

SECTION 260010 - ELECTRICAL GENERAL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. These electrical general provisions specified herein apply to all Sections of Division 26.
- B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 26.
- C. This Section includes responsibilities and obligations in support of the performance verification specified in Section 260090, Electrical Performance Verification.

1.2 QUALITY ASSURANCE

- A. Conform to the following:
 - 1. North Carolina State Electrical Code-2018.
 - 2. North Carolina State Energy Conservation Code-2018.
 - 3. NECA 1-2015.
 - 4. NECA 200-2016.
- B. Codes, standards and regulations specified herein refer to the edition date. Revisions and addenda to these codes, standards and regulations shall be part of these specifications. Provisions of referenced codes, standards and regulations do not create duty or responsibility by the Architect or the Owner, unless otherwise specified herein.
- C. Codes, standards and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes, standards and regulations, the drawings or specifications govern.
- D. Electrical Design Coordination:
 - 1. The power ratings of mechanical, plumbing, and fire suppression system motors and equipment and the characteristics of electrical systems serving them, as specified in other divisions, have been established as minimums which will allow that equipment to satisfactorily function while producing the capacities indicated on the Drawings or specified herein. These power ratings include a safety factor deemed appropriate to accommodate common differences between design parameters and field construction practices.
 - 2. Reasonable efforts have been made to coordinate the electrical requirements of the equipment specified in other divisions with the electrical systems serving that equipment. Differences among manufacturers of equipment make it impossible to produce a single electrical design which will satisfy the varying electrical requirements of those manufacturers. Consequently, the Contractor shall coordinate the electrical requirements of the equipment actually furnished on this Project and provide the electrical systems required by that equipment. This coordination effort shall be completed prior to the installation of either the equipment or the electrical systems serving that equipment. Electrical system revisions required to coordinate with the equipment actually furnished shall be provided at no additional cost to the Owner.
 - 3. Equipment specified in other divisions:
 - a. Audio-visual systems.
 - b. Automatic temperature controls.
 - c. Building control system.
 - d. Communications systems.

- e. Elevators.
- f. Fire detection and alarm systems.
- g. Fire suppression systems.
- h. Fuel systems.
- i. Heating, ventilating and air conditioning systems.
- j. Laundry equipment.
- k. Modular furniture systems.
- l. Plumbing systems.
- m. Power-operated doors.
- n. Security systems.
- o. Sprinkler waterflow and valve monitor switches.
- p. Projection screens

1.3 SPACE CONDITIONS

- A. Drawings are diagrammatic in nature and, unless explicitly dimensioned, indicate appropriate locations of fixtures, apparatus, equipment and raceways. Changes in the location, and offsets, of same to accommodate building conditions and coordination with the work of other trades, shall be made during the preparation of coordination drawings and prior to initial installation, without additional cost to the Owner.
- B. Locations of motors, starters, equipment and apparatus as indicated on the Drawings are approximate; connections shall be made to such equipment as actually installed.
- C. Provide access to equipment and apparatus requiring operation, service or maintenance throughout the life of the system.
- D. Install switchboards and panelboards, such that no piping, ductwork or mechanical equipment is installed in the space equal to the width and depth of the equipment from floor to structure above. In addition switchboards, panelboards, variable frequency drives, transformers, and starters shall be installed such that the working space in front, rear and/or side (where rear and/or side access is required to work on equipment) is clear of piping, ductwork, or mechanical equipment. Dimensions of the working space shall be a minimum depth of 42" horizontally, the width of the equipment or 30", whichever is greater, and the height of the equipment or 78", whichever is greater. Minimum depth shall be increased to 60" for equipment rated over 600 V.
- E. Do not install pad-mounted transformers less than 15' from any doorway or building structure (exterior walls, walkways, overhangs, balcony or windows). Orient the transformer such that the access area is facing away from the building.

1.4 ENVIRONMENTAL AIR-HANDLING SPACES

- A. Electrical power conductors installed in environmental air-handling spaces shall be approved for installation in plenum areas.
- B. Communications, data, control, and signal cable not in conduit or enclosed wireways shall be approved for installation in plenum areas.
- C. Busway installed in spaces above or behind access panels used for environmental air shall be feeder type with no provisions for plug-in connections.

1.5 ASBESTOS MATERIALS

- A. Materials containing asbestos or any trace of asbestos related materials shall not be used on this Project.

1.6 DEFINITIONS

- A. Exposed raceways are those which can be seen when the base building is complete without opening or removing access doors or panels or accessible ceiling components.
- B. Other raceways are considered to be concealed.

1.7 RELATED WORK DESCRIBED IN OTHER DIVISIONS

- A. Cutting, coring, waterproofing, and patching of walls, floors, ceilings, roofs and structure of existing building.
- B. Installation of access panels in wall and ceiling construction.
- C. Painting, except as specified herein.

1.8 SUBMITTALS

- A. Within 5 days after notice to proceed, submit a schedule indicating the proposed submission date of each submittal specified herein. Schedule shall anticipate the submittal review time, the possible need for resubmittals, and the time required for fabrication, shipping and integration into the construction sequence. Architect will advise of any conflicts in reviewing submittals that the proposed schedule presents.
- B. Submittals shall be prepared in a line-by-line format corresponding to these Specifications and shall indicate compliance with each requirement specified herein and indicated in the Drawings.
 - 1. In addition to any other transmittal or cover sheet used, fill out and attach to each individual submittal a copy of the Cover Sheet for Submittals to Newcomb & Boyd included at the end of this Section.
 - 2. Indicate manufacturer's installation instructions.
 - 3. Indicate deviations, if any, including any from the manufacturer's installation instructions.
 - 4. Reproductions or electronic versions of design drawings shall not be used in the preparation of shop drawings.
 - 5. Resubmittals that are required to address review comments shall include a cover transmittal with a written explanation of how each review comment has been addressed.
 - 6. Submittals not specifically required, or not complying with the format requirements, will be returned unreviewed.
 - 7. Shop drawings and submittals shall be provided in portable document format (PDF). PDF files containing multiple drawings or components shall include an index of the file contents and electronic bookmarks.
- C. Electrical submittals shall include the following:
 - 1. Cable trays, including dimensional layout drawings showing support and hangers locations, floor opening requirements, elevations, switchboard adaptors, conduits, and boxes.
 - 2. Performance Verification Supervisor qualifications.
 - 3. Coordination drawings, with dimensions and elevations of electrical conduit 2" and larger, cable trays, busways, equipment, and recessed luminaires, coordinated with the work of other trades, including HVAC, plumbing, fire suppression, structural, and architectural, minimum 1/4" = 1'-0" scale.
 - 4. Dry-type transformers.
 - 5. Electrical equipment room drawings, with dimensions and elevations, for each riser closet and major electric and telephone/data room showing equipment, risers, and code required clearances, minimum 1/4" = 1'-0" scale. Drawings shall be submitted prior to or concurrent with distribution equipment submittals.

6. Emergency power supply system, including generator decrement curve and available fault current at the generator terminals.
7. Floor boxes.
8. Individual circuit breakers.
9. Lighting control devices.
10. Lightning protection system.
11. Low voltage busways.
12. Luminaires, including:
 - a. Data including specified options, photometrics, mounting or suspension devices, and associated details.
 - b. Emergency driver information including initial lumen output, input voltage, battery type, and test switch/indicator lamp arrangement.
13. Modular flexible wiring systems, including circuit diagrams.
14. Occupancy sensor layout and coverage drawings showing sensor locations and coverage patterns in spaces with lighting controlled by occupancy sensors. Drawings shall be minimum 1/8" = 1'-0" scale.
15. Overcurrent protective devices.
16. Panelboards.
17. Short circuit and overcurrent protective device coordination study.
18. Surge protective devices.
19. Switchboards, including equipment nameplate designations.
20. Time switches.
21. Uninterruptible power supply, including size, weight, and configuration, and equipment nameplate designations.
22. Vibration isolation.

1.9 EQUIPMENT AND INSTALLATION REQUIREMENTS

- A. Motor quantities, sizes and equipment wattage ratings specified in other divisions or indicated on the Drawings are the minimum requirements. Motor quantities, sizes and equipment wattage ratings less than those specified in other divisions or indicated on the Drawings are not acceptable. Larger motor sizes and equipment wattage ratings may be provided if necessary to meet the prescriptive requirements specified in those divisions. Where multiple motors or motor sizes or equipment wattage ratings larger than specified in those divisions or indicated on the Drawings are furnished, provide and coordinate the corresponding increased number or capacity of feeders and other electrical equipment serving them, at no additional cost to the Owner.
- B. Equipment and materials, except as otherwise specified herein, shall be new and shall be of the customary standard and quality furnished by the designated manufacturer for that catalogue number.
- C. Materials and equipment shall be UL listed, and shall bear the UL listing mark on products for which standards have been established and for which listing is regularly furnished by UL.

1.10 SHORT CIRCUIT AND OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

- A. Submit a short circuit and overcurrent protective device coordination study prepared in accordance with IEEE 242-2001 and IEEE 399-1997 by the switchboard manufacturer at the time of final submittal of the switchboard submittals. Studies shall be prepared under the supervision and approval of a licensed professional electrical engineer skilled in performing and interpreting power system studies. Do not release the switchboard for construction until the study is submitted and approved.

1. The short circuit study shall show that electrical equipment including switchgear, switchboards, panelboards, motor control centers, busways, switches, and overcurrent protective devices in the electrical distribution system are applied within their short circuit and withstand current ratings.
 2. The short circuit and overcurrent protective device coordination study shall include:
 - a. Time current curves, with different color for each curve, plotted on full scale log-log graph paper for overcurrent devices, starting characteristics of motors, transformer full load current, magnetizing current and withstand parameter curves, cable damage curves, engine-generator set fault current and decrement curves, and motor starting characteristics and damage points. Curves for adjustable devices shall be shown adjusted to afford maximum coordination with upstream and downstream devices, including devices provided by the electric utility system, and minimize arc flash hazard levels.
 - b. Source impedance data, including electric utility system and motor fault contribution characteristics.
 - c. One-line diagram showing equipment designations, protective device ampere ratings and associated designations, cable size and lengths, transformer kVA and voltage ratings, motor and engine-generator set kVA ratings, available fault at each bus, bus withstand ratings, and device interrupting ratings, and arc flash protection boundary, incident energy, and PPE.
 3. For this study, assume a maximum 21.5 KAIC fault current capacity is available from the utility transformer UT-EOC and a maximum 33.9 KAIC fault current capacity is available from the utility transformer UT-T. Refer to electrical drawings for transformer designations.
 4. The sources of fault current for the study shall include the utility's single-line-to-ground fault and three-phase bolted fault with X/R ratio for each fault component and fault current contributions from engine-generator sets.
 5. The interrupting capacity of overcurrent devices shall equal or exceed the maximum fault current level where they are installed in the system. Except as specified herein, the system shall be fully rated in that the ability of the device to interrupt a fault at its terminals shall not depend on the characteristics of an overcurrent device upstream.
 6. The branch circuit devices installed in panelboards having mains 225 A and smaller may be series rated with the main breaker in the panel, the breaker serving the panel, or the fuse serving the panel, provided that the device is 225 A or smaller.
 7. Where minimum interrupting capacities are indicated on the Drawings, the value is the minimum symmetrical AIC required. Where interrupting capacities are not indicated for a particular device, the interrupting capacity of the next device upstream shall be used.
 8. Where the short circuit study indicates a fault level different from that indicated on the Drawings, describe the variance and include back-up information and calculations.
 9. A schedule of adjustable devices indicating proper dial and tap settings to achieve the plotted characteristics shall be submitted with the study.
 10. Short circuit and overcurrent protective device coordination study shall be submitted in the form of 1 set of original reproducible, 3 copies thereof, and an electronic copy in PDF format.
- B. Submit concurrently with the overcurrent protective device coordination study an arc flash evaluation study prepared in accordance with NFPA 70E-2018 and IEEE 1584-2018, by the switchboard manufacturer. The study shall determine the flash protection boundary and personal protective equipment required for personnel within the flash protection boundary and shall include the creation of arc flash hazard warning labels. The study results shall be summarized in a final report and included with the short circuit and overcurrent protective device coordination study. Do not energize electrical equipment until the study is submitted and approved and the arc flash labels are affixed on the equipment.
1. The flash protection boundary and the incident energy shall be calculated at significant locations in the electrical distribution system (switchboards, switchgear, motor control centers, panelboards, busway and splitters) where work could be performed on energized parts.
 2. Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm².
 3. Arc flash calculations shall include:
 - a. Arcing fault magnitude.

- b. Device clearing time.
 - c. Duration of arc.
 - d. Arc flash boundary.
 - e. Working distance.
 - f. Incident energy.
 - g. Hazard risk category.
- 4. Arc flash labels shall have an orange header with the wording "WARNING, ARC FLASH HAZARD" and shall include the following information:
 - a. Location designation.
 - b. Nominal voltage.
 - c. Flash protection boundary.
 - d. Hazard risk category.
 - e. Incident energy.
 - f. Working distance.
 - g. Required level of personal protective equipment.
 - h. Engineering report number, revision number and issue date.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATION

- A. Apparatus shall be by one manufacturer, except where specified herein otherwise.
- B. Isolators shall conform to the following:
 - 1. Type DN - Double-deflection neoprene type, with neoprene-coated metal surfaces, and top and bottom surfaces ribbed. Isolators shall have bolt holes in the base.
 - a. Manufacturer: Kinetics Noise Control RD, Mason ND, Vibration Eliminator T44 or D44, VMC Group R or RVD, or Vibro-Acoustics RD.
 - 2. Type NH - Double-deflection neoprene or natural rubber hanger type, with neoprene or natural rubber grommet between hanger rod and housing. Neoprene or natural rubber element shall have neoprene- or natural rubber-coated metal surfaces.
 - a. Manufacturer: Kinetics Noise Control RH, Mason HD, Vibration Eliminator C, VMC Group HR, or Vibro-Acoustics NH.

2.2 SEISMIC AND WIND RESTRAINTS

- A. Seismic force design shall be determined in accordance with the following seismic design criteria:
 - 1. Office Tower
 - 2. Seismic Design Category: C
 - 3. Risk Category: II.
 - 4. Component Importance Factor, I_p : 1.0.
 - 5. E.O.C. Building
 - 6. Seismic Design Category: D.
 - 7. Risk Category: IV.
 - 8. Component Importance Factor, I_p : 1.5.
- B. Provide restraint devices as required for vibration isolated and nonvibration isolated electrical components. Provide calculations to determine restraint loadings for specific equipment to be installed resulting from seismic forces on equipment. Seismic restraint calculations shall be signed by a licensed engineer in the employ of the seismic restraint device manufacturer.

- C. For roof-mounted equipment and components both the seismic acceleration and wind loads shall be calculated, and the highest load shall be utilized for the design of the seismic restraints and vibration isolators.
- D. Exceptions for electrical components listed within the applicable project building code may be utilized. However, use of exceptions shall be noted with submitted seismic restraint calculations.
- E. Seismic restraints and vibration isolators provided with integral seismic restraint capacity shall have Anchorage Preapproval "R" Number from OSHPD in the State of California listing minimum certified horizontal and vertical load ratings.
- F. Provide restraint devices as necessary for luminaires in suspended ceiling systems as required by ASTM E580/E580M-2017.
- G. Floor-Mounted Restraints:
 - 1. All-directional external seismic restraints for floor-mounted components shall consist of interlocking steel assemblies restrained when engaged under seismic motion by elastomeric material with a minimum thickness of 0.25". The minimum air gap between interlocking assemblies shall be 0.125".
 - 2. Restraints for neoprene vibration isolators shall consist of Type DN isolators with the addition of welded steel housings to resist seismic forces.
 - 3. Restraints for free-standing floor springs shall consist of Type FS isolators with the addition of welded steel housings to resist seismic forces. Restraints shall allow a maximum movement of 0.25" in all directions.
 - 4. Manufacturer: Kinetics Noise Control, Mason, VMC Group, Vibration Eliminator, or Vibro-Acoustics.
- H. Suspended Restraints:
 - 1. Restraints for vibration isolated suspended equipment, conduit, and raceways shall consist of galvanized or stainless steel aircraft cables with end connection fittings designed to swivel in order to ensure proper cable alignment and avoid bending of cable.
 - 2. Restraints for nonvibration isolated suspended equipment, conduit, and raceways shall consist of steel angle or unistrut with anchor bolts and end connection fittings designed to swivel to the final installation angle.
 - 3. Manufacturer: B-Line, International Seismic Application Technology, Kinetics Noise Control, Mason, Tolco, VMC Group, Vibration Eliminator, or Vibro-Acoustics.

2.3 CONCRETE

- A. Normal weight concrete (145 pcf) using Type I Portland Cement, 1" maximum size coarse aggregate to provide a minimum 28 day compressive strength of 3000 psig.

2.4 GROUT

- A. Nonshrink type, conforming to ASTM C1107/C1107M-2017 when tested at fluid consistency. Grout shall exhibit zero bleeding at every age when mixed to fluid consistency. Minimum 28 day compressive strength, when mixed to fluid consistency, shall be 7000 psig.
- B. Manufacturer: Cormix, or Master Builders.

2.5 ACCESS PANELS - BUILDING

- A. Refer to Section 083113, Access Panels.

2.6 SLEEVES

- A. Wall sleeves shall be galvanized rigid metal conduit or electrical metallic tubing.
- B. For floor slabs above grade, plastic core form block-outs shall be used.

2.7 PENETRATION SEALS

- A. Firestops:
 - 1. Refer to Section 078443, Joint Firestopping.
- B. Seal Assemblies:
 - 1. Seal assemblies shall consist of a frame, compression mechanism, and insert modules. Assemblies shall be waterproof and shall be designed to allow easy addition or deletion of penetrating items.
- C. Surge Protective Devices (SPDs):
 - 1. This SPD specification applies to low voltage signal or communications cabling only. See Section 26 67 10, Surge Protective Devices for other SPD applications.
 - 2. SPDs shall incorporate silicon avalanche technology, shall operate bidirectionally, and have a turn-on and turn-off time of less than 5 nanoseconds. Additional minimum requirements include:
 - a. Communication or Signal Conductor Transient Suppressors:
 - 1) SPDs shall be UL listed in accordance with UL 497B-2004.
 - 2) Maximum single impulse current conductor-to-conductor or conductor-to-ground: 10000 A, 8 x 20 μ s waveform, or 200 A, 10 x 1000 μ s waveform.
 - 3) Pulse life rating: 3000 A, 8 x 20 μ s waveform, 2000 occurrences, or 50 A, 10 x 1000 μ s waveform, 200 occurrences.
 - 4) Maximum clamping voltage at 100 A, 10 x 1000 μ s waveform, with the peak current not to exceed the normal applied voltage by 150%, except for coaxial cable suppressors with peak current, the maximum clamping voltage shall not exceed the normal applied voltage by 200%.
 - 5) Failure mode: fail short.
 - b. Manufacturer: Advanced Protection Technologies, Ditek, Emerson, Lightning Eliminators & Consultants, or Transtector.

2.8 UNDERGROUND WARNING TAPE

- A. Tape shall be acid and alkali resistant polyethylene film tape, 6" wide with minimum thickness of 0.004", specifically designed for marking and locating of underground utilities.
- B. Tape shall be manufactured with integral wires, foil backing or other means to enable detection by metal detectors when the tape is buried up to 18" deep. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion.
- C. Tape color shall be as specified below and shall bear a continuous printed inscription describing the specific utility:

<u>Utility</u>	<u>Color</u>
Electric	Red
Telephone/Data	Orange
Television	Orange
Security	Orange

Fire Communications

Orange

- D. Manufacturer: Carlton Industries, Empire Level, Seton, or Stranco.

2.9 IDENTIFICATION MATERIALS

- A. Emergency system markers: self-adhesive vinyl or plastic-coated cloth tape, approximately 1.5" x 2.5" with red background, printed as follows: "Contains Emergency Circuits - Do Not Install Conductors Within This Enclosure That Are Not Part of the Emergency System - Reconnect and Reenergize All Emergency Circuits As Soon As Possible."
- B. Tags: preprinted or partially preprinted accident prevention and operational tags, on plasticized card stock with matte finish for writing, approximately 3.25" x 5.625", with brass grommets and wire fasteners, and appropriate wording.
- C. Signs: 14" x 10" size, 0.04" thick aluminum base with baked enamel finish for indoor or outdoor use.
- D. Nameplates and Labels:
1. White core plastic laminate with engraved lettering.
 2. Nameplate background color shall be black for normal power equipment and red for emergency power equipment.
 3. Nameplates for individual devices shall have 0.25" high letters.
 4. Nameplates for panelboards, switchboards, motor control centers, circuit and motor disconnects, dry-type transformers, and equipment shall have 0.5" high letters.
 5. Labels shall have minimum 0.25" high letters.

2.10 MISCELLANEOUS

- A. Diagram framing system: 0.125" thick acrylic with satin finish aluminum frames.

2.11 PAINTING

- A. Paint for high temperature equipment shall be high temperature resistant, designed for the temperatures at which the equipment will operate.

PART 3 - EXECUTION

3.1 PROTECTION OF EQUIPMENT AND MATERIALS DURING CONSTRUCTION

- A. Provide protective covers, skids, plugs or caps to protect equipment and materials from damage or deterioration during construction.
- B. Store equipment and material under cover, and off the ground or floors exposed to rain.
- C. For outdoor storage, protective covers of 10 mil thick black sheet plastic shall be fitted over equipment and materials. Covers shall be reinforced to withstand wind and precipitation. Set equipment and material on skids or platforms of height to avoid damage or deterioration from spattering and ground water.
- D. Provide dust and debris protection for motors, fixtures, and equipment operated during construction.

3.2 EQUIPMENT AND INSTALLATION REQUIREMENTS

- A. Cut and repair walls, floors and ceilings for the installation of the electrical work.
- B. Exterior building walls below grade shall not be pierced by hanger bolts.
- C. Except where specific instructions are included herein, install and connect equipment in accordance with the manufacturers' instructions and recommendations.
- D. Refer to manufacturer's or equipment supplier's shop drawings for exact type, number, location, dimensions and size of connections to equipment, including but not limited to:
 - 1. Fire protection equipment.
 - 2. Laundry equipment.
 - 3. Heating, ventilating, and air conditioning equipment, including power supplies to automatic temperature control systems.
 - 4. Plumbing equipment.
 - 5. Vertical transportation equipment.
- E. Provide final connections to electrically powered equipment provided under this and other Divisions of these specifications and by the Owner.
- F. In unfinished areas designated for future build out, install conduit and equipment tight against the structure to maximize the future ceiling height.
- G. Maintain physical separation between ferrous wiring methods, such as raceways, metal clad cable, armored cable, or outlet boxes, with piping for other systems. Where contact is unavoidable, provide separation with listed insulating material.
- H. Maintain minimum clearance of 12" between conduits and hot surfaces. This includes, but is not limited to:
 - 1. Heaters.
 - 2. Hot water piping.
 - 3. Flues.
- I. Coordinate the location of electrical equipment in elevator machine rooms with the approved elevator machine room shop drawings.

3.3 SHORT CIRCUIT AND OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

- A. Obtain information required for the study from the utility company and the equipment manufacturers.
- B. Protective devices shall be set and calibrated as recommended by the final approved fault current and coordination study.
- C. Apply arc flash hazard labels to equipment.

3.4 VIBRATION ISOLATION

- A. General:
 - 1. Select and locate vibration isolation equipment to give uniform loading and deflection, according to weight distribution of equipment.
 - 2. Vibration isolators shall be installed and connected, as specified herein, or as indicated on the Drawings, in accordance with the manufacturer's written instruction and certified submittal data.

B. Equipment Isolation:

1. Engine-generator sets not tank-mounted shall be mounted on Type FS isolators with a minimum static deflections of 1" 2".
2. Floor-mounted transformers shall be mounted on Type DN isolators with a minimum static deflection of 0.1".
3. Suspended transformers shall be supported with Type NH isolators with a minimum static deflection of 0.1".
4. Type AS isolators shall be connected to the building control air supply system. Threads cut into compressed air galvanized pipe shall be painted with zinc-rich paint.
5. Threads on compressed air fittings and bolts shall be fully engaged. Threads shall be made up using joint compound or Teflon tape.
6. Mount air compressor on Type NS isolators with a minimum static deflection of 2".

3.5 SEISMIC AND WIND RESTRAINTS

- A. Restraints shall be installed after the equipment is mounted, connected, and operating to ensure that no contact occurs during normal equipment operation.
- B. Installation of seismic restraints shall not cause any change of position of equipment, conduit, or raceways, resulting in stress and misalignment.
- C. No rigid connections between equipment, conduit, or raceways and the building structure shall be made that degrade the vibration isolated system specified herein.
- D. Equipment that is internally vibration isolated and restrained shall have its entire unit assembly seismically attached to the structure.
- E. Do not brace a system to two different structures, such as a wall and a ceiling.
- F. Luminaires in suspended ceilings shall have cable restraints as required.
- G. After installation, manufacturer shall verify that seismic and wind restraints are installed and operating properly, and shall submit a certificate so stating.

3.6 FOUNDATIONS

- A. Provide concrete foundations for floor-mounted or grade-mounted switchboards, transformers, engine-generator sets, uninterruptible power supplies, and other similar equipment.
 1. Exterior foundations: minimum 8" thick pad, minimum 4" above surrounding grade with the exception of engine-generator sets which shall be a minimum of 6" above surrounding grade.
- B. Foundations shall be continuous and shall have beveled edges and smooth float finish. Foundations shall be reinforced with No. 3 bars a maximum of 12" on center each way, and held in place with dowel rods at each corner anchored in the slab. Dowel rods shall not penetrate the slab waterproofing.
- C. Roughen and clean exposed slabs before pouring foundations. Apply bonding agent to surfaces in contact.
- D. Foundations shall extend beyond the equipment footprint in each direction, including appurtenances, vibration isolators, and motors as follows: exterior - 6"; interior - 1", but not less than 1.5 times the seismic anchor embedment depth from the point of anchoring.
- E. Exterior foundations shall be supported on natural ground with organic material under pad removed. The subgrade shall be compacted to 90% modified proctor maximum dry density, ASTM D1557-2012e1, to a

depth of 12". If the compaction density cannot be achieved with the existing soil, the existing subgrade shall be removed to a depth of 12" and replaced with clean backfill and compacted as specified above. A 4" thick granular subbase of sandy gravel or crushed stone shall be compacted with vibratory compactors. Dampen the subbase prior to concrete placement. At the time of placement, the subbase shall not contain standing water.

- F. Fill voids between baseplates and foundations, and level equipment, with grout.

3.7 ACCESS PANELS - BUILDING

- A. Where electrical work is concealed by walls or ceilings, or is inaccessible, provide an access panel to provide access for service and maintenance.
- B. Electrical work located above ceilings is considered accessible if the ceiling is the accessible type and is arranged for access to the equipment.
- C. Fire rated access panels shall be provided in fire barriers, with ratings to match the construction fire rating.
- D. Access doors providing access to equipment access doors shall allow for service and maintenance of the intended equipment.
- E. Installation of access panels is specified under another Division.

3.8 SLEEVES

- A. Provide where conduits pass through elevated floor slabs if conduits are not a part of the slab pour, and for future cable or conduit risers.
 - 1. Install in raised foundations at least 2" high in electrical and mechanical rooms.
- B. Provide where communications and other cables, not installed in conduits, pass through walls and elevated floor slabs.
- C. Wall sleeves shall extend 4" from each side of the wall.
- D. Openings through slabs for busway risers shall be finished with a 4" wide x 2" high curb around the opening.
- E. Sleeves shall be secured in place. Provide insulating bushings on both sides of sleeves for cables.
- F. Provide ground bushings on both sides of sleeves containing ground conductors.

3.9 PENETRATION SEALS

- A. General:
 - 1. Install in accordance with the manufacturer's published instructions to achieve ratings and classifications specified herein. A copy of these instructions shall be maintained and available on site.
- B. Firestops:
 - 1. Close and firestop abandoned penetrations and penetrations through fire- and smoke-rated construction. Materials used to seal these penetrations shall continue the construction's fire and

- smoke resistance ratings uninterrupted and shall maintain an effective barrier against the spread of flame, smoke, water and hot gases.
2. Install after installation of raceways and cable trays.

C. Expansion Seals:

1. Install to seal single conduit or cable penetrations of walls below grade.

D. Seal Assemblies:

1. Install to seal the penetration of walls below grade by multiple cables in the same opening.

3.10 PAINTING

- A. Except where otherwise specified herein, painting shall be done under another Division. Surfaces shall be left clean and free from oil.
- B. Equipment factory finishes damaged or deteriorated during construction shall be repaired to match original finish.
- C. Where galvanizing is broken during fabrication or installation, recoat exposed areas with zinc-rich paint.
- D. Exterior ferrous equipment and supports shall be painted 2 coats of rust preventive paint, color selected by the Architect.
- E. Exposed interior ferrous equipment, and exposed nongalvanized ferrous accessories and metal shall be prepared and painted 1 coat of corrosion resisting paint prior to other painting or identification, or 2 coats of corrosion resisting paints if no other painting is specified herein.

3.11 EXCAVATION AND BACKFILLING

- A. Determine exact location of existing underground utilities before excavation.
- B. Excavation shall be no longer or deeper than necessary. Backfill material shall be free from rocks and debris.
- C. Compact backfill as the excavation is filled.
- D. Excavation, shoring, bracing, backfilling, and compaction, cutting and patching of hardscape, and restoration of landscape shall conform to Division 31, Earthwork.

3.12 COORDINATION

- A. Provide offsets, transitions, and fittings to coordinate the work of each trade with that of other trades, including HVAC, plumbing, fire suppression, structural, and architectural.

3.13 UNDERGROUND WARNING TAPE

- A. During backfilling, install tape continuously at 4" to 6" below finished grade, above buried power, communications, or signal cables, conduits, and duct lines.
- B. Install multiple markers where cables are installed in groups exceeding 18" width.

3.14 CLEANING

A. Luminaires:

1. Remove dirt, dust, and grease, and polish reflector and trim surfaces, and clean lamps.

B. Equipment and Equipment Rooms:

1. Remove dust, dirt, rust, stains, and temporary covers.
2. Foreign matter shall be blown, vacuumed, flushed, or cleaned out of and from equipment, luminaires, raceways, devices, switches, controls and panelboards.
3. Clean and polish identification plates.
4. In equipment rooms, clean equipment, conduit, and room surfaces from dust and dirt and maintain in a clean condition from date of substantial completion until final completion of work and corrective work.
5. Remove excess material from the project site.

3.15 IDENTIFICATION

A. General:

1. Identification shall consist of upper case letters.
2. Where identification is applied to surfaces which require a finish, identification shall be installed after surface has been finished.

B. Box Color-Coding:

1. Paint cover of junction and pull boxes, connectors, couplings, bushings, hubs, entire conduit within 6" of a box, and panelboard backboxes for the different systems as listed below:

<u>System</u>	<u>Color</u>
277 through 600V	White/green lettering
120 through 240	White/black lettering
System Emergency Power	Orange/black lettering
System Normal Power	Silver (unpainted)
Fire Alarm	Red/white lettering
Telephone	White
Data	Yellow
HVAC Controls	Blue/white lettering
Video Surveillance	Yellow

- C. Emergency system markers: install markers on boxes and enclosures, including transfer switches, engine-generator sets, and panels for emergency circuits. In addition, identify in indelible marker, emergency branch circuit panel and circuit numbers for branch circuits contained within each outlet box, on the cover of each box.

- D. Cable identification: install cable identification on each communication or signal cable.

E. Warning Signs:

1. Switchboards, panelboards, control panels, and motor control centers: install a warning sign on equipment enclosure in clear view which states, "Warning – Arc Flash and Shock Hazard – Appropriate Personal Protective Equipment Required." Signs shall be 5" wide by 3.5" high or larger.

- F. Danger signs: install in areas constituting a danger for persons in or about the Project.

G. Nameplates and Labels:

1. Install engraved nameplates at or on each circuit breaker, circuit and motor disconnect, motor controller, panelboard, switchboard, UPS system, lighting control panel, dry-type transformers, special apparatus, and communications and signal system, unless equipment is specified herein with its own self-explanatory identification. Text shall match terminology and numbering of the construction documents and submittals as close as practicable, and shall indicate equipment controlled as well as upstream distribution device and branch circuit or feeder designation.
2. Nameplates shall not cause interference with operation and maintenance of equipment. Attach nameplates with rustproof screws.

H. Wiring devices: refer to Section 261430, Wiring Devices, for emergency marking and labeling requirements.

I. Panelboards: install type written directories describing the load served by each circuit. Identify spaces and spares in pencil. Install on back of panelboard doors.

J. Provide a sign at the normal service switchboard, and emergency power supply system switchboard, and fire pump service disconnect switch indicating other services and feeders supplying the building and the location of each.

K. Provide a sign at the normal service switchboard indicating the type and locations of the on-site emergency power source.

L. Provide a sign at the service switchboard indicating the maximum available fault current. The sign shall indicate the date the fault-current calculation was performed.

M. Label each ground connection at the main grounding bus location to identify emergency and normal sources connected at that location.

3.16 OPERATION AND MAINTENANCE DOCUMENTATION PACKAGE

A. These operation and maintenance manual requirements supplement operation and maintenance manual documentation requirements of other Sections of these specifications.

B. Operation and maintenance documentation, in hardback 3-ring loose-leaf binders except full size drawings and CDs, shall cover the electrical systems. Documentation shall include the following: operations and maintenance documentation directory; emergency information; operating manual; maintenance manual; test reports; and construction documents.

C. The operation and maintenance documentation package shall be submitted as one comprehensive package to the Owner 3 months before systems start-up, and shall be updated, revised and completed at completion of construction.

D. Documentation shall be typewritten and shall contain, at a minimum, the following information.

1. Introduction:

- a. Project name, contractors' and subcontractors' names, addresses, and telephone and facsimile numbers. Indicate the portion of work for which each subcontractor was responsible.
- b. Index.

2. Operations and Maintenance Documentation Directory:

- a. Explanation of the identification system used, including lists of systems, equipment and component identifiers and names.

3. Emergency Information:

- a. Information for technical and nontechnical personnel about actions recommended during emergency situations to protect life and property and to minimize disruption to the building occupants. Emergencies shall, at a minimum, include:
 - 1) Fire.
 - 2) Security breach.
 - 3) Power failure.
 - 4) Emergency power system failure.
4. Operating Manual:
 - a. General Information:
 - 1) Building function.
 - 2) Building description.
 - 3) Operating standards and logs.
 - b. Technical Information:
 - 1) System description.
 - 2) Operating routines and procedures.
 - 3) Routine operational testing program and procedures.
 - 4) Special procedures.
 - 5) Basic troubleshooting.
5. Maintenance Manual:
 - a. Descriptions (specifications) of the equipment and components.
 - b. Description of function, as applicable: the function of the equipment, procedures before start-up, functional parameters (input, output) at the design load and at part loads, and performance verification procedures.
 - c. Recommended maintenance procedures and their recommended frequency for this Project.
 - d. Name, address and contact of at least one qualified service company.
 - e. Recommended list of spare parts, part numbers, and the place(s) from which they can be obtained.
 - f. Original purchase order number; date of purchase; name, address, and the telephone number of the vendor; and warranty information.
 - g. Installation information.
 - h. Any other information needed for the preparation of documents supporting the management of operation and maintenance programs.
6. Test Reports and Certifications:
 - a. Copies of tests and certifications performed during manufacture and construction including, but not limited to, the following:
 - 1) Overcurrent protective device coordination study.
 - 2) Engine-generator set factory test report.
 - 3) Engine-generator set oil sample analysis.
 - 4) Selective catalytic reduction system control panel and dosing panel factory test report.
 - 5) Selective catalytic reduction system on-site acceptance test report.
 - 6) Lightning protection inspection certificate.
 - 7) Dry-type transformer test reports.
 - 8) Receipt for spare fuses.
 - 9) UPS certification, factory, and start-up test reports.
 - 10) Receipt of O&M documentation package.
 - 11) Receipt for instruction of operating personnel.
 - 12) Emergency power supply system on-site test report.
 - 13) Switchboard test reports.
 - 14) Ground resistance test.
7. Construction Documents:

- a. Record drawings.
 - b. Approved submittals, including revised shop drawings indicating field and as-installed conditions.
 - c. Equipment identification charts and schedules.
 - d. Warranty certificates.
 - e. Inspection certificates.
 - f. Performance verification report.
- E. Submit a receipt signed by the Owner acknowledging receipt of the operation and maintenance documentation package.

3.17 DIAGRAMS

- A. Frame and mount the following information:

<u>Information</u>	<u>Location</u>
One-line diagrams of the building electrical system.	Adjacent to each switchboard.
Overcurrent protective device schedule.	On the wall in the Main Electrical Room.
	Adjacent to water detection system control unit.

- B. Diagrams shall be type written or computer generated.
- C. Diagrams shall be as-built, and shall include interfaces and interlocks with other equipment.

3.18 RECORD DRAWINGS

- A. Refer to Section 017839, Project Record Documents.

3.19 MAINTENANCE

- A. Equipment operated prior to the date of the substantial completion shall be maintained in accordance with manufacturers' recommendations.

3.20 INSTRUCTION OF OPERATING PERSONNEL

- A. Conduct formal instruction sessions for operating personnel. Conduct two similar sessions. The first session shall be conducted at the time of start-up and check-out, and the second session shall be approximately 2 months later. Sessions shall be a minimum of 2 days duration for basic electrical systems, and as specified herein for other systems and equipment. Sessions shall be conducted at the site.
- B. Prepare and submit a syllabus describing an overview of the program, describing how the program will be conducted, when and where meetings are to be held, names and company affiliations of lecturers, description of contents and outline for each lecture, and recommended reference material and outside reading. Obtain direction from the Owner on which operating personnel shall be instructed in each system. Proposed training schedules, materials, and lesson plans shall be submitted to the Owner for review.
- C. Sessions shall include:
- 1. General familiarization and operating procedures for the entire electrical installation.
 - 2. Routine maintenance procedures for equipment.

3. Specific operating and maintenance procedures for:
- a. Switchboards.
- D. Factory-trained technicians shall give operating and maintenance instructions on the following systems and equipment:

<u>System/Equipment</u>	<u>Minimum Session Duration, hours</u>
Emergency power supply system	8
Modular flexible wiring systems	2
Occupancy sensors	2
Switchboards	4
Uninterruptible power supply system	8

- E. Provide DVD format video recordings of training sessions and a complete record copy of all training materials, handouts, and other printed materials used in each training session.
- F. Training shall occur after testing is complete, unless approved otherwise by the Architect.
- G. Obtain receipt acknowledging completion of each item of instruction.

END OF SECTION 260010

COVER SHEET FOR
SUBMITTALS TO NEWCOMB & BOYD

Project: _____ Date: _____

Item: _____ Submittal Number: _____

Manufacturer: _____ Model: _____

Specification Paragraph and/or Drawing Number: _____

Capacity: _____

Electrical Characteristics (including identification of all separate connections or services required): _____

Accessories: _____

Options: _____

Deviations (if any; if none, state so): _____

General Contractor Approval: _____