D. Cast Boxes: NEMA FB 1, Type FD, cast ferolloy. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.

E. Wall Plates for Unfinished Areas: Furnish gasketed cover.

2.9 PULL AND JUNCTION BOXES

A. Manufacturers:
   1. Hubbell Wiring Devices.
   2. Thomas & Betts Corp.

B. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

C. Surface Mounted Cast Metal Box: NEMA 250, Type 4 or to match conditions of use; flat-flanged, surface mounted junction box:
   1. Material: Galvanized cast iron.
   2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

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

E. Fiberglass Concrete composite Handholes: Die-molded, glass-fiber concrete composite hand holes:
   1. Cable Entrance: Pre-cut 6 inch x 6 inch (150 mm x 150 mm) cable entrance at center bottom of each side.
   2. Cover: Glass-fiber concrete composite, weatherproof cover with nonskid finish.
PART 3 - EXECUTION
Not Used

END OF SECTION 260533
SECTION 260545 - UNDERGROUND DUCTS AND RACEWAY FOR ELECTRICAL AND COMMUNICATION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Provide all labor, material, equipment, necessary testing, and complete the power and service distribution system as shown on the Drawings and as specified herein.

B. Related Work Described Elsewhere:
   1. For detailed description of the electrical work also see other Sections in Division 26.

1.2 SUBMITTALS

A. Product Data is required.

PART 2 - PRODUCTS

2.1 CONCRETE PULL BOXES/MANHOLE

A. General:
   1. Provide pre-cast concrete pull boxes where pull boxes are indicated complete with cover, drain hole, removable steel ladder, four pull irons, ground bus and ground rods. Pull box/manhole size shall be as indicated.

   2. Pre-cast concrete manholes shall conform to the requirements of ASTM C478 – Standard Specification for Pre-cast Reinforced Concrete Manhole

   3. Pull box/manhole shall meet all legal requirements as to size for conduits terminating therein.

   4. Reinforced concrete shall be Class A, 20,684 kPa (3,000 psi) type. Minimum design loading shall be 300 lb. Per sq. ft.

B. Covers:
   1. Covers shall be concrete with a cast-iron lid and frame. Minimum clear opening through the frame shall be 36 inches in diameter.

   2. Cast-iron lid shall have lid lettering designation; "ELECTRIC", "HIGH-VOLTAGE", for Power Manhole/Pull box and "SIGNALS" for Communication pull boxes. Submit to the Architect for review.
3. Provide traffic-type construction with traffic covers in areas involving vehicular traffic suitable for AASHTO HS-20 wheel loads.

C. Accessories:


2. Provide heavy duty cable racks and arms by Hubbell Power Systems/Chance Group for each manhole.

D. Acceptable Manufacturers: Pre-cast concrete pull boxes shall be Quikset EPB-2100 Series or equal by Brooks Jensen Pre-cast.

2.2 UNDERGROUND CONDUIT SYSTEM

A. Underground Conduit System: Provide as shown on the Drawings and as specified.

B. Excavation: Provide excavation for underground conduit system and manholes as shown on the Drawings and as specified hereinbefore.

C. Conduit for the underground conduit system shall be as shown on the Drawings, and as specified in Section 26 05 00 and in Part Three of this Section.

D. The conduit length for each size shall be the length that is standard with the manufacturer with a permissible tolerance of 1/4" (0.6 cm) in a 10'-0" (3.1 m) length.

E. Conduit fittings shall be UL approved and shall conform to applicable standards, except that where NEMA Standards for conduit fittings do not exist, fittings shall be as recommended by the conduit manufacturer.

F. Conduit fittings shall be of a type especially made for use with the conduit for electrical service. Plastic conduit and fittings shall be capable of being joined, by means of a solvent welding cement, so as to provide a watertight root-proof joint.

PART 3 – EXECUTION

Not Used

END OF SECTION 260545
SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
   A. Provide nameplates and warning signs on all electrical equipment and devices.
   B. Section Includes:
      1. Nameplates.
      2. Wire markers.
      3. Conduit markers.
      4. Stencils.
      5. Underground Warning Tape

1.2 SUBMITTALS
   A. Product Data:
      1. Submit manufacturer’s catalog literature for each product required.
      2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.
   B. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.3 CLOSEOUT SUBMITTALS
   A. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

1.4 DELIVERY, STORAGE, AND HANDLING
   A. Accept identification products on site in original containers. Inspect for damage.
   B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
   C. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.5 ENVIRONMENTAL REQUIREMENTS
   A. Install labels nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.
PART 2 - PRODUCTS

2.1 NAMEPLATES
   A. Manufacturers:
      2. Legend Engraving & Electrical Calcs.
   
   B. Product Description:
      1. Laminated three-layer plastic with engraved black letters over white
         contrasting background color.
      2. Laminated three-layer plastic with engraved white letters over red
         contrasting background color for emergency systems.
      3. Laminated three-layer plastic with engraved red letters over white
         contrasting background color for warning signs. Warning signs that are
         furnished as a standard catalog item are exceptions.
   
   A. Letter Size:
      1. 1/4 inch high letters for identifying system voltage, phase, wire, bus ampere and
         other equipment ratings.
      2. 1/2 inch high letters for identifying equipment designation and loads.
   
   B. Minimum nameplate thickness: 1/8 inch and it shall be secured to equipment front using
      metal sheet screws or rivets, adhesives or glue attachment method is not acceptable.
   
   C. Inscription and size of letters shall be as shown and shop drawing submitted for
      approval. Nameplates for panelboards and switchboards shall include the panel
      designation, bus rating in Amperes, system nominal voltage, phase and wire. For
      example, "PANEL A - 225 AMP, 120/208V, 3PH, 4W". In addition, provide phenolic
      label in panel to describe where the panel is fed from. For example, "FED FROM MS".
   
   D. The following Items shall be equipped with nameplates: All motors, motor starters,
      motor-control centers. Push button stations, control panels, switches, disconnect
      switches, transformers, panelboards, circuit breakers (i.e. all 2 pole, 3 pole C.B.'s).
      contactors or relays in separate enclosures, power receptacles where the nominal
      voltage between any pair of contacts is greater than 150V, wall switches controlling
      outlets that are not located within sight of the controlling switch, high voltage boxes and
      cabinets, large electrical systems junction and pull boxes (larger than 4-11/16"), terminal
      cabinets, terminal boards, and equipment racks. Nameplates shall also describe the
      associated panel and circuit number (if applicable).
   
   E. Stamped manufacturer metal master nameplates shall be installed on each distribution
      section, switchboard section, panelboard, and motor control center indicating the board
      designation, voltage, ampere rating, short-circuit rating, manufacturer's name, general
      order number, and item number.
F. Provide Arc Flash Name plate with PPE category information on each serviceable electrical equipment, which required maintenance and or calibration, including but not limited to Switchboards, Transformers, Disconnect Switches and Panels. PPE level shall be in accordance with the Arc Flash Hazard Analysis report done on the Short – circuit and Over-current device Coordination study.

### 2.2 WIRE MARKERS

**A. Manufacturers:**
1. Grafoplast.
2. Brady Corporation.
3. Wire Marker Plus.

**B. Product Description:** Split sleeve type wire markers.

**C. Legend:**
1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.
2. Control Circuits: Control wire number as indicated on schematic and interconnection diagrams.

### 2.3 CONDUIT MARKERS

**A.** All conduits, busways, cable trays and pullboxes shall be identified with permanent stenciled black letters and numbers which indicate the source panel (feeder supply source), circuit numbers and designated panel or load. For example, “AILA -1, 3, 5 TO MG.” For conduits, the letter height shall be one-third (1/3) the conduit size with ¼ inch minimum height. For pullboxes and busways, the letter height shall be ½ inch minimum height and not larger than ¾ inch in height. Description: Nameplate shall be fastened with rivets.

**B.** The identifications for conduits, busways and cable trays shall be placed at every 20 feet intervals and within 10 feet of wall and floor penetrations, pullboxes, panels, distribution boards, switchboards and electrical equipment.

**C.** Spare conduits, pullboxes, busways, and abandoned raceways (that are to remain) shall be identified as described above (A,B).

**D.** The permanent marking identifications on the raceways and pullboxes shall be visible after the installations are made.

**E.** Color:
1. Medium Voltage System: Red lettering on white background.
2. 480 Volt System: Black lettering on blue background.
3. 208 Volt System: Black lettering on yellow background.
4. System: black lettering on background.

**F.** Legend:
1. Medium Voltage System: DANGER - HIGH VOLTAGE.
2. 480 Volt System: 480 VOLTS - HIGH VOLTAGE.
3. 208 Volt System: 208 VOLTS.
5. Telephone System: TELEPHONE.

2.4 STENCILS

A. Furnish materials in accordance with Facility's standards.

B. Stencils: With clean cut symbols and letters of following size:
   1. Up to 2 inches Outside Diameter of Raceway: 1/2 inch high letters.
   2. 2-1/2 to 6 inches Outside Diameter of Raceway: 1 inch high letters.

C. Stencil Paint: As specified in Section 09 90 00, semi-gloss enamel, colors conforming to the following:
   1. Red lettering on white background.
   2. Black lettering on blue background.
   3. Black lettering on white background.

2.5 UNDERGROUND WARNING TAPE

A. Manufacturers:
   1. Reff Industries, Inc.
   2. Kolbi, Pipe Marker Co.
   3. Stanco, Inc.

B. Description: 4 inch (100 mm) wide plastic tape, detectable type, colored red yellow with black letters for suitable warning legend describing buried electrical lines.

PART 3 – EXECUTION
Not Used

END OF SECTION 260553
SECTION 260573 - OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY AND ARC FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes short circuit and protective device coordination study encompassing portions of electrical distribution system from normal power source or other sources up to and including breakers in service entrance switchboard, fuses in service entrance switchboard, main breaker in sub-distribution panels, fuses in sub-distribution panels and main breaker in each panelboard.

1. The contractor shall furnish short circuit and protective device study prepared by electrical equipment manufacturer or an approved engineering firm for the protective devices to be installed under this project to assure proper equipment and personnel protection.

2. The study shall present an organized time-current analysis of each protective device in series from individual device back to the normal power source (Utility) and the on-site generator sources.

3. The study shall include an Arc Flash Hazard Analysis Study per the requirements set forth in NFPA 70E – Standard for Electrical Safety in the Workplace. The Arc Flash Hazard Analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D.

1.2 DESIGN REQUIREMENTS

A. Complete Short Circuit and Protective Device Coordination Study to meet requirements of NFPA 70.

B. Complete an Arc Flash Hazard Analysis Study per the requirements set forth in NFPA 70E – Standard for Electrical Safety in the Workplace. The Arc Flash Hazard Analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D.

C. Report Preparation:
   1. Prepare study prior to ordering distribution equipment to verify equipment ratings required.
   2. Perform study with aid of computer software program.
   3. Obtain actual settings for packaged chiller and motor characteristics and for equipment incorporated into Work.
   4. Calculate short circuit interrupting and, when applicable, momentary duties for assumed 3-phase bolted fault short circuit current and phase to ground fault short circuit current at each of the following:
      a. Medium voltage fuse/circuit breaker switchgear.
      b. Medium Voltage Transformer.
c. Low-voltage switchgear.
d. Switchboards.
e. Motor control centers.
f. Distribution panelboards.
g. Branch circuit panelboards.
h. Each other significant equipment location throughout system.

D. Report Contents:
   1. Include the following:
      a. Executive Summary.
      b. Descriptions, purpose, basis and scope of study.
      c. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties.
      d. Protective device time versus current coordination curves, tabulation of relay and circuit breaker trip unit settings and fuse selection.
      e. Fault current calculations including definition of terms and guide for interpretation of the computer printout.
      f. Details of incident energy and flash protection boundary calculations.
      g. One-line diagram revised by adding actual instantaneous short circuits available.
      h. State conclusions and recommendations for system improvements, where needed.

1.3 SUBMITTALS

A. Qualifications Data: Submit the following for review prior to starting study.
   1. Submit qualifications and background of firm.
   2. Submit qualifications of individual Registered Professional Electrical Engineer performing study.
   3. The Registered Professional Electrical Engineer shall be a full time employee of the equipment manufacturer or an approved engineering firm by the equipment manufacturer.
   4. The equipment manufacturer or approved engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual Arc Flash Hazard Analysis it has performed in the past year.

B. Complete Report: Submit the following:
   1. Summarize results of study in report format including the following:
      a. Descriptions, purpose, basis, and scope of study.
      b. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short-circuit duties, and commentary regarding same.
      c. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
      d. Fault current calculations including definition of terms and guide for interpretation of computer printout.
      e. Arc Flash Hazard Analysis Study per-NFPA 70E- Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D.
   2. Arc Flash labels shall be provided in Hard copy only.
C. Submit copies of final report signed by professional engineer. Make additions or changes required by review comments.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with IEEE 242 and IEEE 1584.

B. Studies shall be performed using the latest revision of the SKM System Analysis Power Tools for Windows (PTW) software program. Submit for review information on alternative equal software proposed to be used in performing study.

C. Maintain one copy of each document on site.

1.5 QUALIFICATIONS

A. Study Preparer: Electrical equipment manufacturer or an approved engineering firm specializing in performing work of this section with minimum five years documented experience and having completed projects of similar size and complexity within the past years.

B. Perform study under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location in State of with minimum of five years experience in power system analysis.

C. The Registered Professional Electrical Engineer shall be a full time employee of the equipment manufacturer or an approved engineering firm by the equipment manufacturer.

D. The equipment manufacturer or approved engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual Arc Flash Hazard Analysis it has performed in the past year.

E. Demonstrate company performing study has capability and experience to provide assistance during system start up.

1.6 SEQUENCING

A. The Contractor shall expedite collection of data to assure completion of the studies on schedule.

B. Allow for review of completed studies by Architect/Engineer.

C. Submit short circuit and protective device coordination study to Architect/Engineer prior to receiving final approval of distribution equipment shop drawings and prior to releasing equipment for manufacturing.
1.7 SCHEDULING

A. Schedule work to expedite collection of data to ensure completion of study for final approval of distribution equipment shop drawings prior to release of equipment for manufacturing.

1.8 COORDINATION

A. Coordinate work with local power company.

PART 2 - PRODUCTS

2.1 STUDIES

A. Contractor to furnish short-circuit and protective device coordination studies as prepared by equipment manufacturer or an approved engineering firm.

B. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D.

2.2 DATA COLLECTION

A. Contractor shall furnish all data as required by the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

B. Source combination may include present and future motors and generators.

C. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner, or Contractor.

D. If applicable, include fault contribution of existing motors in the study. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

2.3 SHORT CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY


B. Transformer design impedances shall be used when test impedances are not available.
C. Provide the following:
1. Calculation methods and assumptions
2. Selected base per unit quantities
3. One-line diagram of the system being evaluated
4. Source impedance data, including electric utility system and motor fault contribution characteristics
5. Tabulations of calculated quantities
6. Results, conclusions, and recommendations.

D. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:
1. Electric utility’s supply termination point
2. Incoming switchgear
3. Unit substation primary and secondary terminals
4. Low voltage switchgear
5. Motor control centers
6. Standby generators and automatic transfer switches
7. Branch circuit panelboards
8. Other significant locations throughout the system.

E. For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.

F. Protective Device Evaluation:
1. Evaluate equipment and protective devices and compare to short circuit Ratings.
2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short-circuit stresses.
3. Notify Owner in writing, of existing, circuit protective devices improperly rated for the calculated available fault current.

2.4 PROTECTIVE DEVICE COORDINATION STUDY.
A. Proposed protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.

B. Include on each TCC graph, a complete title and one-line diagram with legend identifying the specific portion of the system covered.

C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.

D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

E. Plot the following characteristics on the TCC graphs, where applicable:
1. Electric utility’s overcurrent protective device
2. Medium voltage equipment overcurrent relays
3. Medium and low voltage fuses including manufacturer’s minimum melt,
4. Low voltage equipment circuit breaker trip devices, including manufacturer’s tolerance bands
5. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves
6. Conductor damage curves
7. Ground fault protective devices, as applicable
8. Pertinent motor starting characteristics and motor damage points, where applicable
9. Pertinent generator short-circuit decrement curve and generator damage point
10. The largest feeder circuit breaker in each motor control center and applicable panelboard.

F. Provide adequate time margins between device characteristics such that selective operation is provided (as required per-Code), while providing proper protection.

G. Each level protective devices of the Emergency Systems, Legally required Standby Systems and Critical Operations Power Systems shall be selectively coordinated with all supply side of overcurrent protective devices. This coordination must be carried through each level of distribution that supplies power to emergency systems.

2.5 ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 Equations that are presented in NFPA70E-2004, Annex D.

B. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.

C. The Arc-Flash Hazard Analysis shall include all significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 125 kVA where work could be performed on energized parts.

D. Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm².

E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.

F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations...
must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.

G. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:
   1. Fault contribution from induction motors should not be considered beyond 3-5 cycles.
   2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).

H. For each equipment location with a separately enclosed main device (where there is inadequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.

I. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.

J. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

K. Arc Flash calculations shall be based on actual overcurrent protective device Clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

PART 3 - EXECUTION

Not Used
SECTION 261200 - MEDIUM-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes the following types of transformers with medium-voltage primaries:
   1. Dry-type distribution and power transformers.
   2. Pad-mounted, liquid-filled transformers.

1.2 DEFINITIONS

1.3 SUBMITTALS
A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, location of each field connection, and performance for each type and size of transformer indicated.
B. Shop Drawings: Product data submittal is required.
C. Coordination Drawings: Floor plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Underground primary and secondary conduit stub-up location.
   2. Dimensioned concrete base, outline of transformer, and required clearances.
   3. Ground rod and grounding cable locations.
   4. Operation and Maintenance Data: For transformer and accessories to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE
A. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
   1. Testing Agency's Field Supervisor: Person currently certified by the Inter-National Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing.
B. Product Options: Drawings indicate size, profiles, and dimensional requirements of transformers and are based on the specific system indicated.

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

D. Comply with IEEE C2.


F. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store transformers so condensation will not form on or in units. Provide temporary heating according to manufacturer's written instructions.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in other Division.

B. Coordinate installation of louvers, doors, spill retention areas, and sumps. Coordinate installation so no piping or conduits are installed in space allocated for medium-voltage transformers except those directly associated with transformers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by Square D; Schneider Electric.

2.2 DRY-TYPE DISTRIBUTION AND POWER TRANSFORMERS

A. Description: NEMA ST 20, IEEE C57.12.01, UL 1562 listed and labeled, dry-type, 2-winding transformers.

1. Indoor/Outdoor, ventilated cast coil/encapsulated coil, with primary and secondary windings individually cast in epoxy; with insulation system rated at 185 deg C with an 80
deg C average winding temperature rise above a maximum ambient temperature of 40 deg C.

2. Indoor/Outdoor, ventilated vacuum-pressure impregnated and with insulation system rated at 220 deg C with an 80 deg C average winding temperature rise above a maximum ambient temperature of 40 deg C.

B. Primary Connection: Air terminal compartment with removable door. Tin-plated copper bar for incoming line termination, predrilled to accept terminals for indicated conductors.

C. Primary Connection: Transition terminal compartment with connection pattern to match switchgear.

D. Secondary Connection: Air terminal compartment with removable door. Tin-plated copper bar for incoming line termination, predrilled to accept terminals for indicated conductors.

E. Secondary Connection: Transition terminal compartment with connection pattern to match switchgear.

F. Insulation Materials: IEEE C57.12.01, rated at 220 deg C.

G. Insulation Temperature Rise: 115 deg C, maximum rise above 40 deg C.

H. Basic Impulse Level: 60 kV.

I. Full-Capacity Voltage Taps: Four nominal 2.5 percent taps, 2 above and 2 below rated primary voltage.

J. Full-Capacity Voltage Taps: Four nominal 2.5 percent taps below rated primary voltage.

K. Cooling System: Class AA, self-cooled, complying with IEEE C57.12.01.

1. Automatic forced-air cooling system controls, including thermal sensors, fans, control wiring, temperature controller with test switch, power panel with current-limiting fuses, indicating lights, alarm, and alarm silencing relay.

2. Include mounting provision for fans.

L. Sound level may not exceed sound levels listed in NEMA TR 1, without fans operating.

M. Impedance: 5 percent.

N. High-Temperature Alarm: Sensor at transformer with local audible and visual alarm and contacts for remote alarm.

2.3 PAD-MOUNTED, LIQUID-FILLED TRANSFORMERS

B. Insulating Liquid: Mineral oil, complying with ASTM D 3487, Type II, and tested according to ASTM D 117.

C. Insulating Liquid: Less flammable, edible-seed-oil based, and UL listed as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested according to ASTM D 92. Liquid shall be biodegradable and nontoxic.

D. Insulating Liquid: Less flammable, dielectric, and UL listed as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested according to ASTM D 92. Liquid shall be biodegradable and nontoxic.

E. Insulating Liquid: Less flammable, silicone-based dielectric, and UL listed as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested according to ASTM D 92. Liquid shall have low toxicity and be nonhazardous.

F. Insulation Temperature Rise: 65 deg C when operated at rated kVA output in a 40 deg C ambient temperature. Transformer shall be rated to operate at rated kilovolt ampere in an average ambient temperature of 30 deg C over 24 hours with a maximum ambient temperature of 40 deg C without loss of service life expectancy.

G. Basic Impulse Level: 60 kV.

H. Full-Capacity Voltage Taps: Four 2.5 percent taps, 2 above and 2 below rated high voltage; with externally operable tap changer for de-energized use and with position indicator and padlock hasp.

I. High-Voltage Switch: 200A, make-and-latch rating of 10-kA RMS, symmetrical, arranged for radial feed with 3-phase, 2-position, gang-operated, load-break switch that is oil immersed in transformer tank with hook-stick operating handle in primary compartment.

J. Primary Fuses: 35-kV fuse assembly with fuses complying with IEEE C37.47.
   2. Internal liquid-immersed cartridge fuses.
   3. Bay-O-Net liquid-immersed fuses that are externally replaceable without opening transformer tank.
   5. Bay-O-Net liquid-immersed current-limiting fuses that are externally replaceable without opening transformer tank.

K. Surge Arresters: Distribution class, one for each primary phase; complying with IEEE C62.11 and NEMA LA 1; support from tank wall within high-voltage compartment. Transformers shall have three arresters for radial-feed circuits.

L. High-Voltage Terminations and Equipment: Live front with externally clamped porcelain bushings and cable connectors suitable for terminating primary cable.
M. High-Voltage Terminations and Equipment: Dead front with universal-type bushing wells for
dead-front bushing-well inserts, complying with IEEE 386 and including the following:

1. Bushing-Well Inserts: One for each high-voltage bushing well.
2. Surge Arresters: Dead-front, elbow-type, metal-oxide-varistor units.
3. Parking Stands: One for each high-voltage bushing well.
4. Portable Insulated Bushings: Arranged for parking insulated, high-voltage, load-break
cable terminators; one for each primary feeder conductor terminating at transformer.

N. Accessories:

1. Drain Valve: 1 inch (25 mm), with sampling device.
2. Dial-type thermometer.
3. Liquid-level gage.
4. Pressure-vacuum gage.
5. Pressure Relief Device: Self-sealing with an indicator.
8. Busway terminal connection at low-voltage compartment.
9. Alarm contacts for gages and thermometer listed above.

2.4 IDENTIFICATION DEVICES

A. Nameplates: Engraved, metal nameplate for each transformer, mounted with corrosion-resistant
screws.

2.5 SOURCE QUALITY CONTROL

A. Factory Tests: Perform design and routine tests according to standards specified for
components.

B. Factory Tests: Perform the following factory-certified tests on each transformer:

1. Resistance measurements of all windings on rated-voltage connection and on tap extreme
connections.
2. Ratios on rated-voltage connection and on tap extreme connections.
4. No-load loss at rated voltage on rated-voltage connection.
5. Excitation current at rated voltage on rated-voltage connection.
6. Impedance and load loss at rated current on rated-voltage connection and on tap extreme
connections.
8. Induced potential.
9. Temperature Test: If transformer is supplied with auxiliary cooling equipment to provide
more than one rating, test at lowest kilovolt-ampere Class OA or Class AA rating and
highest kilovolt-ampere Class OA/FA or Class AA/FA rating.
a. Temperature test is not required if record of temperature test on an essentially duplicate unit is available.

10. Owner will witness all required factory tests. Notify Architect at least 14 days before date of tests and indicate their approximate duration.

PART 3 - EXECUTION
Not Used

END OF SECTION 261200
SECTION 262400 - BUILDING SERVICE & DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included: Provide all labor, material, equipment, necessary testing, and complete the building service and distribution system as shown on the Drawings and as specified herein.

1.2 SUBMITTALS
A. Product Data is required

PART 2 - PRODUCTS

2.1 CONCRETE PULL BOXES
A. General:
   1. Provide precast concrete pull boxes where pull boxes are indicated complete with cover, drain hole and two pull irons. Unless otherwise indicated, inside dimensions for pull boxes shall be 2'-6" (0.762 m) wide by 4' (1.22 m) long by 4' (1.22 m) deep.
   2. Pull boxes shall meet all legal requirements as to size for conduits terminating therein.
   3. Reinforced concrete shall be Class A, 20,684 kPa (3,000 psi) type.

B. Covers:
   1. Covers shall be concrete with a cast-iron lid and frame.
   2. Cast-iron lid shall have bead weld designation; "ELECTRICAL", "HIGH-VOLTAGE", "COMMUNICATIONS" etc., as required. Submit to the Architect for review.
   3. Provide traffic-type construction with traffic covers in areas involving vehicular traffic.

C. Acceptable Manufacturers: Pre-cast concrete pull boxes shall be Quikset EPB-2100 Series or equal by Brooks Products.

2.2 UNDERGROUND CONDUIT SYSTEM
A. Underground Conduit System: Provide as shown on the Drawings and as specified.

B. Excavation: Provide excavation for underground conduit system and manholes as shown on the Drawings and as specified hereinbefore.

C. Conduit for the underground conduit system shall be as shown on the Drawings, and as specified in Section 26 05 00 and in Part Three of this Section.
D. The conduit length for each size shall be the length that is standard with the manufacturer with a permissible tolerance of 1/4" (0.6 cm) in a 10'-0" (3.1 m) length.

E. Conduit fittings shall be UL approved and shall conform to applicable standards, except that where NEMA Standards for conduit fittings do not exist, fittings shall be as recommended by the conduit manufacturer.

F. Conduit fittings shall be of a type especially made for use with the conduit for electrical service. Plastic conduit and fittings shall be capable of being joined, by means of a solvent welding cement, so as to provide a watertight root-proof joint.

2.3 INTEGRATED POWER CENTER

A. General

1. Integrated power center (IPC) combine power distribution and controls into one integrated package.

2. The IPC structure is 84 inches high x10-9/32 inches deep load conductors exit the top or bottom of the IPC.

3. The IPC consist of 480Y/277V. main circuit breaker, three-phase 480 Delta – 208Y/120V. transformer assembly, 208Y/120V. panelboard.

4. The integrated power center equipment rating are indicated in the single line diagram.

B. Standard


2. The integrated power center and the devices within shall be manufactured and tested to meet the following federal specifications: W-C 375B/Gen, W-C 865C, WP 115B Type 1, Class 1.

C. Enclosure

1. The IPC enclosure shall be NEMA3R floor standing in 4” concrete pad grounded in accordance with NEC for system and equipment ground.

2. Enclosure shall be steel construction in accordance to applicable U.L. standards.

D. Main circuit breakers

1. Main circuit breakers rating and short circuit duty are as indicated.

2. Refer to standard for compliance.
E. Transformer

1. Three phase, 480 Delta – 208Y/120V. KVA as indicated.
3. Provision for close coupling to integrated power center line-up.
4. Copper winding.
5. Energy efficient (EE) lighting transformers.
7. UL listed under file E8681.

F. Power Panelboard

1. 208Y/120V. 3-phase 4-wire, with main circuit breaker.
2. Refer to single line diagram for trip and frame size.
3. Refer to standard for compliance.

G. Integrated System

1. Power panelboards shall be installed in common-depth and front-accessible switchboard enclosures.
2. Factory installed power cables shall electrically connect main breaker, transformer and panelboard in the line-up.

H. Fronts

1. Trim front shall meet strength and rigidity requirements or applicable U.L. standards.
2. Each section shall have a hinged door with a three-point latch with locking provisions.
3. A clear plastic directory card holder shall be mounted on the inside of the door.
4. Locks shall be cylindrical tumbler type. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock.

I. Manufacturer: Integrated power center shall be Square D.
J. Substitution: Not Permitted.

2.4 TRANSFORMERS (600-VOLT CLASS AND BELOW)
A. General: Provide transformers for use on 60-Hertz system with the following characteristics:

1. Type: Dry, ventilated, self-cooled type with provisions for future cooling fans where indicated.

2. Ratings: Phase, voltage and connection arrangement as indicated.

3. Capacities: The kVA capacities as indicated with capability of carrying a continuous 10-percent overload at rated voltage without exceeding NEMA average and hot spot temperature ratings of the insulation at 104-degree F (40-degree C) ambient air temperature.

4. Windings: Constructed of copper and shall be of the fire-resistant type, designed for natural convection cooling through normal air circulation.

5. Insulation: Suitable for 150-degree C average conductor temperature rise.

6. Dimensions: Within the limitations indicated or the space available for installing the transformers.

7. Taps: Four 2-1/2 percent primary taps, 2 above and 2 below rated voltage.

8. Terminals: Locate terminals at the bottom of the transformer or other area where the temperature, when operating at 10-percent overload and in an ambient of 104-degree F (40-degree C) will not exceed 140-degree F (60-degree C).

9. Mounting: Floor, wall or ceiling mounted, as indicated. Transformers shall be furnished complete with mounting channels and mounting bolts. Enclosures shall be provided with lifting lugs and jacking plates as required.

10. Vibration Dampening: Constructed with built in vibration dampeners which completely isolate the cores and coils from all supports and enclosures.

11. Sound Ratings: In the installed condition, the sound levels shall not exceed:
   - 45 dB for 0 to 45 kVA.
   - 50 dB for 46 to 150 kVA.
   - 55 dB for 151 to 300 kVA.
   - 60 dB for 301 to 500 kVA.

12. Enclosure: Cover plates shall be Code-gauge sheet steel, captive type, bolted to the enclosure framework. Enclosure shall have suitable ventilating openings with rodent-proof screens. Provide weatherproof type when located outdoors.

13. Finish: Metal parts excepting cores or core mounting frames shall be cleaned, rust-proofed, and be given a heavy coating of an inert primer. Cover plates and external metal parts shall be finished with two full-bodied coatings of oil-resistant industrial gray enamel.
14. **Nameplates:** Provide nameplates, identifying the characteristics, as specified in Section 26 05 00.

B. **Manufacturer:** Transformers shall be manufactured by Square D

C. **Substitution:** Not Permitted.

### 2.5 PANELBOARDS

A. **General:**

1. Provide flush or surface mounted panelboards with main breakers or lugs, sub-fed lugs, bus size and circuit breakers of a rating as shown on the Drawings.

2. Top of panelboard shall not be higher than 78" (198 cm) above finished floor.

3. Space for controls such as time clocks, time controlled relays and air-conditioning controls shall be located in a separate compartment with hinged doors within respective panelboards. Where limited by the height of the panels, locate controls in a separate cabinet adjacent to the respective panelboard.

B. **Bus bars shall be rectangular in cross-section constructed of copper with silver-plated joints and interconnections. Unless otherwise indicated, neutral buses shall be full size. Bus bars shall be isolated from wiring troughs and working spaces and be braced to withstand a minimum short circuit fault of 25,000 amperes rms symmetrical or larger as indicated. Provide split bus where indicated on the Drawings.**

C. **Circuit Breakers:**

1. Circuit breakers shall have interrupting capacities as indicated on the Drawings. Minimum interrupting capacities for 120/208 and 277/480-volt circuit breakers shall be 10,000 amperes and 14,000 amperes rms symmetrical respectively. Provide breakers of the bolt-on molded case type. Plug-in types are not acceptable.

2. Single-pole breakers shall be full module size; two poles shall not be installed in a single module. Multi-pole circuit breakers shall be of the common-trip type having a single operating handle and for sizes of 50 amperes or less, may consist of single-pole circuit breakers permanently assembled at the factory into a multi-pole unit.

3. Circuit breakers used for motor-circuit disconnects and not in sight of the motor controller shall be capable of being locked in the open position.

4. All circuit breakers shall have provisions for lock out clips which shall be provided for breakers serving motors, signal systems and air-conditioning controls, and as indicated on the schedules on the Drawings.

5. Provide approved "Lock-Off" devices for all circuit breakers serving lighting circuits without local switching.
6. Circuit breakers shall be arranged in the panels to correspond exactly with the schedules on the Drawings. Circuit numbers shall be black-on-white plastic tabs or other such permanent type which cannot be changed readily from the front of the panel.

7. Breakers serving loads comprised of large wattage incandescent lamps shall be equipped with desensitized magnetic trip mechanisms which prevent tripping by in-rush currents.

8. Provide approved handle ties for individual circuit breakers protecting each ungrounded branch circuit conductor of multi-wire branch circuits.

9. Provide ground fault circuit-interrupter for all Code required lighting or receptacle circuits rated at 15, 20, 25 or 30 amperes at 120 volts or above. The bolt-on molded-case type circuit breaker, similar to General Electric Type THQB-GF, shall be of the quick-make, quick-break operating mechanism with construction as described above and with the following additional features:

   a. Amperes line-to-line, ground fault conditions: 0.005.
   b. Amperes, symmetrical rms at 120 volts: 10,000.
   c. Push-to-test circuit.
   d. Trip-free handle to allow breaker to trip even if handle is held or blocked in the "ON" position.
   e. If the above requirements cannot be met, the following shall be provided:
      1) Provide ground fault circuit-interrupter for all Code required circuits. Ground-fault protection shall consist of a ground-sensor encircling all phase conductors, connected to a solid-state ground relay which initiates tripping of the circuit breaker.
      2) Ground protection shall be adjustable from 5 to 50 amperes. Circuit-interrupter shunt-trip and relay shall operate from a 120-volt control source. Time-current characteristic shall provide 0.1-second operation at about 10 times pickup. Relay shall be surface mounted in a separate barriered space.

D. Control Devices: Contactors, relays, time switches and related equipment shall be as specified in Section 26 05 00 and shall be mounted in a separate barriered space. Refer to the paragraph, "Cabinets", herein.

E. Cabinets:
1. Back boxes shall be flush or surface mounted as shown on the Drawings. Construction shall be of Code gauge zinc-coated sheet steel bearing the UL label where required. Back boxes shall be galvanized when recess mounted. Refer to "Painting" section for finish requirement of galvanized surfaces.

2. Panelboards shall be minimum 20" (51 cm) wide and shall be of types as required by the schedules and these Specifications. Where specifically indicated on the Drawings, provide UL listed column-type panelboards. All other requirements of the column-type panelboard shall comply with those specified in this section.

3. Panelboard doors shall be hinged and have pin tumbler cylinder locks operated by paracentric type keys. All panelboard locks shall be common keyed. Furnish two keys for each panelboard.

4. Where more than one door is mounted on a panelboard, arrange the trim so that a minimum 2" (5.1 cm) solid metal trim space is maintained between doors. Doors and trims shall be minimum 12 gauge steel.

5. Provide 12" (30.5 cm) high gutter where double lugs are required or where cable size exceeds bus size.

6. Wiring gutters on panelboards having through feeders shall be 5" (12.7 cm) minimum. Gutters shall be an integral part of the panelboard.

7. Provide barriered space for mounting contactors and control devices with a hinged door and lock, where shown or required.

F. Finish: Doors, trims and surface mounted back boxes located in areas exposed to public view shall be painted with one coat zinc chromate and one coat of primer sealer. Finish painting shall be in accordance with section, "Painting". Provide doors, trims and surface mounted back boxes located in custodian's rooms, mechanical rooms, electrical rooms and other areas not exposed to public view with one coat zinc chromate and a light gray baked enamel finish.

G. Identification:

1. Provide neatly typed circuit index cards, clearly and correctly identifying all circuits, mounted in card holders, behind glass or heavy plastic on the inside of the panelboard doors. Indexes shall accurately record all room numbers.

2. Provide nameplates as specified under paragraph, "Nameplates", in Section 26 05 00. Designate the identifying nomenclature, voltage and phase of the panel as shown on the Drawings; for example, "PANEL T3LA, 208/120 VOLT, 3 PHASE, 225 AMPERE BUS".

H. Manufacturer: Panelboard assembly, devices and major components shall be of the same manufacturer, Square D.

I. Substitution: Not Permitted
2.6 DISTRIBUTION SWITCHBOARDS

A. General:

1. Provide distribution switchboards with ratings, components and features as indicated on the Drawings.

2. Switchboards shall consist of molded case thermal magnetic circuit breakers or externally operable quick-make, quick-break fused switch as indicated on the Drawings, in floor-standing, dead front, totally metal enclosed sections requiring front access only.

3. All sections shall be nominal 90" (22.9 cm) high, 15" (38.1 cm) deep and 38" (0.965 m) or 42" (1.067 m) wide and shall not exceed the physical spaces allowed for on the Drawings. Switchboards shall be constructed of Code gauge sheet steel.

4. In outdoor locations or where indicated, provide weatherproof enclosure having doors with padlocking facilities.

B. Bus bars:

1. Bus bars shall be rectangular in cross-section, constructed of copper with silver-plated joints and full-height in each vertical section with horizontal cross bus bars between sections. Short circuit bracing capabilities shall be in accordance with the minimum requirement as indicated for the circuit breakers.

2. Provide all lugs for sizes No. 6 AWG or larger suitable for copper conductors. Shop drawings must show lug sizes based on the actual conductors to be provided.

3. Neutral bar shall have terminals for all active, spare or inactive circuits.

C. Disconnect Devices:

1. Circuit breakers shall be of the bolted-on molded case type, with thermal magnetic trips and shall be rated at the voltage with frame sizes, number of poles, and trip settings as shown on the Drawings. Multi-pole circuit breakers shall have a common operating handle.

2. Provide circuit breakers with interrupting capacity as indicated on plans, minimum interrupting capacity shall be 14,000 symmetrical rms amperes at 480/277 volts and 10,000 amperes at 208/120 volts.

3. Fusible switches shall be of the quick-made, quick-break, visible blade type and shall be UL listed and horsepower rated. Phase sequence and circuit numbering shall be uniform. Temperature rise and current carrying capacity of busses and parts shall be in accordance with NEMA Standards and NEC requirements. Provide fuses as specified under paragraph, "Fuses", in Section 26 05 00.
4. When indicated, provide circuit breakers and switches with shunt-trips, motor operators or other features as required for the application.

5. All circuit breakers shall be pad-lockable in the "OFF" position. All switches shall be pad-lockable in either the "OPEN" or "CLOSE" position.

D. Identification:

1. Nameplates: Provide nameplates and warning signs as specified, in Section 26 05 53.

2. Provide a nameplate for each circuit breaker or fusible switch with wording to indicate load served.

3. The main nameplate shall give the switchboard designation in 1/2" (1.3 cm) high letters. A second line in 1/4" (0.6 cm) high letters shall indicate the Ampere, Voltage –Phase and Wire. The third line of same dimensions as the second line shall indicate where the equipment fed from.

E. Finish: Supporting framework, cover plates and other metal surface shall first be given a phosphate coating for superior paint adhesion and corrosion resistance. Alkyd amine standard gray enamel shall be electrostatically applied and baked thoroughly in a convection-type oven to ensure a long lasting, mark resistant finish.

F. Manufacturer: Switchboard assembly, switches, circuit breakers, devices and major components shall be of the same manufacturer, Square D.

G. Substitution: Not Permitted.

2.7 DISTRIBUTION PANELBOARDS

A. General: Distribution panelboards in general shall comply with the requirements of the distribution switchboards except that distribution panelboards shall be suitable for wall mounting instead of free floor standing.

PART 3 – EXECUTION

Not Used
SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes wall switches; wall dimmers; receptacles; multioutlet assembly; and device plates and decorative box covers.

1.2 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 WALL SWITCHES

A. Single Pole Switch:
   1. Hubbell, Model HBL1221 (Decorator Style Model HBL2121).
   2. Leviton, Model 1221-2 (Decorator Style Model 5621-2).
   3. Pass & Seymour, Model PS20AC1 (Decorator Style Model 2621)

B. Double Pole Switch:
   1. Hubbell, Model HBL1222 (Decorator Style Model HBL2122).
   2. Leviton, Model 1222-2 (Decorator Style Model 5622-2).
   3. Pass & Seymour, Model PS20AC2 (Decorator Style Model 2622)
   4. Substitutions: Section 01 60 00 - Product Requirements.

C. Three-way Switch:
   1. Hubbell, Model HBL1223 (Decorator Style Model HBL2123).
   2. Leviton, Model 1223-2 (Decorator Style Model 5623-2).
   3. Pass & Seymour, Model PS20AC3 (Decorator Style Model 2623)
   4. Substitutions: Section 01 60 00 - Product Requirements.

D. Product Description: NEMA WD 1, Heavy-Duty, AC only general-use snap switch.

E. Color: White.

F. Ratings:
   1. Voltage: 120-277 Volts, AC.

2.2 WALL DIMMERS

A. Manufacturers:
1. Leviton.
2. Lutron.
3. Pass & Seymour – Legrand

B. Product Description: NEMA WD 1, Type, 0-10V dimmer for dimming ballasts or LEDs.
C. Accessory Wall Switch: Match dimmer appearance.

2.3 RECEPTACLES

A. Manufacturers:
   1. Hubbell
   2. Pass & Seymour - Legrand
   3. Leviton

B. Product Description: NEMA WD 1, Heavy-duty general use receptacle.
C. Device Body: As selected by Owner.
D. Configuration: NEMA WD 6
E. Convenience Receptacle: Type 5-20R.
F. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2.4 WALL PLATES

A. Manufacturers:
   1. Hubbell
   2. Pass Seymour - Legrand
   3. Leviton

B. Cover Plate: 0.035 inch thick satin finished stainless steel.
C. Jumbo Cover Plate: As selected by Owner.
D. Weatherproof Cover Plate: Gasketed cast metal, Stainless steel plate with hinged threaded and gasketed device cover.

2.5 MULTIOUTFLET ASSEMBLY

A. Manufacturers:
   1. Hubbell
   2. Pass Seymour - Legrand
   3. Leviton
B. Multi-outlet Assembly: Sheet metal channel with fitted cover, with pre-wired receptacles, suitable for use as multi-outlet assembly.

C. Receptacles: NEMA WD 6, type 5-20R, single receptacle.

D. Receptacle Color: As selected by Owner.

E. Channel Finish: As selected by Owner.

PART 3 - EXECUTION
Not Used

END OF SECTION 262726
SECTION 283100 – FIRE DETECTION AND ALARM

PART 1 – GENERAL

1.1 SUMMARY

A. This Section covers fire alarm systems, including initiating devices, notification appliances, controls, and supervisory devices.

B. Work covered by this section includes the furnishing of labor, equipment, and materials for installation of the fire alarm system as indicated on the drawings and specifications.

C. The Fire Alarm System shall consist of all necessary hardware equipment and software programming to perform the following functions:

1. Fire alarm system detection, and notification operations.

2. Control and monitoring of door hold-open devices, fire suppression systems, emergency power systems, and other equipment as indicated in the drawings and specifications.

1.2 SYSTEM DESCRIPTION

A. Fire Alarm System: NFPA 72, manual and automatic local fire alarm system with connections to central station.

B. Alarm Sequence of Operation: Actuation of initiating device causes the following system operations:

1. Local fire alarm signaling devices sound and display with march time signal.
2. Non-coded, Zone-coded signal transmits to central station.
3. Location of alarm zone indicates on fire alarm control panel and on remote annunciator panel.
4. Signal transmits by zone to building smoke removal system.
5. Signal transmits to building elevator control panel, initiating return to main floor or alternate floor and lockout for fire service
6. Signal transmits to building mechanical controls, shutting down fans and operating dampers.
7. Signal transmits by zone to release door hold-open devices.
8. Signal releases magnetic door hold opens.
9. Signal releases electric door locks

C. Drill Sequence of Operation: Manual drill function causes alarm mode sequence of operation.

D. Trouble Sequence of Operation: System or circuit trouble causes the following system operations:

1. Visual and audible trouble alarm indicates by zone at fire alarm control panel.
2. Visual and audible trouble alarm indicates at remote annunciator panel.
3. Trouble signal transmits to central station.
E. Zoning required.

F. The fire alarm system shall be addressable incorporating analog smoke and heat sensors, addressable duct detectors, and addressable manual pull stations. The fire alarm control panels shall activate addressable notification devices for the interior and control for the exterior weatherproof horns.

PART 2 - PRODUCTS

2.1 FIRE ALARM CONTROL PANEL (FACP)

A. General: Comply with UL 864, "Control Units and Accessories for Fire Alarm Systems".

B. The following FACP hardware shall be provided:

1. Power Limited base panel with beige cabinet and door, 120 VAC, 60 HZ input power.

2. 318 Addressable point capacity inclusive of inputs and outputs in any combination. Maximum of 144 points of annunciation where one (1) point of annunciation equals:
   a. 1 LED output or 1 switch input on a 24 Point I/O module.

3. Four (4) Class B, Style Y Notification Appliance Circuits (NAC; rated 2A @ 24VDC, resistive).

4. Two form "C" Auxiliary Output Circuits (rated 2A @ 24VDC, resistive), operation is programmable for trouble, alarm, supervisory or other selective control operations. Provide capability for switching up to 2 A @ 120VAC, inductive loads.

5. Dual Municipal City Circuit Connection for connection to either 24VDC Remote Station (reverse polarity) or local energy.

6. The FACP shall support two (2) RS-232-C ports.

7. Supervised serial communication channel for control and monitoring of remotely located LCD annunciators and I/O panels.

8. Universal 318 point DACT

C. Cabinet: Lockable steel enclosure. Arrange panel so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single panel is required to form a complete control panel, provide exactly matching modular panel enclosures.
D. Alphanumeric Display and System Controls: Panel shall include an 80 character LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands. The fire alarm control panel shall be Notifier model NFS-320C and be listed for suppression.

2.2 EMERGENCY POWER SUPPLY

A. General: Components include battery, charger, and an automatic transfer switch.

B. Battery: Sealed lead-acid type. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all notification appliances in alarm or supervisory mode for a period of 5 minutes.

2.3 ADDRESSABLE MANUAL PULL STATIONS

A. Description: Addressable double-action type, red LEXAN, with molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units. The manual pull station shall be Notifier model NBG-12LX.

B. Protective Shield: Where required, as indicated on the drawings, provide a tamperproof, clear LEXAN shield and red frame that easily fits over manual pull stations.

2.4 SMOKE SENSORS

A. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:

1. Factory Nameplate: Serial number and type identification.

2. Operating Voltage: 24 VDC, nominal.

3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.

4. Plug-In Arrangement: Sensor and associated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. Base shall provide break-off plastic tab that can be removed to engage the head/base locking mechanism. No special tools shall be required to remove head once it has been locked. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control unit.

5. Each sensor base shall contain an LED that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the sensor base LED shall be on steady.

6. Each sensor base shall contain a magnetically actuated test switch to provide for
easy alarm testing at the sensor location.

7. Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.

8. The sensor's electronics shall be immune from nuisance alarms caused by EMI and RFI.

9. Sensors include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACP. Sensor address shall be located in base to eliminate false addressing when replacing sensors.

10. Removal of the sensor head for cleaning shall not require the setting of addresses.

B. Type: Smoke sensors shall be of the photoelectric or combination photoelectric / heat type. Photoelectric smoke detectors shall be Notifier model FSP-851A.

C. Bases: Relay output, sounder and isolator bases shall be supported alternatives to the standard base. The standard sensor base shall be Notifier model B210LPA.

D. Duct Smoke Sensor: Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Sensor includes relay as required for fan shutdown.

1. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct smoke sensor shall be provided by the FACP.

2. The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable. Relay shall be mounted within 3 feet of HVAC control circuit.

3. Duct Housing shall provide a relay control trouble indicator Yellow LED.

4. Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.

5. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.

6. Duct Housing shall provide a magnetic test area and Red sensor status LED.

7. For maintenance purposes, it shall be possible to clean the duct housing sampling
tubes by accessing them through the duct housing front cover. The addressable duct detector shall be Notifier model FSP-851RA-DNR.

8. Each duct smoke sensor shall have a Remote Test Station with an alarm LED and test switch. The remote test station shall be Notifier model RTS-451.

9. Where indicated provide a NEMA 4X weatherproof duct housing enclosure that shall provide for the circulation of conditioned air around the internally mounted addressable duct sensor housing to maintain the sensor housing at its rated temperature range. The housing shall be UL Listed to Standard 268A. If required the NEMA 4X weatherproof duct housing enclosure shall be compatible with Notifier model FSP-851RA-DNRW duct detector.

2.5 HEAT SENSORS

A. Thermal Sensor: Combination fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; 135-deg F fixed-temperature setting except as indicated.

B. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermistor-based, rate-compensated, self-restoring and shall not be affected by thermal lag.

C. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and] programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACP for either 15-deg F or 20-deg F per minute.

D. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F. The addressable heat sensor shall be Notifier model FST-851A.

2.6 ADDRESSABLE CIRCUIT INTERFACE MODULES

A. Addressable Circuit Interface Modules: Arrange to monitor or control one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of waterflow, valve tamper, non-addressable devices, and for control of AHU systems. Individual addressable monitoring modules shall be Notifier model FMM-1A.

B. Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line circuit or a separate two wire pair running from an appropriate power supply, as required.

C. Type 3: Line Powered Control Circuit Interface Module

D. This module shall provide control and status tracking of a Form "C" contact. The two-wire signaling line circuit shall supply power and communications to the module. Addressable control relay modules shall be Notifier model FRM-1A.

E. All Circuit Interface Modules shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing
according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACP. The LEDs shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.

2.7 NOTIFICATION APPLIANCES DEIVICES

A. Horn Strobes.

1. The horn strobe appliances shall be a Cooper - Wheelock Series AS-24MCW-FR audible or audible visual appliance or equivalent. Horn strobe notification appliance shall be electronic and use solid state components. Electromechanical alternatives are not approved. Each electronic horn appliance shall provide field selectable single stroke or vibrating operation with volume control and tone control. The horn and the strobe shall be able to operate from a single NAC circuit when set to the vibrating mode. The peak anechoic dBA measurement at 10 feet shall be 87dBA minimum, at nominal voltage. Operating voltages shall be 24 VDC for horns and horn strobes using filtered power or unfiltered (VRMS) power supply. All models shall have provisions for standard reverse polarity type supervision and IN/OUT field wiring using terminals that accept #12 to #18 AWG wiring.

2. Combination horn strobe appliances shall incorporate a Xenon flashtube enclosed in a rugged Lexan lens or equivalent with solid state circuitry that are Sync in one (synchronization requires the Cooper - Wheelock Series DSM-12/24R Sync Module(s)). If the Dual Sync Module(s) contacts fail in the passive state (i.e., contacts remain closed) the strobe shall revert to a non-synchronized flash rate of 1 flash per second. Strobe shall meet UL 1971 and produce a flash rate of one (1) flash per second minimum over the Listed input voltage (20 VDC-31 VDC) range. The multi candela strobe intensity shall be rated per UL 1971 for 15, 30, 75, or 110 Candela for Wall Mount applications.

B. Strobe:

1. The multi-candela Visual notification appliances shall be Cooper - Wheelock Series RSS-24MCW-FR Strobe Appliances. Series RSS shall meet and be Listed under UL Standard 1971 (Emergency Devices for the Hearing Impaired for Indoor Fire Protection Service). The strobes shall be listed for indoor use only. The strobe appliances shall produce a flash rate of one (1) flash per second minimum over the Listed Voltage range of 20 to 31 VDC for 24 volt models. All inputs shall be polarized for compatibility with standard reverse polarity supervision of circuit wiring by a Fire Alarm Control Panel (FACP).

2. All visual appliances shall incorporate a Xenon flashtube enclosed in rugged Lexan lens. The RSS Strobes shall be the Low Current Design and shall have Zero Inrush. The strobe intensity shall be rated per UL 1971 for 15, 30, 75 and 110 candela for wall mount applications. Series RSS appliances shall incorporate circuitry for synchronized strobe flash and shall be designed for compatibility with Cooper -Wheelock Sync Modules. The strobes shall not drift out of synchronization at any time during operation. If the sync module fails to operate (i.e., contacts remain closed), the strobes shall revert to a non-synchronized flash
C. Sync Control Modules:

1. The sync control modules shall be Cooper-Wheelock DSM-12/24R Sync Modules. Sync Modules shall be the master controllers for Cooper-Wheelock #AS-24MFW-FR, and Cooper-Wheelock #RSS-24MCW-FR Strobe products where synchronized only signal is specified. All modules shall be UL listed under Standard 464.

2.8 EXTERIOR HORNS

A. The exterior horn shall offer field selectable choice of 2 recognized alerting signals and three installer selectable sound output levels (Low, Medium, and High). The horn shall be capable to be connected to a coded output from the fire alarm control panel. The weatherproof exterior horn shall be Wheelock model AH-24WP-R.

PART 3 – EXECUTION

Not Used

END OF SECTION