SECTION - 260500  COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 IMPOSED REGULATIONS

   A. Applicable provisions of the State and Local Codes and of the following codes and standards in addition to those listed elsewhere in the specifications are hereby imposed on a general basis for electrical work: codes and standards listed on the electrical drawings.

1.2 SCOPE OF WORK

   A. Provide all labor, materials, equipment and supervision to construct complete and operable electrical systems as indicated on the drawings and specified herein. All materials and equipment used shall be new, undamaged and free from any defects.

1.3 RELATED DOCUMENTS AND OTHER INFORMATION

   A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the portions of work specified in each and every Section of this Division, individually and collectively.

1.4 EXISTING SERVICES AND FACILITIES

   A. Damage to Existing Services: Existing services and facilities damaged by the Contractor through negligence or through use of faulty materials or workmanship shall be promptly repaired, replaced, or otherwise restored to previous conditions by the Contractor without additional cost to the Owner.

   B. Interruption of Services: Interruptions of services necessary for connection to or modification of existing systems or facilities shall occur only at prearranged times approved by the Owner. Interruptions shall only occur after the provision of all temporary work and the availability of adequate labor and materials will assure that the duration of the interruption will not exceed the time agreed upon.

   C. Removed Materials: Existing materials made unnecessary by the new installation shall be stored on site. They shall remain the property of the Owner and shall be stored at a location and in a manner as directed by the Owner. If classified by the Owner's authorized representative as unsuitable for further use, the material shall become the property of the Contractor and shall be removed from the site at no additional cost to the owner.

1.5 PRODUCT WARRANTIES

   A. Provide manufacturer's standard printed commitment in reference to a specific product and normal application, stating that certain acts of restitution will be performed for the Purchaser or Owner by the manufacturer, when and if the product fails within certain operational conditions and time limits. Where the warranty requirements of a specific specification section exceeds the manufacturer's standard warranty, the more stringent requirements will apply and modified manufacturer's warranty shall be provided. In no case shall the manufacturer's warranty be less than one (1) year.

1.6 PRODUCT SUBSTITUTIONS

   A. General: Materials specified by manufacturer's name shall be used unless prior approval of an alternate is given by addenda. Requests for substitutions must be received in the office of the Architect at least 10 days prior to opening of bids.
1.7 ELECTRICAL DRAWINGS

A. Electrical contract drawings are diagrammatic and indicate the general arrangement of electrical equipment. Do not scale electrical plans. Obtain all dimensions from the Architect's dimensioned drawings and field measurements. The Contractor shall review Architectural plans for door swings and built-in equipment; conditions indicated on those plans shall govern for this work.

B. Coordinate installation of electrical equipment with the structural and mechanical equipment and access thereto. Coordinate exterior electrical work with civil and landscaping work.

C. Discrepancies shown on different drawings, between drawings and specifications or between documents and field conditions shall be installed to provide the better quality or greater quantity of work; or, comply with the more stringent requirement; either or both in accordance with the A/E's interpretation.

1.8 SYSTEMS REQUIRING ROUGH-IN

A. Rough-in shall consist of all outlet boxes/raceway systems/supports and sleeves required for the installation of cables/devices by other Divisions and by the Owner. It shall be the responsibility of this Contractor to determine the requirements by reviewing the contract documents and meeting with the Superintendent of the trade involved and Owner's representative to review submittal data, shop drawings, etc.

B. Sealing of all sleeves, to meet the fire rating of the assembly, whether active or not, is work of this Division.

1.9 SUBMITTALS

A. Refer to section 260510

PART 2 - PRODUCTS

2.1 FIRESTOPPING:

A. A firestop system shall be used to seal penetrations of electrical conduits and cables through fire-rated partitions per NEC 300.21. The firestop system shall be qualified by formal performance testing in accordance with ASTM E-814, or UL 1479.

B. The firestop system shall consist of a fire-rated caulk type substance and a high temperature fiber insulation. It shall be permanently flexible, waterproof, non-toxic, smoke and gas tight and have a high adhesion to all solids so damming is not required. Only metal conduit shall be used in conjunction with this system to penetrate fire rated partitions. Install in strict compliance with manufacturer's recommendations. 3M or equal.

C. Comply with TIA/EIA-569-A, Annex A, "Firestopping."

D. Comply with BICSI TDMM, "Firestopping Systems" Article.

PART 3 - EXECUTION

3.1 PRODUCT INSTALLATION, GENERAL

A. Except where more stringent requirements are indicated, comply with the product manufacturer's installation instructions and recommendations, including handling, anchorage, assembly, connections, cleaning and testing, charging, lubrication, startup, test operation and
shut-down of operating equipment. Consult with manufacturer's technical experts, for specific instructions on unique product conditions and unforeseen problems.

B. Protection and Identification: Deliver products to project properly identified with names, models numbers, types, grades, compliance labels and similar information needed for distinct identifications; adequately packaged or protected to prevent deterioration during shipment, storage and handling. Store in a dry, well ventilated, indoor space, except where prepared and protected by the manufacturer specifically for exterior storage.

C. Permits and Tests: Provide labor, material and equipment to perform all tests required by the governing agencies and submit a record of all tests to the Owner or his representative. Notify the Architect five days in advance of any testing.

D. Install temporary protective covers over equipment enclosures, outlet boxes and similar items after interiors, conductors, devices, etc. are installed, to prevent the entry of construction debris and to protect the installation during finish work performed by others. Do not install device plates, equipment covers or trims until finish work is complete.

E. Clean all equipment, inside and out, upon completion of the work. Scratched or marred surfaces shall be touched-up with touch-up paint furnished by the equipment manufacturer.

F. Replace all equipment and materials that become damaged.

G. No more than three phase conductors, each of opposite phases for a three phase WYE system, shall be combined in a single raceway unless written approval is granted by the engineer or noted otherwise on the construction documents. (120 volt and 277 volt receptacle and lighting circuits are exempt from this requirement, but must meet the requirements of the NEC)

3.2 EQUIPMENT PROTECTION

A. Equipment and materials shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.

B. Store equipment indoors in clean dry space with uniform temperature to prevent condensation. Equipment shall include but not be limited to motor controllers, enclosures, controllers, circuit protective devices, cables, wire, light fixtures, electronic equipment, and accessories.

C. During installation, equipment shall be protected against entry of foreign matter; and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.

D. Damaged equipment shall be, as determined by the Engineer, placed in first class operating condition or be returned to the source of supply for repair or replacement.

E. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.

F. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.
END OF SECTION 260500
SECTION 260501 - ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 Not Used

PART 2 - PRODUCTS

2.1 Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field verify measurements and circuiting arrangements are as shown on Drawings.
B. Verify that abandoned wiring and equipment serve only abandoned facilities.
C. Demolition drawings are based on casual field observation.
D. Report discrepancies to Engineer before disturbing existing installation.
E. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
B. Provide temporary wiring and connections to maintain existing systems in service during construction.
C. When work must be performed on energized equipment or circuits, use personnel experienced in such operations, submit verification of compliance with the contractor’s safety procedures to the Architect, and notify the Owner in writing a minimum of 24 hours prior to work.
D. Existing Fire Alarm System: Maintain existing system in service.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Maintain electrical service to areas outside of the construction area.
B. Remove, relocate, and extend existing installations to accommodate new construction.
C. Remove abandoned wiring to source of supply.
D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
F. Repair adjacent construction and finishes damaged during demolition and extension work.
G. Maintain access to existing electrical installations that remain active. Modify installation or
provide access panel as appropriate.

H. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

I. Remove all abandoned conductors and cables within the construction area.

J. Support all existing communication cables within the construction area.

K. Provide fire stopping for all existing communication conduit fire rated wall penetrations within the construction area.

3.4 CONSTRUCTION PHASING

A. Plan and execute the work in accordance with the construction phasing indicated on the Architectural plans. Test and certify all systems, by phase of construction, so that “partial occupancy” can be obtained.

3.5 REUSE OF EXISTING MATERIALS

A. Where new devices are to replace existing, it shall be permissible to reuse existing outlet boxes and branch circuit conduits. It shall be the responsibility of the Contractor to ensure that existing outlet boxes and conduits that are reused comply with requirements for new.

B. The reuse of conduits (not remaining in place), conductors, and devices is not permitted.

3.6 CUTTING AND PATCHING

A. Structural Limitations: Do not cut structural framing, walls, floors, decks, and other members intended to withstand stress, except with the Engineer’s written authorization. Authorization will be granted only when there is no other reasonable method for completing the electrical work, and where the proposed cutting clearly does not materially weaken the structure.

B. Cutting Concrete: Where authorized, cut openings through concrete (for conduit penetrations and similar services) by core drilling or sawing. Do not cut by hammer-driven chisel or drill. Prior to cutting of existing concrete walls, floors, or ceilings x-ray existing concrete to locate existing hidden utilities.

C. Other Work: Do not endanger or damage other work through the procedures and process of cutting to accommodate electrical work. Review the proposed cutting with the Installer of the work to be cut, and comply with his recommendations to minimize damage. Where necessary, engage the original Installer or other specialists to execute the cutting in the recommended manner.

D. Patching: Where patching is required to restore other work, because of cutting or other damage inflicted during the installation of electrical work, execute the patching in the manner recommended by the original Installer. Restore the other work in every respect, including the elimination of visual defects in exposed finished, as judged by the Engineer. Engage the original Installer to complete patching of various categories of work including: concrete and masonry finishing, waterproofing and roofing, exposed wall finishes, etc.

3.7 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or that are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections.
Replace damaged circuit breakers and provide closure plates for vacant positions.

3.8 LABELING

A. Provide typed circuit directory showing revised circuiting arrangement.

B. Provide and install a new engraved nameplate for all electrical panels that have been modified during construction.

END OF SECTION 260501
SECTION 260502 - ELECTRICAL ACCEPTANCE TESTS

PART 1 - GENERAL

1.1 SUBMITTALS
   A. Refer to section 260510.

1.2 References

1.3 SCOPE OF WORK
   A. Acceptance tests shall be performed in accordance with the current version of ASNI/NETA ATS and by an independent testing agency.
   B. Tests shall be performed in accordance with applicable codes, standards, and equipment manufacturers’ instruction.
   C. The Contractor shall provide all test equipment, materials and labor necessary to perform the tests, and shall coordinate with the other trades for necessary services, such as scaffolding and the uncoupling of motors.
   D. Tests shall consist of visual inspections, manual operations, and electrical testing under all normal and expected abnormal operating conditions.
   E. The Owner shall be notified at least 2 weeks in advance of all tests.
   F. Tests shall be witnessed by the Engineer unless such witnessing is waived in writing.
   G. The Engineer shall be provided with a written test report, signed and dated, for all tests.
   H. Acceptance testing shall be provided and reviewed by the Engineer prior to energizing of electrical equipment. Phasing may require multiple trips/tests/reports and after hours work.

1.4 TESTING CRITERIA
   A. High potential tests shall be performed at the AC or DC voltage listed in ASNI/NETA ATS unless specified otherwise herein. Do not perform more than one high potential test on any item without authorization from the Owner.
   B. Dielectric absorption tests shall be performed with a 2,500 volt DC megger.
   C. Megger tests shall be performed at a DC voltage of 1,000 volts for 600 volt rated equipment, and at a DC voltage of 500 volts for 120-300 volt rated equipment.
   D. Continuity checks shall be performed with a low voltage DC meter, light or bell.
   E. The resistance to ground shall be measured using either the three point method or the fall of potential method.
   F. Test instruments shall be calibrated to national standards to ensure the accuracy of tests. These calibration reports shall be made available to the Owner when requested. Depending upon frequency of use, the instruments shall be calibrated at least every 12 months.
PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 VISUAL INSPECTIONS

A. Prior to manual operation and electrical testing, verify the following:
   1. The equipment is free from damage and defects.
   2. The equipment has been lubricated.
   3. The ventilation louvers are open and unobstructed.
   4. Electrical connections have been tightened.
   5. Voltages, phases, and rotation have been identified.
   6. Terminations have been identified.
   7. Equipment labels have been installed.
   8. The equipment has been calibrated.
   9. The equipment is ready to be electrically tested.

3.2 MANUAL OPERATIONS

A. Prior to electrical testing, verify the following:
   1. Mechanical components operate smoothly and freely.
   2. Mechanical stops, limit switches, etc., are properly adjusted.

3.3 ELECTRICAL ACCEPTANCE TESTS

A. 600 Volt Power Cables
   1. A continuity check and a 1,000 volt DC megger test shall be performed on 600 volt
      power cables No. 4 AWG and larger. The megger test shall be performed between
      each pair of conductors and from each conductor to ground. Each test shall be
      performed for 15 seconds or until the insulation resistance value stabilizes.
   2. The insulation resistance between conductors, and from each conductor to ground,
      shall be 100 megohms minimum in one minute or less. In addition, the lowest
      insulation resistance value shall not differ from the highest value by more than 20
      percent. If all megger readings for a given circuit are above 1000-megohms, the 20
      percent balance requirement may be waived.
   3. Proper rotation shall be verified.

END OF SECTION 260502
SECTION 260510 – ELECTRICAL SUBMITTALS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Comply with the applicable requirements of the Division 1 specifications (013300) and the requirements of this Division of the specifications.

1.2 SUBMITTALS

A. Submit for review by the Engineer Architect a schedule with engineering data of materials and equipment to be incorporated in the work. Submittals shall be supported by descriptive materials, i.e., catalog sheets, product data sheets, diagrams, performance curves and charts published by the manufacturer, warranties, etc., to show conformance to Specifications and Plan requirements; model numbers alone shall not be acceptable. Data submitted for review shall contain all information to indicate compliance with Contract Documents. Complete electrical characteristics shall be provided for all equipment. Submittals for lighting fixtures shall include Photometric Data. The Engineer reserves the right to require samples of any equipment to be submitted for review.

B. The purpose of shop drawing review is to demonstrate to the Architect that the Contractor understands the design concept. The Architect's review of such drawings, schedules, or cuts shall not relieve the Contractor from responsibility for deviations from the drawings or specifications unless he has, in writing, called the Architect's attention to such deviation at the time of submission, and received written permission from the Architect for such deviations.

C. Where cut sheets include an entire product family, mark all specific items to be utilized for this project on equipment cut sheets. Generic cut sheets with no indication of which items on the cut sheet shall be used will be rejected.

D. Response to Submittals: Shop drawings shall be stamped and signed by the Electrical Engineer with the following classifications:

E. "No Exceptions Taken": No corrections, no marks. Contractor shall submit copies for distribution

F. "Make Corrections Noted": A few minor corrections. Items may be ordered as marked up without further resubmission. Submit copies for distribution.

G. "Amend and Resubmit": Minor corrections. Item may be ordered at the Contractor's option. Contractor shall resubmit drawings with corrections noted.

H. "Rejected - Resubmit": Major corrections or not in accordance with the contract documents. No items shall be ordered. Contractor shall correct and resubmit drawings.

I. Prior Approvals and Shop Drawings must be hand delivered, received by mail, or email.

J. Submittal data received by facsimile will not be reviewed.

K. Equipment and materials requiring submittals:

1. Section 260500 – Common Work Results for Electrical
   a. Product Warranties
   b. Firestopping Materials
   c. Firestopping Installation Drawings for each conduit penetration, cable in metal sleeve penetration and blank metal sleeve penetration for each type of wall/floor
construction encountered.

2. Section 260502 – Electrical Acceptance Tests
   a. Test Reports

3. Section 260511 – Electrical Work Closeout
   a. Record Drawings
   b. Record Manuals
   c. Close out submittals

4. Section 260512 – Electrical Coordination
   a. Coordination Affidavit

5. Section 260519 – Low-Voltage Electrical Power Conductors and Cables
   a. Waterproof Wire Connectors
   b. Wire
   c. Field Quality Control Test Reports

6. Section 260526 – Grounding and Bonding for Electrical Systems
   a. Product Data

7. Section 260529 – Hangers and Supports for Electrical Systems
   a. Product Data

8. Section 260533 – Raceway and Boxes for Electrical Systems
   a. Product Data

9. Section 26536 – Cable Trays for Electrical Systems
   a. Product Data

10. Section 260548 – Vibration and Seismic Controls for Electrical Systems
    a. Submit seismic force level (FP) calculations from applicable building code.
    b. Submit pre-approved restraint selections and installation details
    c. Restraint selection and installation details shall be sealed by a professionally licensed engineer experienced in seismic restraint design.
    d. Submit manufacturer’s product data on strut channels including, but not limited to, types, materials, finishes, gauge thickness, and hole patterns. For each different strut cross-section, submit cross sectional properties including Section Modulus (Sx) and Moment of Inertia (Ix).
    e. Field reports

11. Section 260553 – Identification for Electrical Systems
    a. Product data for all labeling products

12. Section 262400 – Panelboards
    a. Product data
    b. Enclosures
    c. Dimensional Data
    d. Layout Drawings and elevations
    e. Short Circuit Current Rating

13. Section 262726 – Wiring Devices
    a. Product data

14. Section 265100 – Interior Lighting
    a. Lighting Fixtures
PART 2 - PRODUCTS
2.1 Not Used.

PART 3 - EXECUTION
3.1 MANUFACTURER’S DATA
   A. Include the manufacturer’s comprehensive product data sheet and installation instructions. Where operating ranges are shown, mark data to show portion of range required for project application. Where pre-printed data sheet covers more than one distinct product-size, type, material, trim, accessory group or other variations, delete or mark-out portions of the pre-printed data which are not applicable.

3.2 EQUIPMENT LIST
   A. Where more than one type of a product is being used (i.e. starters, disconnects, breakers, etc.) provide a list with each submittal correlating the type and size of product to the load served.

3.3 TEST REPORTS
   A. Submit test reports which have been signed and dated by the firm performing the tests, and prepare in the manner specified in the standard or regulation governing the tests procedure as indicated.
SECTION 260511 - ELECTRICAL WORK CLOSEOUT

PART 1 - GENERAL

1.1 SUBMITTALS

A. Refer to section 260510.

1.2 RELATED SECTIONS

A. Refer to section 017839 for additional requirements.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Except where otherwise indicated, electrical drawings prepared by Engineer are diagrammatic in nature and may not show locations accurately for various components of electrical system. Shop drawings, including coordination drawings, prepared by the Contractor show portions of work more accurately to scale and location, and in greater detail. It is recognized that actual layout of installed work may vary substantially from both Contractor drawings and shop drawings.

B. The electrical superintendent shall maintain a white set of contract documents and shop drawings in clean, undamaged condition, for mark-up of actual installations which vary substantially from the work as shown. PDF or digital mark-ups is acceptable alternates Mark-up whatever drawings are most capable of showing installed conditions accurately. However, where shop drawings are marked, record a reference note on appropriate contract drawings. Mark with erasable pencil, and use multiple colors to aid in the distinction between work of separate electrical systems. These documents shall be used for no other purpose. In general, record every substantive installation of electrical work which previously is either not shown or shown inaccurately, but in any case record the following:

1. Post all addenda prior to beginning work.
2. Underground feeder conduits, both interior and exterior, drawn to scale and fully dimensioned.
3. Work concealed behind or within other work, in a non-accessible arrangement.
4. Mains and branches of wiring systems, with panelboards and control devices located and numbered, with concealed splices located, and with devices requiring maintenance located.
5. Scope of each change order (C.O.), noting C.O. number.

C. Upon each visit by the Architect/Engineer, the Contractor shall demonstrate that the record documents are being kept current, as specified hereinbefore.

2.2 RECORD MANUALS

A. Record manuals shall include the following the following:

1. Manufacturer’s operation and maintenance manuals for:
   a. Light Fixtures
   b. Panelboards

2. Shop drawings, revised to reflect all review comments, supplemented with the installation instructions shipped with equipment.
3. One copy of all panelboard directories.
4. All field test Reports
5. Electrical Contractor’s Warranty
B. Submit record manuals in quantities and in the format prescribed in the Division 1 specifications.

PART 3 - EXECUTION

3.1 INSPECTIONS

A. At all construction observations by the Architect/Engineer, the Contractor shall demonstrate to the Architect/Engineer that all work is complete in accordance with the contract documents and that all systems have been tested and are fully operational. The Contractor shall furnish the personnel, tools and equipment required to inspect and test all systems.

END OF SECTION 260511
SECTION 260512 - ELECTRICAL COORDINATION

PART 1 - GENERAL

1.1 SUBMITTALS

A. Refer to section 260510.

PART 2 - PRODUCTS

2.1 EQUIPMENT REQUIRING ELECTRICAL SERVICE

A. Provide electrical connections for all electrically driven equipment. Final connections are electrical work, except as otherwise noted. Obtain a copy of the shop drawings of equipment. Review shop drawings to verify electrical characteristics and to determine rough-in requirements, final connection requirements, location of disconnect switch, etc. Notify the General Contractor if the information received is ambiguous or incomplete. Keep a copy of these shop drawings at the project site throughout the course of construction.

B. Equipment to be connected includes, but is not limited to the following:
   1. HVAC Equipment
   2. Telephone/Computer Systems
   3. Control Systems

C. The design of circuits for electrically driven equipment is based on the product of one manufacturer and may not be representative of all acceptable manufacturers. If equipment furnished has differing characteristics, make necessary adjustments to circuit components at no additional cost to the Owner, subject to the approval of the Engineer.

D. Provide motor starters and disconnects for all mechanical equipment unless provided by the mechanical contractor.

PART 3 - EXECUTION

3.1 COORDINATION OF MECHANICAL INSTALLATION:

A. Attachment Number 1 shall be filled out and returned with shop drawing submittals. The intent of Attachment Number 1 is to ensure that the electrical requirements for equipment have been reviewed and coordinated by the Contractor. No electrical equipment shall be ordered, nor shall rough-in begin, before this coordination has taken place. This document shall be returned appropriately marked whether or not any changes are deemed to be necessary by the contractor.
ATTACHMENT NO. 1

SHOP DRAWING COORDINATION AFFIDAVIT

I, the undersigned, certify that I have reviewed the equipment shop drawings for electrically driven equipment and that the accompanying electrical shop drawings reflect the requirements of the actual equipment to be furnished for use on this project. The following deviations from design drawings were required to serve the furnished equipment:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>CKT.DESIG.</th>
<th>BKR.SIZE</th>
<th>CONDUIT/WIRE</th>
<th>DISC.SIZE</th>
<th>STARTER</th>
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<tr>
<td></td>
<td>New</td>
<td>Old</td>
<td>New</td>
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</table>

NOTE: If no deviations are required please indicate by circling the appropriate answer above your signature.

PROJECT: _____________________________ DEVIATIONS: Yes / No

COMPANY: __________________________________________________________

TITLE: __________________ SIGNATURE: ________________________

TELEPHONE: ______________ DATE: ________________________________

IT IS THE RESPONSIBILITY OF THE DIVISION 26 CONTRACTOR TO OBTAIN SHOP DRAWING INFORMATION FROM OTHER TRADES. FAILURE TO PERFORM THE WORK REQUIRED BY THIS AFFIDAVIT, PRIOR TO ORDERING MATERIALS OR ROUGHING-IN, MAY RESULT IN IMPROPER CONNECTIONS BEING PROVIDED. THE EXPENSE OF CORRECTIVE MEASURES, IF REQUIRED, SHALL BE BORNE BY THE CONTRACTOR.

NOTE:

PANELBOARD SHOP DRAWINGS WILL NOT BE REVIEWED UNTIL THE ELECTRICAL CONTRACTOR COMPLETES AND SUBMITS THIS AFFIDAVIT TO THE ELECTRICAL ENGINEER.

END OF SECTION 260512
SECTION 260519 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the requirements for the following:
   1. Wire and cable for 600 volts and less.
   2. Wiring connectors and connections.

1.2 SUBMITTALS

A. Refer to section 260510.

1.3 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.4 REFERENCE STANDARDS


PART 2 - PRODUCTS

2.1 WIRING REQUIREMENTS

A. Concealed Dry Interior Locations: Use only THHN, THWN-2 or XHHW-2 wire in raceway.

B. Exposed Dry Interior Locations: Use only THHN, THWN-2, or XHHW-2 in raceway.

C. Above Accessible Ceilings: Use only THHN, THWN-2, or XHHW-2 in raceway.

D. Wet or Damp Interior Locations: Use only THWN-2 or XHHW-2 in raceway.

E. Exterior locations (above or below grade) THWN-2, XHHW-2 or USE in raceway.

F. Use conductors not smaller than 12 AWG for power and lighting circuits.

G. Use conductors not smaller than 14 AWG for control circuits.

H. Metal Clad (MC) cable shall not be used.

2.2 BUILDING WIRE

A. Conductor: Copper.

B. Insulation Voltage Rating: 600 volts.
C. Temperature Rating: 90° C.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Pull all conductors into raceway at same time.

B. Use suitable wire pulling lubricant for building wire 4 AWG and larger. Do not exceed manufacturers recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

D. Neatly train and lace wiring inside boxes, equipment, and panelboards.

E. Clean conductor surfaces before installing lugs and connectors.

F. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

G. Use split bolt connectors or compression fittings for splices and taps on conductors 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

H. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.

I. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

J. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values or UL 486A and UL 486B.

K. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

L. For each electrical connection/termination, provide a complete assembly of materials, including but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other materials necessary to complete splices and terminations. Torque all connections according to installation instructions.

M. Motor connections shall be made with compression connectors forming a bolted in-line or stub-type connection.

N. Splicing of feeder conductors shall not be acceptable, unless specifically indicated on the drawing. Where splicing of feeder conductors is indicated, splices shall be made using compression type butt splice.

O. All splices made underground or in the pipe basements shall be rated suitable for water immersion.

P. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for cables in riser conduits. Plugs shall
have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

3.2 LABELING

A. Color Coding

1. Color shall be green for grounding conductors and green with yellow stripe for isolated grounding conductors.

2. The color of the circuit conductors shall be as follows:

   120/208 volt, 3-phase
   Phase A - Black
   Phase B - Red
   Phase C - Blue
   Neutral - White

   277/480 volt, 3-phase:
   Phase A - Brown
   Phase B - Orange
   Phase C - Yellow
   Neutral – Gray

END OF SECTION 260519
SECTON 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
   A. Grounding and bonding components.

1.2 SUBMITTALS
   A. Refer to section 260510.

1.3 QUALITY ASSURANCE
   A. Conform to requirements of NFPA 70.

1.4 REFERENCES

PART 2 - PRODUCTS

2.1 GROUND CONNECTIONS
   A. Above Grade:
      1. Bonding Jumpers: compression type connectors, using zinc-plated fasteners and external tooth lock washers.
      2. Ground Busbars: Two-hole compression type lugs using tin-plated copper or copper alloy bolts and nuts.
      3. Rack and Cabinet Ground Bars: one-hole compression-type lugs using zinc-plated or copper alloy fasteners.

2.2 EQUIPMENT RACK AND CABINET GROUND BARS
   A. Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks with minimum dimensions of 3/8 inch x ¾ inch unless noted otherwise.
   B. Busbar Connectors: Cast silicon bronze, solderless, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch (15.8- or 25.4-mm) centers for a two-bolt connection to the busbar.
   C. Shielded Cable: Bond the shield of shielded cable to the TGB in communications rooms and spaces. Comply with TIA/EIA-568-B.1 and TIA/EIA-568-B.2 when grounding screened, balanced, twisted-pair cables.

2.3 GROUND TERMINAL BLOCKS
   A. At any equipment mounting location (e.g. backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.
PART 3 - EXECUTION

3.1 ELECTRICAL AND COMMUNICATION ROOM GROUNDING
   A. Building Earth Ground Busbars: Provide ground busbar hardware at each electrical and communication room and connect to pigtail extensions of the building grounding ring.

3.2 CORROSION INHIBITORS
   A. When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.
   B. Where concrete penetration is necessary, non-metallic conduit shall be cast flush with the points of concrete entrance and exit so as to provide an opening for the ground wire and the opening shall be sealed with a suitable compound after installation of the ground wire.

3.3 SECONDARY EQUIPMENT AND CIRCUITS
   A. Switchgear, Panelboards, Disconnects, and Switchboards: Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and grounding conductor to the equipment ground bus.
   B. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders and power and lighting branch circuits, sized in accordance with Article 250 of NFPA 70.
   C. Boxes, Cabinets, Enclosures, and Panelboards:
      1. Bond the equipment grounding conductor to each pull box, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
      2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
      3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.
   D. Motors and Starters: Provide lugs in motor terminal box and starter housing or motor control center compartment to terminate equipment grounding conductors.
   E. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.
   F. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.
   G. Metallic Conduit: Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a bare grounding conductor to the equipment ground bus.

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

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the requirements for the following:
   1. Conduit and equipment supports.
   2. Anchors and fasteners.

1.2 SUBMITTALS

A. Refer to section 260510.

1.3 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.4 REFERENCE STANDARDS


PART 2 - PRODUCTS

2.1 MATERIALS

A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

B. Supports: Fabricated of structural steel or formed steel members; galvanized.

C. Anchors and Fasteners:
   1. Do not use powder-actuated anchors.
   2. Concrete Structural Elements: Use precast inserts, expansion anchors, or preset inserts.
   3. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
   4. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
   5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
   7. Sheet Metal: Use sheet metal screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
   1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
B. Cutting or Holes:
   1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the Architect prior to drilling through structural sections.
   2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Architect as required by limited working space.

C. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

D. Install surface-mounted cabinets with minimum of four anchors.

E. In wet and damp locations use steel channel supports to stand cabinets and disconnects 1 inch off wall.

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

G. Use stamped steel bridges to fasten flush mounting outlet box between studs.

H. Use adjustable steel channel fasteners for hung ceiling outlet box.

I. Do not fasten boxes to ceiling support wires.

J. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

K. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

L. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.

M. Do not support conduit with wire, wire ties, or perforated pipe straps. Remove wire used for temporary supports.

N. Do not attach conduit to ceiling support wires.

END OF SECTION 260529
SECTION 260533 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUBMITTALS
A. Refer to section 260510

1.2 QUALITY ASSURANCE
A. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.3 REFERENCE STANDARDS
A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); current edition
B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); current edition
C. ANSI C80.5 - American National Standard for Electrical Rigid Aluminum Conduit (ERAC); current edition
E. NECA 101 - Standard for Installing Steel Conduit (Rigid, IMC, EMT); National Electrical Contractors Association; current edition
F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; current edition

1.4 DELIVERY, STORAGE, AND HANDLING
A. Accept conduit on site. Inspect for damage
B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

PART 2 - PRODUCTS

2.1 CONDUIT REQUIREMENTS
A. Conduit Size: Comply with NFPA 70.
   1. Minimum Size: 3/4 inch
B. Wet and Damp Locations:
   1. Exterior above ground and in pipe basements: RMC, IMC, or LTFMC (LTFMC shall be only used with restrictions, see conduit installation)
   2. Exterior below ground: RNC schedule 40
   3. Interior: RMC, IMC, or LTFMC (LTFMC shall be only used with restrictions, see conduit installation)
   4. Interior below grade: RNC schedule 40
   5. Where RNC Schedule 40 is installed below grade or under floor slabs, the elbows required to turn the raceway up through the slab shall be RMC.
C.  Dry Locations:
   1. Concealed: Use EMT or FMC (FMC shall be only used with restrictions, see conduit installation)
   2. Exposed: Use EMT or FMC (FMC shall be only used with restrictions, see conduit installation)
   3. Interior below grade: RNC schedule 40

D.  Area subject to physical damage: RMC, IMC, or LTFMC (LTFMC shall be only used with restrictions, see conduit installation)
   1. “Areas subject to physical damage” shall be defined as the most stringent of the following:
      a. Exposed conduit below eight feet above finished floor.
      b. As interpreted by the authority having jurisdiction (AHJ).

2.2  METAL CONDUIT

A.  Rigid Steel Galvanized Conduit (RMC): ANSI C80.1.


C.  Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.
   1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
   2. Standard threaded couplings, locknuts, bushings, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
   3. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
   4. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
   5. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
   6. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.

2.3  FLEXIBLE METAL CONDUIT

A.  FLEXIBLE METAL CONDUIT (FMC) Description: Interlocked steel construction. Flexible metal conduit shall conform to UL 1.

B.  Fittings: NEMA FB 1.
   1. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
   2. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
   3. Clamp type, with insulated throat.

2.4  ELECTRICAL METALLIC TUBING

A.  ELECTRICAL METALLIC TUBING (EMT) Description: ANSI C80.3

B.  Fittings and Conduit Bodies: NEMA FB 1; steel compression type.
   1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
2. Only steel or malleable iron materials are acceptable.
3. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
4. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors.
5. Indent type connectors or couplings are prohibited.

2.5 NONMETALLIC CONDUIT

A. RIGID NONMETALLIC CONDUIT (RNC): Direct burial plastic conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).

B. RNC: NEMA TC 2, schedule 40 PVC

C. Fittings shall meet the requirements of UL 514C and NEMA TC3

D. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

2.6 EXPANSION AND DEFLECTION COUPLINGS

A. Conform to UL 467 and UL 514B.

B. Accommodate, 0.75 inch deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.

C. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.

D. Jacket: Flexible, corrosion resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

2.7 CORROSION PROTECTION

A. Corrosion protection for conduits passing through concrete slabs shall be by one of the following means: field-wrapped with 3M Scotchrap No. 50, 2-inch wide (minimum), with a 50 percent overlay, or shall have a factory-applied polyvinyl chloride, plastic resin, or epoxy coating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify routing and termination locations of conduit prior to rough-in.

B. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to provide a complete wiring system.

3.2 CONDUIT INSTALLATION

A. All fire alarm cable shall be installed in metallic conduit. Coordinate with fire alarm system manufacturer for cable routing and quantities.

B. Install conduit securely, in a neat and workmanlike manner, as specified in NECA 101.

C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal
clearances around the conduit and make watertight.

D. Arrange supports to prevent misalignment during wiring installation.

E. Arrange conduit to maintain headroom and present neat appearance.

F. Route exposed conduit parallel and perpendicular to walls.

G. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

H. Route conduit in and under slab from point-to-point.

I. Maintain adequate clearance between conduit and piping.

J. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.

K. Cut conduit square using saw or pipecutter; de-burr cut ends.

L. Bring conduit to shoulder of fittings; fasten securely.

M. For power conduits install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 2 inch size.

N. For communication conduits install no more than the equivalent of two 90 degree bends between pull points. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 2 inch size.

O. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

P. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control, and expansion joints.

Q. Seal the inside of all conduits where conduit passes below floor or outside of the building.

R. Provide suitable pull string in each empty conduit except sleeves and nipples.

S. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

T. Do not install FMC or LTFMC in lengths over 6’.

U. Use LTFMC or FMC only to connect to equipment subject to vibration or to suspended light fixtures.

V. Wherever possible, install horizontal raceway runs above water and drain piping. Give the right-of-way in confined spaces to piping that must slope for drainage and to larger HVAC ductwork and similar services that are less conformable than electrical services.

W. Complete the installation of electrical raceways before starting installation of cables within raceways.

X. Raceways shall not be installed exposed in finished spaces. Install concealed in walls, ceilings, below slab-on-grade or embedded in slabs above grade.
3.3 BOX INSTALLATION

A. Boxes for Conduits:
   1. Surface mounted.
   2. Provide boxes with hinged, lockable covers using inset cylindrical locks.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.

C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

D. Outlet boxes in the same wall mounted back-to-back are prohibited. A minimum 24 inch, center-to-center lateral spacing shall be maintained between boxes.

E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 4 inches square by 2-1/8 inches deep, with device covers for the wall material and thickness involved.

3.4 IDENTIFICATION

A. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1"

B. On all junction box covers, identify the circuits with black marker.

END OF SECTION 260533
SECTION 260536 – CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
A. This section includes the requirements for the following:
B. Provide cable tray system in areas indicated, complete with all supports, fittings and accessories.
C. Furnishing, installation and connection of raceway systems and wiring for the radiology equipment.

1.2 SUBMITTALS
A. Refer to section 260510.

1.3 QUALITY ASSURANCE
A. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown
B. The drawings, which constitute a part of these specifications, indicate the general route of the cable tray systems. Data presented on these drawings is as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification of all dimensions, routing, etc., is required by the contractor.
C. Drawings are for assistance and guidance, but exact routing, locations, distances and levels will be governed by actual field conditions. Contractor is directed to make field surveys as part of his work prior to submitting system layout drawings.

PART 2 - PRODUCTS

2.1 CENTER SUPPORTED CABLE TRAY
A. Acceptable manufacturers
   1. Basis of design manufacturers
      a. Mono-Systems, Inc.
      b. Atlas
      c. B-line
      d. Legrand CABLOFIL
B. Complete assembly of cable tray, and necessary accessories, shall be free of burrs and sharp edges.

PART 3 - EXECUTION

3.1 LAYOUT
A. Layout of cable tray is the responsibility of the Contractor. Coordinate location with building structure and other trades to ensure that the tray is readily accessible.

3.2 INSTALLATION
A. Provide all connector assemblies, clamp assemblies, connector plates, splice plates and
splice bars, and mounting hardware required for a compete system.

B. Splice Connectors: Sections of tray shall be joined using a two bolt rectangular splice connector which telescopes into the spine of the tray. Splice connectors shall allow for thermal expansion/contraction of the tray system.

C. Supporting: The tray shall be supported on 8-foot centers, maximum

D. Bracing and Leveling: Brace trays on intervals required to prevent lateral movement. After installation of cables by other trades, adjust supports and braces so that tray is level.

E. Trough-type raceway sections and cable tray sections shall be made electrically continuous by short bonding jumpers between adjacent sections.

F. Ground all cable tray and trough.

G. Fittings: All fittings, inserts, covers, couplings, connectors and other accessories required to effect a complete rigid mechanical installation shall be provided and shall be listed as suitable for use with cable tray.

H. Bushings: Provide conduit bushings and bond to ground, attached to tray, to accommodate conduit sleeves terminated at tray or trough. Conduits shall be supported within 6” of tray, independent of tray supports.

END OF SECTION 260536
SECTION 260548 – VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUBMITTALS

A. Refer to section 260510.

1.2 QUALITY ASSURANCE

A. Submittals must be signed and sealed shop drawings from a professional engineer licensed in the state that the project is located in. Shop drawings to include project specific details, sketches, product data cut sheets.

B. The contractor shall provide pre-engineered seismic restraint systems to meet total design lateral force requirements for support and restraint of piping, conduit, cable trays and other similar systems and equipment where required by the applicable building code.

C. System Supports/Restraints Manufactures shall be firms regularly engaged in the manufacture of products of the types specified in this section, whose products have been in satisfactory use in similar service for not less than 5 years.

PART 2 - PRODUCT

2.1 SEISMIC BRACING

A. General:
   1. Seismic restraint designer shall coordinate all attachments with the structural engineer of record.
   2. Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
   3. Analysis shall detail anchoring methods, bolt diameter, and embedment depth.
   4. All seismic restraint devices shall be designed to accept without failure the forces calculated per the details and notes on the construction documents.

B. Friction from gravity loads shall not be considered resistance to seismic forces.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All seismic restraint systems shall be installed in strict accordance with the manufacturer’s seismic restraint guidelines manual and all certified submittal data.

B. Installation of seismic restraints shall not cause any change in position of equipment or piping, resulting in stresses or misalignment.

C. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.

D. Do not install any equipment, piping, duct, or conduit that makes rigid connections with the building.

E. Prior to installation, bring to the architect’s/engineer’s attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment.
selection.

F. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or wedge-type concrete anchors. Consult structural engineer of record.

G. Overstressing of the building structure shall not occur from overhead support of equipment. Bracing attached to structural members may present additional stresses. The contractor shall submit loads to the structural engineer of record for approval in this event.

H. Brace support rods when necessary to accept compressive loads. Welding of compressive braces to the vertical support rods is not acceptable.

I. Provide reinforced clevis bolts where required.

J. Seismic restraints shall be mechanically attached to the system. Looping restraints around the system is not acceptable.

K. Do not brace a system to two independent structures such as a ceiling and wall.

L. Provide appropriately sized openings in walls, floors, and ceilings for anticipated seismic movement.

M. Provide seismic controls as required for all existing electrical items exposed during renovations.

3.2 FIELD QUALITY CONTROL

A. Inspect all seismic supports after installation and submit a report from a professional engineer licensed in the state that the project is located in.

END OF SECTION 260548
SECTION 260553 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUBMITTALS

A. Refer to section 260510.

PART 2 - PRODUCTS

2.1 NAMEPLATES AND LABELS

A. Nameplates: Engraved three-layer laminated plastic, black letters on white background unless noted otherwise.

B. Locations:
   1. Each electrical distribution and control equipment enclosure.

C. Letter Size:
   1. Use 1/4 inch letters for identifying grouped equipment and loads.

D. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background. Use only for identification of individual wall switches, receptacles, and control device stations. Labels shall identify the panel and circuit number (Ex: PANEL: CIRCUIT).

E. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
   2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
   3. UL 94 Flame Rating: 94V-0.
   4. Temperature Range: Minus 50 to plus 284 deg F.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION

A. Install nameplates and labels parallel to equipment lines.

B. Secure nameplates to equipment front using corrosion resistant screws.

C. Secure nameplates to inside surface of door on panelboard that is recessed in finished locations.

D. Provide name plates on all disconnects, panels, switchboards, switchgear, and motor starters.

E. Provide labels on all receptacles, light switches, and wall mounted occupancy sensors.

END OF SECTION 260553
SECTION 262400 – PANELBOARDS

PART 1 - GENERAL

1.1 SUBMITTALS
A. See section 260510.

1.2 QUALITY ASSURANCE
A. Where switchboards or panelboards are used as service entrance equipment, they shall comply with all NEC and UL requirements for service entrance and a UL service entrance label shall be provided.
B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.3 REFERENCE STANDARDS
B. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association; current edition.
C. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association; current edition.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Eaton Electrical/Cutler-Hammer
B. GE Industrial
C. Square D
D. Siemens

2.2 PANELBOARDS
A. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.
B. Panelboard Bus: Copper (98% conductivity).
C. Provide copper ground bus in each panelboard
D. Enclosure: Interior - NEMA 1
E. Cabinet Front: Flush cabinet front with concealed trim clamps, concealed hinge, metal
directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel. Paint all hallway panels to match wall finish.

F. All panelboards shall be hinged "door in door" type with:
   1. Interior hinged door with hand operated latch or latches as required to provide access to circuit breaker operating handles only, not to energized ports.
   2. Outer hinged door shall be securely mounted to the panelboard box with factory bolts, screws, clips or other fasteners requiring a tool for entry, hand operated latches are not acceptable.
   3. Push inner and outer doors shall open left to right.

G. All panelboard shall have bolt-on style breakers.

H. Provisions for future breakers shall be fully bussed complete with all necessary mounting hardware.

2.3 CIRCUIT BREAKERS

A. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers.
   1. Type SWD for lighting circuits.
   2. Type HACR for air conditioning equipment circuits.
   3. Class A ground fault interrupter circuit breakers where scheduled.
   4. Do not use tandem circuit breakers.
   5. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration for all residential applications.
   6. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

2.4 SHORT CIRCUIT CURRENT RATING:

A. Devices which achieve the level of fault protection indicated by means of "series" or "integrated" rating shall not be acceptable unless specifically indicated on the drawings. All panelboards shall be fully rated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1 and NECA 1.

B. Install panelboards plumb. Install recessed panelboards flush with wall finishes.

C. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.

D. Provide filler plates for unused spaces in panelboards.

E. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

F. Provide engraved plastic nameplates on all switchboard and panelboards.

G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.
   1. Minimum spare conduits: 6 empty 1 inch conduits.
H. Ground and bond panelboard and switchboard enclosure according to Section 2605.26.

I. Do not splice conductors in panelboard or switchboard enclosure.

J. Install switchboard on 4" high concrete pad with 3" minimum overlap on all sides. Bolt switchboard to pad in all four corners, minimum.

K. Each section of two section panels shall contain only those conductors which originate in that section. Do not use panel as a wireway.

L. Piggy-back or tandem type breakers shall not be used.

M. Multi-pole breakers shall be common trip, with a single handle.

3.2 ADJUSTING

A. Adjust the breaker trip set point values per an Overcurrent protective device study provided by the contractor.

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

C. Clean all debris from panel interiors.

3.3 LABELING

A. Provide nameplates on all electrical panels that new circuits are modified or installed. Indicate the following information:
   1. Panel name
   2. Panel fed from
   3. Voltage, phase, wire, short circuit current rating
   4. Date installed

B. Provide a typed legend for all modified or new electrical panels. Update the panel board schedules after load balancing.

C. Identify load served and location by room names assigned by user, not by room numbers on floor plans. Note spares and spaces as such.

D. For switchboards Provide laminated plastic nameplate for main and for each feeder circuit. Nameplates shall be secured to switchboard with two screws.

E. Provide ARC flash identification per NFPA 70E.

3.4 CLEARANCE AND WORKSPACE

A. Maintain workspace and clearances as required by the NEC for the voltage encountered. No pipes or ducts shall pass above the outline of the panelboard. It shall be the responsibility of this Contractor to make sure that other trades do not encroach on this space.

END OF SECTION 262400
SECTION 262726 – WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY
A. This section includes the requirements for the following:
   1. Receptacles.
   2. Device plates.
   3. Wall switches.
   4. Occupancy Sensors

1.2 SUBMITTALS
A. Refer to section 260510.

1.3 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
C. Products: Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.4 REFERENCE STANDARDS
B. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; current edition.
C. NEMA WD 6 - Wiring Device -- Dimensional Requirements; National Electrical Manufacturers Association; current edition.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS
A. Acceptable manufacturers
   1. Cooper Wiring Devices
   2. GE Industrial
   3. Leviton Manufacturing, Inc
   4. Hubbell, Inc
   5. Lutron Electronics Inc
   6. Wattstopper Inc
   7. Schneider Electric
   8. Legrand – Pass & Seymour
   9. C.W. Cole & Company

2.2 RECEPTACLES
A. Receptacles: Specification Grade Receptacles, complying with NEMA WD 6 and WD 1.
   1. Device Body: color, plastic.
2. Configuration: NEMA WD 6, type as specified and indicated.
3. Type 5-20.

B. GFCI Receptacles: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements. Feed through GFCI devices shall not be used. GFCI devices shall contain self-testing feature with power lockout if self-test fails.

C. Special Purpose Receptacles: Provide heavy-duty type as indicated on the drawings.

D. Wet Location: A receptacle installed in a wet location shall be GFCI listed weather-resistant type.

2.3 WALL PLATES

A. Cover Plates: Provide one piece wall plates for wiring devices, with ganging and cutouts as required. Provide blank wall plates for all un-used outlet boxes. Provide with metal screws for securing plates to devices, screw heads colored to match finish of plate. All plates shall be standard size, nylon.

B. Weatherproof Cover Plates: All devices installed outdoors and indoor devices specifically indicated, shall be provided with weatherproof covers. Covers shall be of the type that maintains weatherproof integrity when in-use and not in-use. Covers shall be listed and identified as “extra duty” type.

2.4 WALL SWITCHES

A. Wall Switches: Heavy Duty, AC only general-use snap switch, complying with NEMA WD 6 and WD 1.
   1. Body and Handle: color, plastic with toggle handle.
   2. Locator Light: Lighted handle type switch; red color handle.
   3. Ratings: Match branch circuit and load characteristics.

B. Switch Types: Single pole, double pole, 3-way, and 4-way.

2.5 OCCUPANCY SENSORS

A. Wall switch sensors: Passive Infrared type.
   1. Capable of detection of occupancy at desktop level up to 300 sqft, and gross motion up to 1000 sqft with 180 degree coverage capability.
   2. Rating: Sensor rating shall be at least 125% of the connected load.
   4. Sensor shall have no leakage current to load, and voltage drop protection.
   5. Sensor shall provide high immunity to false triggering from RFI and EMI.
   6. Sensor shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.
   7. Sensor shall utilize automatically adjustable time delay and sensitivity settings.
   8. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
   9. A bypass manual override shall be provided on each sensor.
   10. An integral photo cell with adjustable light level shall be provided.
   11. All sensors shall have UL rated, 94V-0 plastic enclosures.

B. Ceiling Sensors: Dual Technology type.
   1. Rating: Sensor rating shall be at least 125% of the connected load.
   2. Sensor shall be ceiling mounted in such a way as to minimize coverage in unwanted areas.
3. Sensor shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.
4. Passive Infrared Sensor shall provide high immunity to false triggering from RFI and EMI.
5. Ultrasonic Sensor shall adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout the controlled space.
6. Sensor shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.
7. Sensor shall utilize automatically adjustable time delay and sensitivity settings.
8. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
9. A bypass manual override shall be provided on each sensor.
10. All sensors shall have UL rated, 94V-0 plastic enclosures.

C. Circuit Control Hardware – Where required.
   1. Control Unit: Self-contained unit consisting internally of isolated load switching relay(s) and transformer to provide low-voltage power.
   2. Control Unit shall provide power to a minimum of two sensors.
   3. Relay Contacts shall have ratings as required for connected load.

PART 3 - EXECUTION

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

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

3.3 INSTALLATION
   A. Install securely, in a neat and workmanlike manner, as specified in NECA 1.
   B. Install devices plumb and level.
   C. Do NOT utilize back wiring on any wiring device.
   D. Install receptacles with grounding pole on top.
   E. Do not install receptacles within 6” of the edge of sinks.
   F. Connect wiring device ground terminal to outlet box with bonding jumper.
   G. All receptacles installed as listed below shall be GFCI type.
      1. Receptacles installed outdoors.
2. Receptacles installed within six feet of sinks.
3. Receptacles designated for electric drinking fountains.
4. Receptacles designated for vending machines.
5. Any other receptacles specifically indicated on the drawings.

H. Install decorative plates in finished areas.
I. Connect wiring devices by wrapping conductor around screw terminal.
J. Provide engraved stainless steel wall plates that indicate the branch circuit to which the associated devices is connected. Use 1/8” high black letters.
K. Install switches with OFF position down.

3.4 FIELD QUALITY CONTROL
A. Inspect each wiring device for defects.
B. Verify that each receptacle device is energized.
C. Test each receptacle device for proper polarity.
D. Test each GFCI receptacle device for proper operation.
E. Operate each wall switch with circuit energized and verify proper operation.

3.5 ADJUSTING
A. Adjust devices and wall plates to be flush and level.

3.6 CLEANING
A. It is anticipated that painting and other finish work may occur after device installation. Device plates shall not be installed until these activities are completed. Protect device and conductors by installing molded plastic cover.
B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION 262726
SECTION 265100 – LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the requirements for the following:
   1. Interior luminaires and accessories.
   2. Emergency lighting units.
   3. Exit signs.
   4. Lamps.
   5. Luminaire accessories.

1.2 SUBMITTALS

A. Refer to section 260510.

1.3 QUALITY ASSURANCE

A. Conform to requirements of ICC and NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.4 REFERENCE STANDARDS


F. IESNA LM-80-08 – Approved Method: Measuring Lumen Maintenance of LED Light Sources.


H. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; current edition.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of design is as scheduled on drawings. Equal products by other manufacturers are acceptable providing substitutions are submitted in accordance with requirements listed elsewhere in the Bid Documents and approved by the A/E.

B. Equal Manufacturer(s) are listed in lighting fixture schedule on drawings.

C. LM-79 reports must be submitted with all proposed LED substitutions from those listed in the Light Fixture Schedule.

2.2 LUMINAIRES

A. Furnish products as indicated in Schedule on plans.

2.3 LAMPS

A. Lamp Types: As specified for each luminaire.

B. Use lamp colors as indicated on the plans or to match existing lamp colors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting).

B. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.

C. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.

D. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

E. Install recessed luminaires to permit removal from below.

F. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

G. Install clips to secure recessed grid-supported luminaires in place.

H. Install wall mounted luminaires, emergency lighting units, and exit signs at height as indicated on Drawings.

I. Install accessories furnished with each luminaire.

J. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

K. Bond products and metal accessories to branch circuit equipment grounding conductor.
L. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.

3.2 FIELD QUALITY CONTROL
   A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.3 ADJUSTING
   A. Aim and adjust luminaires as indicated.
   B. Position exit sign directional arrows as indicated.

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

3.5 CLOSEOUT ACTIVITIES
   A. Demonstrate luminaire operation for minimum of two hours.

3.6 PROTECTION
   A. Replace/Repair luminaires that have failed at Substantial Completion.

END OF SECTION 265100