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SECTION 011100 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work covers construction of a [**new <Indicate description of work>**][**addition and remodeling <Indicate description of additions/remodeling>**].

1.2 CONTRACTS

A. Project shall be constructed under a [**single**][**multiple**] contract(s) that shall include the [**General,][HVAC,][Piping and Plumbing,][Fire Protection][and][Electrical]** work.

1.3 WORK OF CONTRACTORS

A. In addition to fulfilling Contract Requirements, Contractor shall fulfill the requirements of all drawings, specifications, and the requirements of the General Conditions, Supplementary Conditions, and Division 1, General Requirements, all of which are hereby made a part of each division and section of the project specifications.

1.4 WORK BY OWNER

A. Items not in contract: <**List items not included in Contract**>

B. Owner to remove and/or retain: <**Indicate Owner remove/retain**>

1.5 OWNER SUPPLIED PRODUCTS

A. Owner's responsibilities: <**List Owner's responsibilities**>

1.6 CONTRACTOR'S USE OF SITE

A. Access: <**Indicate Contractor's access**>

B. Time restrictions for performing work: <**Indicate time restrictions (if any)**>

C. Utility outage and shutdown: <**Indicate utility outage and shutdown at site**>

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

A. Types of allowances scheduled herein for the work include the following:

1. Contingency Allowance in accordance with the following paragraph:

a. Contingency allowance shall be used only as directed for Owner's purposes, and only by change orders that designate amounts to be charged to contingency allowance. Contractor's related costs are not included in the Contract Sum (other than allowance itself) for work so ordered to be charged to contingency allowance. The change orders will include costs and allowable overhead/profit margins. At time of project closeout, unused amounts remaining in contingency allowance shall be credited to Owner by change order.

2. Lump Sum Allowance in accordance with the following General Conditions of the Contract for Construction Paragraph 3.8:

a. At time of project closeout, unused amounts remaining in lump sum allowances shall be credited to Owner by change order.

PART 2 - PRODUCTS (Pre-ordered items assigned to Contractor)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALLOWANCES

A. Contingency Allowances to be included in General Contractor's Base Bid:

1. The General Contractor shall include a contingency allowance in the amount of $<**Enter amount of contingency allowance**> to cover costs of any additional work ordered.

B. Lump Sum Allowances:

1. The General Contractor shall include in the contract price, lump sum allowances for the purchase of items shown below:

a. Hardware $<**Enter amount**>

C. Brick Allowance:

1. The General Contractor shall include in the contract price an allowance of $<**Enter amount of allowance**> per thousand, F.O.B., job site delivery, unloaded, for the face brick to be used on this project.

D. Testing and Balancing Allowance:

1. <**Enter allowance/instructions**>

END OF SECTION

SECTION 012300 - ALTERNATES/ALTERNATIVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 specification sections, apply to this section.

1.2 SUMMARY

A. This section specifies administrative and procedural requirements for alternates.

B. Definition: An alternate is an amount proposed by Bidders and stated on the Bid Form for certain construction activities defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the product, material, equipment, systems, or installation methods described in the Contract Documents.

C. Coordination: Coordinate related work and modify or adjust adjacent work as necessary to ensure that work affected by each accepted alternate is complete and fully integrated into the project.

D. Notification: Immediately following the award of the Contract, prepare and distribute to each party involved, notification of the status of each Alternate. Indicate whether Alternates have been accepted, rejected or deferred for consideration at a later date. Include a complete description of negotiated modifications to Alternates.

E. Schedule: A "Schedule of Alternates" is included under Part 3 of this Section. Specification sections referenced in the Schedule contain requirements for materials and methods necessary to achieve the work described under each Alternate.

1. Include as part of each Alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation, whether or not mentioned as part of the alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate Bid No. 1: <**Insert**>

B. Alternate Bid No. 2: <**Insert**>

END OF SECTION

SECTION 013119 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 specification sections apply to this section.

1.2 SUMMARY

A. This section specifies administrative and procedural requirements for project meetings including but not limited to:

1. Preconstruction conference.
2. Coordination meetings.
3. Progress meetings.
4. Construction schedule.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 015000 - CONSTRUCTION FACILITIES & TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 JOB CONDITIONS AND WORK SEQUENCE

A. Contractor(s), Subcontractor(s), and Material Supplier(s) shall inform themselves as to conditions relating to the execution of work. Neglect of this requirement will not be accepted as cause for additional compensation and/or additional time for completion.

B. Existing building will remain in operation during construction. Contractor shall schedule work in consultation with the Owner so there will be no interruption of existing building operations.

1.2 SITE EXAMINATION

A. The Contractor shall take all measurements related to the existing building as required for the new work and to locate existing utilities. Contractor shall contact the City, Owner, and all utilities to carefully review all records of exposed, concealed, and buried points of connections, as to location, size, type, depth, operating characteristics, etc., including but not limited to, electrical service, telephone service, and water, gas, and sewer lines.

1.3 GRADES, LINES, AND LEVELS

A. The Contractor shall lay out the building and establish all lines and levels for the work as required by drawings and specifications. The General Contractor shall maintain proper base lines, levels, and benchmarks outside or inside the building, where necessary, for the use by all trades.

B. Each trade shall lay out and establish at the job all other lines and levels necessary for own work.

C. The Contractor is responsible for coordination of work by all trades to ensure that potential conflicts are eliminated prior to installation beginning.

1.4 SUBMITTAL PROCEDURES FOR SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

A. Shop Drawings:

1. Each Contractor shall prepare and submit shop drawings, where requested, to the Architect for review. All shop drawings shall bear verification of Contractor's review and approval prior to submittal. No work shall be fabricated by the Contractor except at Contractor's own risk, until shop drawings have been reviewed in accordance with review procedure.

2. Unless otherwise specified in the respective specification sections of Division 1 through 31, the Contractor shall submit one (1) reproducible transparency and three (3) opaque prints of all fabricated work and line type shop drawings to the Architect for review. The reviewed reproducible transparency will be returned to the Contractor for reproduction and distribution purposes. For products covered by catalog cuts or brochures, unless otherwise specified, the Contractor shall submit a minimum of eight (8) copies of each item for review.
3. Corrections or changes indicated on shop drawings shall not be considered as extra work orders. Final drawings will be considered reviewed only if they bear the stamp and signature of Architect.
4. Contractor shall be responsible for final distribution of reviewed shop drawings to the various Subcontractors or Trades.

B. Samples:

1. The Contractor shall furnish for review, with reasonable promptness, all samples as directed by the Architect. The Architect will review such samples, with reasonable promptness, only for conformance with the design concept of the project and for compliance with the information given in the Contract Documents. The work shall be in accordance with reviewed samples approved for design concept conformance.
2. The Contractor shall submit transmittal letter requesting sample review and prepay transportation charges to Architect's office on samples forwarded.
3. The Contractor shall order no material until receipt of written approval of shop drawing submitted.

1.5 SITE LIMITS AND MATERIALS STORAGE

A. Space Limitations: No areas outside construction limits may be used for any purpose by Contractor(s) or Subcontractor(s).

B. Contractor(s) or Subcontractor(s) shall not store their materials or equipment on the structure or permit any part of any structure to be loaded to such an extent as to endanger its safety.

C. Contractor(s) and Subcontractors(s) shall confine equipment, storage of materials, parking, and operations of their workers to limits indicated or by direction of Architect. Storage space will be confined to area of site.

D. Store, place, and handle material and equipment delivered to job site to preclude inclusion of foreign substances or causing of discoloration. Pile neatly and compactly; barricade to protect public from injury. Protect materials as required to prevent damage thereto from weather or the ground. Should it be necessary at any time to move materials, sheds, or storage platforms, Contractor shall move same, as and when required, at Contractor's expense.

E. Owner assumes no responsibility for materials stored in buildings or on site. Contractor assumes full responsibility for damage due to storage of materials.

F. Repairing of areas used for parking, placing of sheds, offices, and storage of materials shall be done by Contractor at Contractor's expense.

G. Contractor's personnel shall not use the existing building for any purpose except as required to perform the work of this Contract unless otherwise specified.

1.6 CLEANING

A. General Cleaning: The Contractor and each Subcontractor shall remove rubbish and debris from the building site promptly as it accumulates but, in any case, not less frequently than each Friday afternoon. The Contractor shall perform an overall cleanup of the entire site including a broom cleaning of all appropriate surfaces as required but, in any case, not less frequently than each Friday afternoon.

B. No burning of rubbish or debris will be allowed at site, nor shall rubbish at any time be thrown from structure. No debris shall be buried at the site. Do not dispose of wastes into streams or waterways.

C. All dumpsters used on the project site shall have lids or canvas covers securely fastened to prevent debris from blowing about site.

D. Keep streets and public roadways clean of dirt and mud tracked onto such surfaces by vehicles or equipment used or parked on construction site.

1.7 PROTECTION

A. The Contractor shall:

1. Provide, and maintain fences, planking, guard lights, barricades, warning signs, and guards as necessary for protection of material storage, curbs, sidewalks, streets, drives, and adjoining property, public, and new building. Use caution at all times to protect persons against injury resulting from job operations, movement of materials, and standing equipment.
2. Notify in writing, the Owners of corporate or private property that interferes with work and arrange with them for disposition of such property.
3. Provide and maintain proper shoring and bracing to prevent earth from caving or washing into excavation, and/or undermining present building. Provide temporary protection around openings through and at floors and roofs.
4. Provide and maintain proper shoring and bracing for existing underground utilities, sewer, etc., encountered during excavation work, to protect them from collapse or other type of damage until they are to be removed, incorporated into work of new building, or can be properly backfilled upon completion of new work.
5. Protect trees, shrubs, lawn, and landscape work from damage. Provide guards and covering. Provide and maintain plank covering over walks, drives, newly installed service facilities, etc., to prevent damage by trucking or otherwise. This shall include areas outside of grading and/or construction limits.
6. Provide protection against rain, snow, wind, ice, storms, or heat to maintain work, materials, apparatus and fixtures free from damage. At the end of a day's work, cover new work likely to be damaged. Remove snow and ice, as necessary for safety and proper execution of work.
7. Protect building from damage at all times from rain water, ground water, backing up of drains or sewers and other water. Provide pumps, equipment, and enclosures to provide this protection.
8. Provide temporary fence or barricade at least 5'-0" high. Snow fencing or similar type fencing acceptable. Posts for fencing shall be spaced a maximum of 10'-0" OC.

B. Each Contractor and Subcontractor shall protect own materials, work, and equipment not normally covered by above protection; protect work of other trades, adjust damage when performing work; protect work outside of building lines such as trenches and excavations, as specified above; when performing work, maintain protection provided above. Contractor causing damage to any work shall repair or replace damaged work at Contractor's expense.

C. Work outside of property line shall be repaired in accordance with requirements of authority having jurisdiction.

D. Provide temporary dust barriers as required to protect existing areas during work of the contract.

1.8 TEMPORARY OFFICES/TRAILERS, EQUIPMENT AND SHEDS

A. Offices/Trailers: The Contractor shall provide and maintain temporary watertight office of suitable size for use by Contractor, Subcontractors, and Architect. Contractor's space shall be as required for general use and to provide space and furnishings for project meetings. Telephone service in this office, local and long distance, shall be paid for by the Contractor. Location of office/trailer shall be approved by the Owner.

B. Equipment: The Contractor shall provide and maintain a plain paper copier, telephone, and fax machine in the office for use by the Architect for job related business. The operating cost of all electronic equipment shall be paid for by the Contractor.

C. Sheds: The Contractor and each Subcontractor shall provide sheds for storing tools and materials. Storage sheds shall be watertight and storm proof, and shall have floors raised above ground. The Contractor and each Subcontractor will be held responsible for water or storm damage to stored tools or materials.

1.9 ENCLOSURES

A. Definitions of Enclosures:

1. Temporary: Sufficient preliminary enclosures of an area or structure, or of an entire building, to prevent entrance or infiltration of rain water, wind, and other elements, and which will prevent undue heat loss from within enclosed areas.
2. Permanent: Stage of construction at which all moisture and weather protection elements of construction have been installed in accordance with the Contract, either for a portion of structure or for entire building.

B. The Contractor shall construct temporary enclosures as required during construction in areas where interior work may proceed.

1. Temporary enclosures shall be provided and maintained by the Contractor until the areas temporarily enclosed become permanently enclosed.
2. The Contractor shall remove temporary enclosures at completion of construction or when directed by Architect.

3. Temporary enclosures shall consist of fire resistive plywood panels or one layer of 3-ply fire resistive, reinforced polyethylene film fastened to wood framework, consisting of fire resistant 2" x 4" fire resistive wood studs spaced 24" OC, securely spiked to wood plates top and bottom. Provide fire resistive intermediate girts between studs as required for fastening of plywood or film.
4. Make suitable provisions for passage of air to permit proper drying out of building.
5. Windows will not require temporary enclosures if glazed promptly when approved. If Contractor considers it impractical or is unable to glaze windows when approved, Contractor shall provide temporary enclosures as specified above.
6. At the end of the day's work, the Contractor shall securely close temporary enclosures, supervise effectiveness of enclosures, see that every precaution is used to prevent unnecessary escape of temporary heat, and take additional precautions as may be directed by Architect.

1.10 CONSTRUCTION HEAT AND VENTILATION

A. The Contractor shall provide construction heat and ventilation as specified in enclosed areas throughout construction period as required to:

1. Facilitate progress of work.
2. Protect work and products against dampness and heat.
3. Prevent moisture condensation on surfaces.
4. Provide suitable ambient temperatures for installation and curing of finish materials.
5. Provide adequate ventilation to meet health regulations for safe working environment.
6. Prevent hazardous accumulations of dusts, fumes, mists, vapors, or gases in areas occupied during construction.

B. The Contractor shall maintain, as construction heat, an even temperature of at least 60ºF in the building or buildings under construction for all trades.

1. No salamanders or open fires will be permitted in the building or buildings.

C. The Contractor shall provide own fuel, apparatus, and heat as necessary for the thawing or heating of frozen ground and material, and in the case of the latter, sufficient heat shall be maintained until material incorporated in construction has set and all danger of frost has passed.

D. The Contractor shall furnish, install, maintain, and operate oil or gas-fired, blower type portable heating units for providing construction heat.

1. Heating units shall be self-contained units and furnished in sufficient number and adequate capacity to conform to the requirements for construction heat stated above.
2. Ventilation shall be adequate for specific operations, but not less than one (1) air change per hour in work areas.
3. Each heating unit shall be properly vented if required to dissipate noxious fumes and prevent discoloration of building construction.
4. Each heating unit shall be provided with the normal safety devices to prevent injury to building and workers.
5. All oil or gas-fired equipment and methods used for construction heat, shall be presented to the Architect for review.

6. All fuel oil and gas for self-contained units shall be provided and paid for by the Contractor.

E. The Contractor, at all times, will be held responsible for the damage to all materials and work due to insufficient heat. The Contractor shall also remove all construction heating equipment upon conclusion of its use.

1. NOTE: No new permanent equipment shall be used for construction heating unless in the opinion of the Architect's representative, the building and the mechanical work has progressed to a stage where the use of the new heating equipment would be expedient and permanent. The Contractor shall pay for all maintenance and attendance required for the permanent heating system up to the time of Substantial Completion. The Contractor shall pay the cost of fuel for the permanent system up to the time of Substantial Completion. The percentage of the utility bill to be paid by the Contractor shall be determined by the percentage of square footage of the total building that is being used for construction purposes as opposed to that being occupied by the Owner.

F. The Subcontractor for the heating work shall have the heating system and units, as described by the Contract Documents, in place and ready for operation as soon as the Contractor has enclosed the building with glass and temporary wood doors that can be locked, has completed all interior masonry partitions, and has swept the building clean inside. The Subcontractor for the heating work shall, at this time, make available the contractual heating system for the purposes of construction heat and ventilation.

G. The Subcontractor for the heating work shall provide specified filters in all air handling units before same are started up for use in furnishing construction heat and ventilation and shall maintain clean filters in the units for duration of construction heat and ventilation period. No fan units shall be run for construction heat without filters.

H. Failure of the Subcontractor for heating work to make available the contractual central heating system shall in no way relieve the Contractor of the responsibility to provide heating and ventilating protection for all work.

I. The Subcontractor for electrical work shall provide electrical services to the contractual heating units when they are ready for use.

J. When the building is ready to be accepted by the Owner, the Subcontractor for heating work shall leave the heating system and units clean and in proper and acceptable condition. All fan units for construction heat shall be provided with new filters by Subcontractor for heating and ventilating work.

K. Guarantee period for contractual heating system and units shall not begin until date of Substantial Completion.

L. The Contractor shall provide, without cost to the Owner, such ventilation as may be necessary during construction to adequately dry out the construction, and prevent the buildup of fumes, humidity, gases, etc., that may be detrimental to the construction. This will not alter any other provisions of this specification.

M. Contractual duct systems shall not be used during construction unless such use is authorized in writing by the Architect.

1.11 CONSTRUCTION ELECTRICITY

A. The Contractor shall make the necessary application, pay all fees and charges, including power consumed, take out all permits and provide and maintain construction electric power service from sources other than the Owner, for power and light for all electric machinery and lights required for carrying on the work of all trades. Power service requirements shall be coordinated with all Contractors and be of size, phase, and voltage required for construction purposes, but in no case shall be less than 400 amp, single phase, 120/240 volts, located at temporary office area with a separate meter. At the Owner's option, the Contractor may be permitted to pay all fees and charges including power consumed, take out all permits and provide and maintain construction electric power service by extending from the Owner's source and providing a separate meter.

B. Existing power sources may be used for work in areas to be remodeled. The Contractor shall provide and maintain construction electricity as required for the Work by extending power feeder switches, etc., from the Owner's existing system. Owner will pay cost of power used. Do not connect any equipment requiring more than 110 volts to Owner's system.

C. During the construction period, the Contractor shall provide and pay for all wiring, switches, outlets, lamps, etc., required to provide construction electric service for light and power throughout the building and shall maintain these services as the work progresses, providing the necessary temporary feeders and extensions therefrom to provide sufficient construction lighting and power in all spaces as required for carrying on the work of all contracts.

D. All temporary wiring shall be erected and maintained by the Contractor in accordance with rules of the Underwriters Laboratory and the local electrical utility company, and shall be arranged as not to interfere with the progress of the work throughout the building. Remove all temporary wiring, etc., upon conclusion of its use.

E. Until permanent services are available, the Contractor shall provide construction electric services to all points not more than 50 feet from where the work is in progress. All extensions, controls, and equipment beyond the point of construction electric services shall be provided under the work of the respective contractors requiring such extensions. Subcontractors shall make their own arrangements with the Contractor for lighting their construction offices, sheds, or fabrication shanties.

F. The Contractor shall provide wiring for single phase power for electric construction lighting and for normal equipment used by the various Subcontractors or trades.

G. If a Subcontractor requires power different than initially agreed, Contractor shall arrange and pay for the necessary wiring and power needed.

H. Heavy equipment such as welders, winches, air compressors, etc., shall be gasoline driven or energized from gasoline or diesel engine generators. This equipment shall be furnished and the fuel paid for by the party who requires this equipment.

I. The Contractor shall maintain general lighting in all spaces not receiving sufficient daylight as required for safety. The Contractor shall furnish and maintain lamps required to properly light the work.

J. Use of the permanent electrical system will be permitted for construction purposes as soon as use of construction services becomes impractical. However, any use of the permanent electrical system before the project is completed or accepted by the Owner, shall be subject to the approval of the Owner or Architect. If the permanent systems are permitted to be used prior to acceptance by the Owner, the Contractor shall remove all temporary work as rapidly as allowed by the installation of the permanent work. As the permanent electrical systems are put into service, the Contractor shall replace all burned out bulbs, tubes, and all other damaged elements, fixtures, receptacles, etc., and turn the entire system over to the Owner, whole and undamaged.

1.12 CONSTRUCTION TELEPHONES AND FAX

A. Cost of installation, removal, and all service charges for telephones and fax lines in the construction trailer shall be paid by the Contractor.

1.13 CONSTRUCTION WATER AND SEWER

A. The Contractor shall make arrangements for and furnish, at Contractor's expense, from sources within existing building, all water required for drinking and construction purposes, and shall install and maintain necessary supply connections and piping for same at such locations and in such manner as may be approved by Architect. Before final acceptance, temporary connections and piping shall be removed by the Contractor in a manner acceptable to the Architect.

1.14 CONSTRUCTION TOILETS

A. The Contractor shall construct and maintain, in such manner and location as the Architect may approve, temporary toilet facilities for use by all personnel engaged in the work. Toilet facilities shall have approved plumbing fixtures and shall be serviced twice weekly; including emptying tanks, recharging with a germicidal and deodorizing solution, and scrubbing entire interior with a germicidal solution. Portable chemical units will be acceptable if they meet the above conditions. Permanent toilets shall not be used for temporary toilet facilities.

1.15 TEMPORARY STAIRS, LADDERS, RAMPS, AND RUNWAYS

A. Contractor shall provide and maintain temporary stairs, fixed ladders, ramps, chutes, and runways as required for proper execution of work by all trades.

1.16 TEMPORARY ROADWAYS AND PARKING

A. Contractor shall construct temporary access roads and parking area with limestone as required for the work of the project. Temporary roads and parking areas shall be located only where finished roads and parking areas are to be constructed and shall be maintained until building is complete or finish surfaces are installed.

B. The Contractor shall construct parking area and access roads from the streets to the building with limestone. After completion of the building, Contractor shall scrape clean and level, leaving site ready for the finish grading, walks, drives, etc., as called for. The temporary roadway shall remain until all phases of construction have been completed.

C. Construction personnel may park vehicles on site (within the limits of construction area) as directed by Owner.

1.17 PROJECT SIGN

A. The Contractor shall provide and maintain in good condition, a 4' x 8' x 3/4" thick exterior grade plywood sign. This sign shall contain the name of the Institution, Owner, Architect, and General Contractor. The sign shall remain until all phases of construction have been completed. No other signs will be permitted on the site, other than the Contractor's name on trailer or on the construction building.

B. Paint the entire sign, frames, and supports, with a primer coat and one finish coat of oil-based paint; colors as directed by the Architect.

1.18 FIRE PROTECTION

A. During the construction period, the Contractor shall provide and maintain adequate fire protection per requirements of jurisdictional authorities, for the construction site, for each floor of the building, and for Contractor's temporary offices.

B. In addition, each Subcontractor who maintains enclosed shed on premises for storage of materials or as workshop, or for convenience of workers, shall provide and maintain fire protection in each shed.

1.19 REPLACEMENT OF BROKEN GLASS

A. Contractor shall be held responsible for damaged, broken, or scratched glass and at completion of contract shall replace such glass without cost to Owner. Include existing glass damaged, broken, or scratched due to work of Contract.

B. In general, glass which is merely cracked will be considered damaged due to faulty setting and shall be replaced by glass installer.

C. It shall be the Contractor's prerogative to charge cost of replaced glass to the party responsible. Building shall be turned over to Owner with glazing work complete and in perfect condition.

1.20 MANUFACTURER'S DIRECTIONS

A. The Contractor shall apply, install, connect, erect, use, clean, and condition manufactured articles, materials, and equipment as directed by manufacturer unless specified to contrary.

1.21 CUTTING AND PATCHING

A. Cutting and patching requirements specified herein, apply to all sections and divisions of the specifications, and all drawings covering demolition, remodeling, and new construction work to be performed by the Contractor and Mechanical and Electrical Subcontractors.

B. All on site welding shall conform to the requirements and techniques of FM Global Engineering Division.

C. Portions of the existing structure where existing work is to be demolished or removed, and where new work is to be done, connections made, materials handled, or equipment moved and relocated, shall be temporarily protected. Temporary protection shall be such that the interior of existing structure will at all times be protected from dust and weather inclemency and interior heat and/or air conditioning conserved. Temporary openings in exterior walls shall be protected by temporary weatherproof closures. Contractor will be held responsible for any damage to the existing structure or contents due to the insufficiency of such protection.

D. Cutting and Patching Requirements:

1. Where new work connects with present building and where remodeling of existing work occurs, the Contractor shall do all cutting, notching, keying, removal and trimming of existing construction required to make connections between the new and the old work and shall do all patching, repairing or refinishing of cut and immediately adjacent surfaces to provide a finish in conformance with industry standards and appropriate to finish materials intended to be used.
2. Holes through existing floors, walls, and roofs for Mechanical and Electrical work shall be cut, patched, sealed, fire proofed, and flashed by the trade requiring the opening.
3. Before breaking of surfaces, cut primary saw-cut 1" to 1-1/2" deep around areas where portions of work will be removed. Lines shall be straight.
4. Materials and workmanship employed in patching, repairing, or refinishing existing surfaces and/or involving new construction shall conform to that of original work, unless otherwise shown or specified.
5. Clean existing surfaces remaining exposed as a result of demolition work and/or new construction. Clean entire wall faces, floor surfaces, column faces, etc., using sandblasting, wire brushing, or carborundum wheel. Where dovetail or other insert slots are exposed, they shall be filled with grout.

E. Keep property adjacent to buildings clean and free from accumulation of rubbish. Remove excess debris resulting from demolition operations, as it accumulates.

F. Walls, floors, etc., required to carry the excess weight of stored materials and equipment during demolition, removal and remodeling work, or which will be subjected to undue pressure from waste material, shall be shored or braced to withstand these excess loads.

1.22 CODE REQUIREMENTS

A. The Contractor shall conform to all requirements of local, state, and national codes, laws, ordinances, and utility company requirements and other regulations having jurisdiction over this installation.

B. If there is a discrepancy between the codes and regulations having jurisdiction over this installation and these specifications, the codes and regulations shall determine the method of the Work.

C. If the Contractor notes, at the time of bidding, any parts of the drawings and specifications that are not in accord with the applicable codes or regulations, Contractor shall inform the Architect in writing, requesting a clarification. If there is insufficient time to allow this procedure, Contractor shall submit, with proposal, a separate price required to make the system shown on the drawings comply with the codes and regulations.

D. All changes to the system made after the letting of the contract in order to comply with the applicable codes or requirements of the Inspector, shall be made by Contractor without cost to the Owner.

1.23 PROGRESS SCHEDULE

A. Immediately after being awarded the contract, the Contractor shall prepare an estimated Progress Schedule and submit same for the Architect's approval. It shall indicate the dates for the starting and completion of the various stages of construction.

1.24 IAQ MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

A. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:

1. [**General Contractor**]<**Insert**> shall erect and maintain dust barriers throughout the construction work. These barriers shall be reasonably airtight and shall prevent entry into the construction zone by unauthorized persons. Reasonably airtight means construction equivalent to full-height temporary or permanent walls with joints taped or sealed, and shafts and other penetrations sealed as well as possible. Fire resistant polyethylene is acceptable; if flame spread/smoke developed ratings are demonstrated to conform to the applicable building codes and licensing acts.
2. The Contractor shall continuously maintain the construction zone under a negative pressure of at least 0.01 w.g. minimum relative to all adjacent areas of the building.

    a. Exhaust fans used for this purpose shall filter air and discharge it outdoors or to the least populated area adjacent to the construction work using negative air machines designed specifically for this purpose. All filtration for air recirculated back into the building shall be HEPA (99.97% DOP efficiency) for work adjacent to healthcare or elderly facilities. If no work is adjacent to these areas, [**95%**]<**Insert**> filtration is acceptable. Filtering air discharged to outdoors shall be accomplished with [**30%**]<**Insert**> filters.
    b. If air is discharged outdoors, maintain all required distances to doors, windows, air intakes, etc.
    c. If high levels of VOC's or odors are released, activated carbon or equivalent filtration shall also be employed. Exhaust shall not discharge near doors, air intakes, pedestrians, gathering areas, or operable windows.
    d. Adjusting existing air handling equipment to assist in pressure control is acceptable, if approved by the Owner and the authority having jurisdiction.
    e. Seal return, exhaust, and supply air openings in or near the construction zone that serve existing air handling systems, and rebalance the systems for proper operation. If this is impractical, add filters at the intakes of sufficient cross-sectional area to minimize the pressure drop and avoid the need for rebalancing.
    f. Maintain pressure control one hour before and after all construction periods, and 24 hours per day in healthcare or elderly facilities.

3. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:

a. Minimizing the amount of dust generated.
b. Reducing solvent fumes and VOC emissions.
c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.

4. Request that the Owner designate an IAQ representative.
5. Review and receive approval from the Owner's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.
6. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.
7. Schedule activities that may cause IAQ conditions that are not acceptable to the Owner's IAQ representative during unoccupied periods.
8. Request copies of and follow all Owner's IAQ and infection control policies.
9. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.
10. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.
11. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings Under Construction."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017500 - STARTING AND ADJUSTING

PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

A. <**Enter Description of Requirements**>

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017700 - CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's review, normally referred to as "final punch list."

B. Provide submittals to Architect that are called for in other specification sections.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and remaining sum due.

1.2 FINAL CLEANING

A. The Contractor and each Subcontractor shall perform thorough cleaning, sweeping, washing, and polishing of the entire new structure and site. The Contractor and each Subcontractor shall remove from work and equipment, provided under their respective divisions of work, all foreign matter, spots, and soil so as to put all such work and equipment, including finishes, in a complete and finished condition to the satisfaction of the Architect.

1. Cleaning shall include removal of foreign matter from all drains, exterior and interior.
2. Clean debris from roofs, gutters, downspouts, and drainage systems.
3. Clean and sweep all paved areas; rake clean all landscaped areas.

B. Initial protection of aluminum will be provided by Subcontractor providing work. Maintenance and any additional protection and repair work required shall be the responsibility of Contractor who shall have damaged work refinished where possible or replaced where required.

C. Immediately prior to the occupancy of this project or parts thereof, the Contractor shall have all glass cleaned by a professional window washing contractor. Work shall include the removal of labels, paint spattering, excess glazing sealant, etc. Surfaces shall include mirrors, both sides of all glass in windows, borrowed lights, partitions, and doors.

D. Upon completion of the work, the Contractor and each Subcontractor shall remove and dispose of all equipment, unused materials, waste, and construction facilities provided for the Contractor's work.

E. After all outside cleanup work has been completed, interior cleanup shall be completed as follows:

1. Subcontractor for plumbing work shall wash and leave free of stains and dust, all fixtures, and all piping, etc. This Contractor shall also clean all faucet aerators.
2. Subcontractor for heating work shall wash and leave clean all radiation covers, etc. Vacuum clean all air handling units, unit ventilators, unit heaters, and finned radiation, inside and out, cap, replace all filters with new filters if units have been used for temporary heating, and clean all motors.

3. Subcontractor for electrical work shall wash and clean all plates on switches and receptacles, light fixture lenses and trim reflectors, etc., and vacuum clean all panels (inside), etc.
4. The Contractor shall, after the above work has been done, completely vacuum all floors and walls, dust and clean all cabinet and wall materials, exposed steel and wood, clean all glass and scrub and clean all floors.
5. If Contractor does not remove rubbish or clean building as specified above, Owner reserves the right to have work done by others at Contractor's expense. If Subcontractors fail to perform their cleaning, the Contractor shall perform such work at the offending Subcontractor's expense.

1.3 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

1.4 PROJECT RECORD DOCUMENTS

A. Maintain one set of drawings with changes marked on record documents on site; record actual revisions to the work and turn over the following to the Architect:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change orders and other modifications to the Contract.
5. Reviewed shop drawings, product data, and samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each Product Section description of actual products installed, including the following:

1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:

1. Measured depths of foundations in relation to finish main floor datum.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
4. Field changes of dimension and detail.
5. Details not on original Contract drawings.

G. Submit documents to Architect with claim for final Application for Payment.

1.5 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Submit three properly indexed and bound copies, in 'D' Ring style notebooks, of the Operations and Maintenance Instructions to the Architect. Make all corrections or additions required.

B. Operation and Maintenance Instructions shall include:

1. Notebooks shall be heavy duty locking three ring binders and incorporate clear vinyl sheet sleeves on the front cover and spine for slip-in labeling. "Peel and stick" labels are not acceptable. Sheet lifters shall be supplied at the front of each notebook. Provide "Wilson-Jones" or equal, color black. Size notebooks a minimum of 1/2" thicker than material for future inserts. Label the spine and front cover of each notebook. If more than one notebook is required, label in consecutive order. For example; 1 of 2, 2 of 2. No other forms of binding will be acceptable.
2. Prepare binder covers (front and spine) with printed title "Operation and Maintenance Instructions", title of project and subject matter of binder when multiple binders are required.
3. Title page with project title, Architect, Contractor and Subcontractors, with addresses, telephone numbers, and contacts.
4. Table of Contents describing all index tabs.
5. Listing of all Subcontractors and major equipment suppliers with addresses, telephone numbers, and contacts.
6. Index tabs dividing information by specification section, major equipment, or systems. All tab titling shall be clearly printed under reinforced plastic tabs.
7. Copies of warranties.
8. Copies of all final approved shop drawings and submittals.
9. Copies of all factory inspections and/or equipment start-up reports.

1.6 WARRANTIES

A. Provide duplicate notarized copies.

B. Execute and assemble transferable warranty documents from Subcontractors, suppliers, and manufacturers.

C. Provide table of contents and assemble in three-ring binder with durable plastic cover.

D. Submit prior to final Application for Payment.

E. For items of work delayed beyond date of Substantial Completion, provide updated submittal within 15 days after acceptance, listing date of acceptance as start of warranty period.

1.7 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification sections.

B. Deliver to project site; obtain receipt prior to final payment.

1.8 RECORD DRAWINGS

A. At completion of work and prior to final payment, the Contractor and each Subcontractor shall provide the Architect with a complete, accurate, clean, and legible set of record drawings that indicate exact location of all material items recorded on a day to day basis during the construction period.

1.9 GUARANTEES AND WARRANTIES

A. The Contractor shall deliver all guarantees and warranties to the Owner prior to final completion.

1.10 REGULATORY AGENCY REQUIREMENTS

A. The A/E and Contractor shall complete the applicable forms, certifications, matrices, and checklist listed in the Illinois Department of Public Health's "Final Occupancy Checklist Certifications for Request of Inspection."

B. The Contractor shall submit certification (upon notification by A/E) stating the Elevator Recall System is installed and operates in accordance with ANSI A17.1 1993 "Safety Code for Elevators and Escalators."

C. The Contractor shall submit certification (upon notification by A/E) stating the Nurses Call Systems has been checked and is in proper operation.

D. The Owner shall provide applicable certification for the following:

1. The fire protection plans have been made available to all supervisory personnel.
2. Provide a copy of the fire evacuation plans indicating the areas of refuge.
3. Identify the location(s) where the fire evacuation plans are posted on all floors.
4. Staff has received training and is familiar with the fire protection plan and evacuation plans.
5. Hospital Board's resolution that only non-flammable medical gases will be used in all operating rooms, delivery rooms, and other anesthetizing locations.
6. Certification that a smoking policy is on file and the locations of posting of signs in prominent locations throughout the building.

E. The Contractor shall submit certification stating the electrical systems have been installed and all electrical work has been performed in accordance with NFPA 70-1993.

F. The Contractor shall submit certification (upon notification by A/E) stating the emergency generator has been installed to meet the licensure standards and NFPA 110 "Emergency and Standby Power Systems." The generator must operational for the IDPH inspection.

G. The Contractor shall submit certification (upon notification by A/E) stating the sprinkler system is installed as required by NFPA 13, Chapter 8, and NFPA 20 and NFPA 14. Submit a copy of the sprinkler acceptance and/or hydrostatic test report. Submit a letter certifying the total number and type of sprinkler head installed and the number and type of spare sprinkler heads available.

H. The Contractor shall provide applicable documentation for the following:

1. Other fire extinguishing systems have been tested and checked to determine compliance with the appropriate NFPA Standard for the system being used.
2. All fire extinguishers have been checked and inspection tags are dated and attached to each device.
3. Range hood and duct systems are installed and operating in accordance with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations".

I. The Contractor shall submit certification (upon notification by A/E) stating the smoke control system has been tested and operates as designed per NFPA 92A.

J. Contractor shall provide applicable documentation stating all above referenced IDPH certifications have been reviewed and verified by site inspection.

K. The Contractor shall submit all IDPH certifications completed as referenced above in the time frame stated by the Owner and A/E. Project retainage will not be reduced below 10% until complete IDPH submission package has been founded to IDPH by the Owner and A/E and IDPH acknowledges project submission is complete.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017823 - OPERATIONS AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SUMMARY

A. Description of Work: This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation manuals for systems, subsystems, and equipment.
2. Maintenance manuals for the care and maintenance of products, materials, and finishes, and systems and equipment.

1.2 RELATED WORK

A. Specific commissioning requirements are given in the following sections of these specifications. All the following sections apply to the Work of this section:

1. Section 017900 - Demonstration and Training
2. Section 019100 - Commissioning
3. Section 210800 - Commissioning of Fire Suppression
4. Section 220800 - Commissioning of Plumbing
5. Section 230800 - Commissioning of HVAC
6. Section 260800 - Commissioning of Electrical
7. Section 270800 - Commissioning of Communications
8. Section 280800 - Commissioning of Electronic Safety and Security
9. Section <**Insert number**> - <**Insert Name**>.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMISSION OF MANUALS

A. Initial Submittal: Submit two draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect/Engineer will return one copy of draft and mark whether general scope and content of manual are acceptable.

B. Final Submittal: Submit one copy of each manual in final form at least 15 days before final inspection. Architect/Engineer will return copy with comments within 15 days after final inspection.

1. Correct or modify each manual to comply with Architect/Engineer's comments. Submit two copies of each corrected manual within 15 days of receipt of Architect/Engineer's comments.

1.5 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

C. Manufacturers' Data:

1. Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
2. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

D. Comply with Division 01 Section CLOSEOUT PROCEDURES for schedule for submitting operation and maintenance documentation.

END OF SECTION

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section includes administrative and procedural requirements for instructing the Owner's and operations and maintenance personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment. Contractor shall develop training sessions for systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.

B. Demonstration and training requirements are described in this section, Section 019100, and in the technical sections of Divisions [**02 through 28**]. The Contractor shall comply with the requirements for demonstration and training data described in all specification sections.

1.2 RELATED WORK

A. Specific commissioning requirements are given in the following sections of these specifications. All the following sections apply to the Work of this section

1. Section 017823 - Operations and Maintenance
2. Section 019100 - Commissioning
3. Section 210800 - Commissioning of Fire Suppression
4. Section 220800 - Commissioning of Plumbing
5. Section 230800 - Commissioning of HVAC
6. Section 260800 - Commissioning of Electrical
7. Section 270800 - Commissioning of Communications
8. Section 280800 - Commissioning of Electronic Safety and Security
9. Section <**Insert Number**> - <**Insert Name**>.

1.3 COORDINATION

A. Coordinate instruction schedule with Owner.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training sessions with content of approved operation and maintenance manuals.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 INSTRUCTION

A. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide instruction on actions necessary to prepare for and execute seasonal changeover.

1. Schedule training through the Owner with at least [**30 days'**] notice. This requirement for notice takes precedence over other advance notice requirements in the specification.

B. Quality and Contents of Training Sessions: Each training session shall include the following.

1. Training plan for each class. Training plan shall contain:

a. Class objectives (what the student will learn).
b. Script of lecture and demonstrations.
c. Duration of each instruction period.
d. Participant attendance roster.
e. Participant evaluation survey form.

2. Names of instructors, name of company where employed, their credentials and affiliation with product if applicable and their qualifications as instructor.
3. Name of company who will videotape the classes. Include video script coordination with instructor's syllabus.
4. Training session information shall be submitted to CxA for approval.

C. Evaluation: At conclusion of each training session, assess and document training.

1. Assess and document each participant's comprehension of session by use of an oral performance-based test.
2. Obtain each participant's evaluation of the training.

D. Cleanup: Collect used and leftover educational materials. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

E. Record of Training. Submit the attendance roster as part of the completed training plan upon successful completion of the training session.

END OF SECTION

SECTION 260500 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to all Division 26 Sections. Also refer to Division 1 - General Requirements. This section is also applicable to Fire Alarm and Detection Systems Section 283100.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 REFERENCES

A. NFPA 70 - National Electrical Code (NEC)

1.3 SCOPE OF WORK

A. This Specification and the associated drawings govern furnishing, installing, testing and placing into satisfactory operation the Electrical Systems.

B. The Contractor shall furnish and install all new materials as indicated on the drawings, and/or in these specifications, and all items required to make the portion of the Electrical Work a finished and working system.

C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.

D. Description of Systems shall be as follows:
1. Grounding system.
2. Fire alarm system.
3. Wiring of equipment furnished by others.
4. Removal work and/or relocation and of existing systems and equipment.
5. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.

1.4 OWNER FURNISHED PRODUCTS

A. The following items shall be relocated, installed and/or connected by this Contractor:

1. Existing 100kW UPS and expansion cabinet to be relocated.

B. This Contractor shall make all electrical system connections shown on the drawings **or** required for fully functional units.

C. This Contractor is responsible for all damage to Owner furnished equipment caused during installation.

1.5 WORK SEQUENCE

A. All work that will produce excessive noise or interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during unoccupied hours. The Owner reserves the right to determine when restricted construction hours are required.

B. Schedule overtime hours for the following work:

1. Electric service interruption due to connecting new generator.
2. Electric service interruption due to new ATS installation.

1.6 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
   a. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with existing conditions.
   b. Maintenance clearances and code-required dedicated space shall be included.
   c. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. The contractor shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractor and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable xisting conditions, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Electrical Contractor.

   a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for coordination of existing conditions. IMEG will provide electronic file copies of electrical drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

    a. Scale of drawings:

        1) General plans: 1/4 Inch = 1'-0" (minimum).
        2) Electrical rooms, including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
        3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
        4) Sections of shafts and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
        5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).

2. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Engineer and Owner's Representative. The Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractor will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractor will not be allowed additional costs or time extensions for additional fittings, reroutings or changes, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.

8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Engine. Complete the coordination drawing process and obtain sign-off of the drawings by all contractors prior to installing any of the components.
9. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
10. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.7 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing/Bid Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guides, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Engineer any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Engineer will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers as determined by the Engineer are acceptable.
2. All Contractors and subcontractors shall employ only workmen who are skilled in their trades. At all times, the number of apprentices at the job site shall be less than or equal to the number of journeymen at the job site.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the city of Springfield, MO Codes, Laws, Ordinances and other regulations having jurisdiction.
2. If there is a discrepancy between the codes and regulations and these specifications, the Engineer shall determine the method or equipment used.
3. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
4. All changes to the system made after the letting of the contract to comply with codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.
5. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
6. If there are no local codes having jurisdiction, the current issue of the National Electrical Code shall be followed.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.

4. Pay all fees and taxes imposed by State, Municipal, and other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
7. Where applicable, all equipment and materials shall be listed by Underwriter's Laboratories, Inc. or a nationally recognized testing organization.

E. Examination of Drawings:

1. The drawings for the electrical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of raceways to best fit the layout of the job. Conduit entry points for electrical equipment including, but not limited to, panelboards, and UPS Unit, shall be determined by the Contractor unless noted in the contract documents.
3. Scaling of the drawings will not be sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as junction boxes, pull boxes, conduit fittings, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either shown on the drawings or called for in the specifications, it shall be included in this contract.
7. The Contractor shall determine quantities and quality of material and equipment required from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater and better-quality number shall govern.
8. Where used in electrical documents the word "furnish" shall mean supply for use, the word "install" shall mean connect up complete and ready for operation, and the word "provide" shall mean to supply for use and connect up complete and ready for operation.
9. Any item listed as furnished shall also be installed unless otherwise noted.
10. Any item listed as installed shall also be furnished unless otherwise noted.

F. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.

7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any conduit, conductors, wireways, fittings, etc.

1.8 WEB-BASED PROJECT SOFTWARE

A. The General Contractor shall provide a web-based project software site for the purpose of hosting and managing project communication and documentation until completion of the warranty phase.

B. The web-based project software shall include, at a minimum, the following features: construction schedule, submittals, RFIs, ASIs, construction change directives, change orders, drawing management, specification management, payment applications, contract modifications, meeting minutes, construction progress photos.

C. Provide web-based project software user licenses for use by the Engineer. Access will be provided from the start of the project through the completion of the warranty phase.

D. At project completion, provide digital archive of entire project in format that is readable by common desktop software applications in format acceptable to Engineer. Provide data in locked format to prevent further changes.

1.9 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced Specification Section	Submittal Item	Coordination Drawing
26 05 03	Through Penetration Firestopping	
26 05 33	Conduit and Boxes	+> 1.5"
26 05 48	Seismic Requirements for Equipment and Supports	
26 05 73	Power System Study	
26 05 53	Electrical Identification	
26 24 16	Panelboards	Yes
26 32 13	Packaged Engine Generator Systems	Yes
26 36 00	Transfer Switch	Yes
28 31 00	Fire Alarm and Detection Systems	Yes

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

    a. Date
    b. Project title and number
    c. Contractor's name and address
    d. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
    e. Description of items submitted and relevant specification number
    f. Notations of deviations from the contract documents
    g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

    a. Date
    b. Project title and number
    c. Engineer
    d. Contractor and subcontractors' names and addresses
    e. Supplier and manufacturer's names and addresses
    f. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
    g. Description of item submitted (using project nomenclature) and relevant specification number
    h. Notations of deviations from the contract documents
    i. Other pertinent data
    j. Provide space for Contractor's review stamps

3. Composition:

    a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
    b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
    c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:

    a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
    b. Unstamped submittals will be rejected.

c. The Contractor's review shall include, but not be limited to, verification of the following:

1) Only approved manufacturers are used.
2) Addenda items have been incorporated.
3) Catalog numbers and options match those specified.
4) Performance data matches that specified.
5) Electrical characteristics and loads match those specified.
6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
7) Dimensions and service clearances are suitable for the intended location.
8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place.).

d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:

a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
b. The Contractor shall clearly indicate the size, finish, material, etc.
c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Engineer before releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Engineer's approval.

15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.

    a. Allow at least two weeks for Engineer's review and processing of each submittal, excluding mailing.

16. Engineer reserves the right to withhold action on a submittal which, in the Engineers opinion, requires coordination with other submittals until related submittals are received. The Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. Submittal file name: 26 XX XX.description.YYYYMMDD
    b. Transmittal file name: 26 XX XX.description.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.10 SCHEDULE OF VALUES

A. The requirements herein are in addition to the provisions of Division 1.

B. Format:

1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Engineer.
2. Submit in Excel format.
3. Support values given with substantiating data.

C. Preparation:

1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
2. Break down all costs into:

    a. Material: Delivered cost of product with taxes paid.
    b. Labor: Labor cost, excluding overhead and profit.

3. Itemize the cost for each of the following:

    a. Overhead and profit.
    b. Bonds.
    c. Insurance.
    d. General Requirements: Itemize all requirements.

4. For each line item having an installed cost of more than $5,000, break down costs to list major products or operations under each item. At a minimum, provide material and labor cost line items for the following:

    a. Each piece of equipment requiring shop drawings. Use the equipment nomenclature (SB-1, PANEL P-1, etc.) on the Schedule of Values.
    b. Each type of small unitary equipment (e.g., FDS, FCS, CS, etc.). Multiple units of the same type can be listed together provided quantities are also listed so unit costs can be determined.
    c. Each conduit system (normal, emergency, etc.). In addition, for larger projects breakdown the material and labor for each conduit system based on geography (building, floor, and/or wing).
    d. Fire alarm broken down into material and labor for the following:

        1) Engineering
        2) Controllers, devices, sensors, etc.
        3) Conduit
        4) Wiring
        5) Programming
        6) Commissioning

    e. Seismic design
    f. Testing
    g. Commissioning
    h. Record drawings
    i. Punchlist and closeout

D. Update Schedule of Values when:

1. Indicated by Engineer.
2. Change of subcontractor or supplier occurs.
3. Change of product or equipment occurs.

1.11 CHANGE ORDERS

A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.

B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.

C. Change order work shall not proceed until authorized.

1.12 PRODUCT DELIVERY, STORAGE, HANDLING and MAINTENANCE

A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage.

B. Protect equipment, components, and openings with airtight covers and exercise care at every stage of storage, handling, and installation of equipment to prevent airborne dust and dirt from entering or fouling equipment to include, but not limited to:

1. Distribution equipment - distribution panels
2. Electronic equipment, UPS

C. Equipment and components that are visibly damaged or have been subject to environmental conditions prior to building turnover to Owner that could shorten the life of the component (for example, water damage, humidity, dust and debris, excessive hot or cold storage location, etc.) shall be repaired or replaced with new equipment or components without additional cost to the building owner.

D. Keep all materials clean, dry and free from damaging environments.

E. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Electrical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.

F. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

1.13 NETWORK / INTERNET CONNECTED EQUIPMENT

A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

B. The following network connected equipment shall be equipped with restricted access protocols:
1. Package engine generator and remote annunciator
2. Transfer switch and remote annunciator
3. Static uninterruptible power supply (UPS)
4. Fire alarm and automatic detection

1.14 WARRANTY

A. Provide one-year warranty for all equipment, materials, and workmanship.

B. The warranty period for all work in this specification Division shall commence on the date of Substantial Completion or successful system performance whichever occurs later. The warranty may also commence if a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization of the Owner. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.

C. Warranty requirements extend to correction, without cost to the Owner, of all work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage due to defects or nonconformance with contract documents excluding repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Engineer.

1.15 INSURANCE

A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.16 MATERIAL SUBSTITUTION

A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis for job design and establishes the quality.

B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors. The Engineer shall make the final determination of whether a product is equivalent.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Engineer via addendum. The Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.

D. Voluntary add or deduct prices for alternate materials may be listed on the bid form. These items will not be used in determining the low bidder. This Contractor assumes all costs incurred as a result of using the offered material or equipment on the Contractors part or on the part of other Contractors whose work is affected.

E. All material substitutions requested after the final addendum must be listed as voluntary changes on the bid form.

PART 2 - PRODUCTS

2.1 GENERAL

A. All items of material having a similar function (e.g., safety switches, panelboards, switchboards, contactors, motor starters, dry type transformers) shall be of the same manufacturer unless specifically stated otherwise on drawings or elsewhere in specifications.

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

A. Neither the professional activities of the Engineer, nor the presence of the Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Engineer and the Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 EXCAVATION, FILL, BACKFILL, COMPACTION

A. General:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found by calling 811.
2. The Contractor shall do all excavating, filling, backfilling, compacting, and restoration in connection with the work.

B. Excavation:

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
2. If excavations are carried in error below indicated levels, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Engineer shall be placed in such excess excavations under the foundation. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
3. Trim bottom and sides of excavations to grades required for foundations.
4. Protect excavations against frost and freezing.
5. Take care in excavating not to damage surrounding structures, equipment or buried pipe. Do not undermine footing or foundation.
6. Perform all trenching in a manner to prevent cave-ins and risk to workmen.
7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.

8. If satisfactory bearing soil is not found at the indicated levels, immediately notify the Engineer or their representative, and do no further work until the Engineer or their representative gives further instructions.
9. Excavation shall be performed in all ground conditions, including rock, if encountered. Bidders shall visit the premises and determine the soil conditions by actual observations, borings, or other means. The cost of all such inspections, borings, etc., shall be borne by the bidder.
10. If a trench is excavated in rock, a compacted bed with a depth of 3" (minimum) of sand and gravel shall be used to support the conduit unless masonry cradles or encasements are used.
11. Mechanical excavation of the trench to line and grade of the conduit or to the bottom level of masonry cradles or encasements is permitted, unless otherwise indicated on the electrical drawings.

C. Dewatering:

1. Furnish, install, operate and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:

1. Known underground piping, conduit, feeders, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Review all Bid Documents for all trades on the project to determine obstructions indicated. Take great care in making installations near underground obstructions.
2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Engineer.

E. Fill and Backfilling:

1. No rubbish or waste material is permitted for fill or backfill.
2. Provide all necessary sand and/or CA6 for backfilling.
3. Native soil materials may be used as backfill if approved by the Geotechnical Engineer.
4. Dispose of the excess excavated earth as directed.
5. Backfill materials (native soil material, sand, and/or CA6) shall be suitable for required compaction, clean and free of perishable materials, frozen earth, debris, earth with a high void content, and stones greater than 4 inches in diameter. Water is not permitted to rise in unbackfilled trenches.
6. Backfill all trenches and excavations immediately after installing of conduit, or removing forms, unless other protection is directed.
7. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Spread fill and backfill materials in 6" uniform horizontal layers with each layer compacted separately to required density.
8. For conduits that are not concrete encased, lay all conduits on a compacted bed of sand at least 3" deep. Backfill around conduits with sand, in 6" layers and compact each layer.
9. Backfill with native soil material (if approved) or sand up to grade for all conduits under slabs or paved areas. All other conduits shall have sand backfill to 6" above the top of the conduit.
10. Place all backfill above the sand in uniform layers not exceeding 6" deep. Place then carefully and uniformly tamp each layer to eliminate lateral or vertical displacement.

11. After backfilling of trenches, no superficial loads shall be placed on the exposed surface of the backfill until a period of 48 hours has elapsed.

F. Surface Restoration:

1. Where trenches are cut through graded, planted or landscaped areas, the areas shall be restored to the original condition. Replace all planting and landscaping features removed or damaged to its original condition. At least 6" of topsoil shall be applied where disturbed areas are to be seeded or sodded. All lawn areas shall be sodded unless seeding is called out in the drawings or specifications.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition. Broken edges shall be saw cut and repaired as directed by Engineer.

3.3 ENGINEER OBSERVATION OF WORK

A. The contractor shall provide seven (7) calendar days' notice to the Engineer prior to:

1. Placing fill over underground utilities.
2. Covering exterior walls, interior partitions and chases.
3. Installing hard or suspended ceilings and soffits.

B. The Engineer will review the installation and provide a written report noting deficiencies requiring correction. The contractor's schedule shall account for these reviews and show them as line items in the approved schedule.

C. Above-Ceiling Final Observation:

1. All work above the ceilings must be complete prior to the Engineer's review. This includes, but is not limited to:

a. All junction boxes are closed and identified in accordance with Section 260553 Electrical Identification.
b. Conduit identification is installed in accordance with Section 260553 Electrical Identification.
c. All wall penetrations have been sealed.

2. To prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
3. It is understood that if the Engineer finds the ceilings have been installed prior to this review and prior to seven days elapsing, the Engineer may not recommend further payments to the contractor until full access has been provided.

3.4 PROJECT CLOSEOUT

A. The following paragraphs supplement the requirements of Division 1.

B. Final Jobsite Observation:

1. To prevent the Final Jobsite Observation from occurring too early, the Contractor shall review the completion status of the project and certify that the job is ready for the final jobsite observation.
2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review. The Contractor shall sign the attached certification and return it to the Engineer so that the final observation can be scheduled.
3. It is understood that if the Engineer finds the job not ready for the final observation and additional trips and observations are required to bring the project to completion, the cost of the additional time and expenses incurred by the Engineer will be deducted from the Contractor's final payment.
4. Contractor shall notify Engineer 48 hours prior to installation of ceilings or lay-in ceiling tiles.

C. The following must be submitted before Engineer recommends final payment:

1. Operation and maintenance manuals with copies of approved shop drawings.
2. Record documents including marked-up or reproducible drawings and specifications.
3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of this Contractor and shall be signed by the Owner's representatives.
4. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed and submit receipt to Engineer.
5. Inspection and testing report by the fire alarm system manufacturer.
6. Start-up reports on all equipment requiring a factory installation or start-up.

D. Circuit Directories:

1. Provide custom typed circuit directory for each branch circuit panelboard. Provide updated custom typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

3.5 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.

3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. O&M file name: O&M.div26.contractor.YYYYMMDD
    b. Transmittal file name: O&Mtransmittal.div26.contractor.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copies of all factory inspections and/or equipment startup reports.
5. Copies of warranties.
6. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
7. Dimensional drawings of equipment.
8. Detailed parts lists with lists of suppliers.
9. Operating procedures for each system.
10. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
11. Repair procedures for major components.
12. Replacement parts and service material requirements for each system and the frequency of service required.
13. Instruction books, cards, and manuals furnished with the equipment.
14. Include record drawings of the one-line diagrams for each major system. The graphic for each piece of equipment shown on the one-line diagram shall be an active link to its associated Operation & Maintenance data.

15. Copies of all panel schedules in electronic Microsoft Excel spreadsheet (.xlsx) file. Each panelboard shall be a separate tab in the workbook.

3.6 INSTRUCTING THE OWNER'S REPRESENTATIVE

A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of the complete systems installed under this contract.

B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. Contractor shall make a DVD video recording of instructions to the Owner while explaining the system so additional personnel may view the instructions at a later date. The video recording shall be the property of the Owner.

D. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.

E. The instructions shall include:

1. Maintenance of equipment.
2. Start-up procedures for all major equipment.
3. Description of emergency system operation.
4. ATS with by-pass.

F. Notify the Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can be present if desired.

G. Minimum hours of instruction time for each item and/or system shall be as indicated in each individual specification section.

H. Operating Instructions:

1. Contractor is responsible for all instructions to the Owner's representatives for the electrical and specialized systems.
2. If the Contractor does not have staff that can adequately provide the required instructions, the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Engineer to perform these services.

3.7 RECORD DOCUMENTS

A. The following paragraphs supplement Division 1 requirements.

B. Maintain at the job site a separate and complete set of electrical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.

C. Mark drawings and specifications to indicate approved substitutions; Change Orders, and actual equipment and materials used. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should this Contractor fail to complete Record Documents as required by this contract, this Contractor shall reimburse Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Engineer's hourly rates in effect at the time of work.

D. Record changes daily and keep the marked drawings available for the Engineer's examination at any normal work time.

E. Upon completing the job, and before final payment is made, give the marked-up drawings to the Engineer.

F. Record actual routing of conduits exceeding 2 inches.

3.8 PAINTING

A. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available. All equipment shall have a finished coat of paint applied unless specifically allowed to be provided with a prime coat only.

B. Equipment cabinets, casings, covers, metal jackets, etc., located in equipment rooms or concealed spaces, shall be furnished in standard finish, free from scratches, abrasions, chippings, etc.

C. Equipment furnished with a suitable factory finish need not be painted; provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.

3.9 ADJUST AND CLEAN

A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.

B. Clean all foreign paint, grease, oil, dirt, labels, stickers, etc. from all equipment.

C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.10 SPECIAL REQUIREMENTS

A. Coordinate the installation of all equipment, controls, devices, etc., with existing conditions to maintain clear access area for servicing.

B. Install all equipment to maximize access to parts needing service or maintenance. Review the final location, placement, and orientation of equipment with the Owner's representative prior to setting equipment.

C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's representative will result in removal and reinstallation of the equipment at the Contractor's expense.

D. Raceway and Cable Routing Restrictions: Raceways and cable are restricted from being routed in the following locations, unless serving the space or permitted by the authority having jurisdiction.

1. Elevator machine rooms and hoistways.
2. Exit enclosures.
3. Other areas restricted by code.

3.11 INDOOR AIR QUALITY (IAQ) MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

A. Within the Limits of Construction:

1. The Electrical Contractor shall coordinate all work with the contractor responsible for IAQ.
2. The means, methods and materials used by the Electrical Contractor shall be coordinated with the contractor responsible for IAQ and shall comply with the IAQ requirements set forth in Division 1 of these specifications.

B. Outside the Limits of Construction:

1. IAQ shall be the responsibility of the electrical contractor for work that is required outside the limits of construction.
2. The Electrical Contractor is responsible for the IAQ set forth in Division 1 of these specifications.
3. The Electrical Contractor shall review and coordinate all IAQ plans and procedures with the owner's IAQ representative.

C. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:

1. General Contractor shall erect and maintain dust barriers throughout the construction work. These barriers shall be reasonably airtight and shall prevent entry into the construction zone by unauthorized persons. Reasonably airtight means construction equivalent to full-height temporary or permanent walls with joints taped or sealed, and shafts and other penetrations sealed as well as possible. Fire resistant polyethylene is acceptable; if flame spread/smoke developed ratings are demonstrated to conform to the applicable building codes and licensing acts.
2. The Contractor shall continuously maintain the construction zone under a negative pressure of at least 0.01" w.g. minimum relative to all adjacent areas of the building.

    a. Exhaust fans used for this purpose shall filter air and discharge it outdoors or to the least populated area adjacent to the construction work using negative air machines designed specifically for this purpose. All filtration for air recirculated back into the building shall be 95% filtration. Filtering air discharged to outdoors shall be accomplished with 30% filters.

b. If air is discharged outdoors, maintain all required distances to doors, windows, air intakes, etc.
c. If high levels of Volatile Organic Compounds (VOC's) or odors are released, activated carbon or equivalent filtration shall also be employed. Exhaust shall not discharge near doors, air intakes, pedestrians, gathering areas, or operable windows.
d. Adjusting existing air handling equipment to assist in pressure control is acceptable, if approved by the Owner and the authority having jurisdiction.
e. Seal return, exhaust, and supply air openings in or near the construction zone that serve existing air handling systems, and rebalance the systems for proper operation. If this is impractical, add filters at the intakes of sufficient cross sectional area to minimize the pressure drop and avoid the need for rebalancing.

3. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:

a. Minimizing the amount of dust generated.
b. Reducing solvent fumes and VOC emissions.
c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.

4. Request that the Owner designate an IAQ representative.
5. Review and receive approval from the Owner's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.
6. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.
7. Schedule activities that may cause IAQ conditions that are not acceptable to the Owner's IAQ representative during unoccupied periods.
8. Request copies of and follow all Owner's IAQ and infection control policies.
9. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.
10. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.
11. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings under Construction".

3.12 SYSTEM STARTING AND ADJUSTING

A. The electrical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes all calibration and adjustment of electrical controls, balancing of loads, troubleshooting and verification of software, and final adjustments that may be needed.

B. Complete all manufacturer-recommended startup procedures and checklists to verify proper equipment operation and does not pose a danger to personnel or property.

C. All operating conditions and control sequences shall be tested during the start-up period. Testing all interlocks, safety shut-downs, controls, and alarms.

D. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.13 FIELD QUALITY CONTROL

A. General:

1. Conduct all tests required during and after construction. Submit test results in NETA format, or equivalent form, that shows the test equipment used, calibration date, tester's name, ambient test conditions, humidity, conductor length, and results corrected to 40°C.
2. Supply necessary instruments, meters, etc., for the tests. Supply competent technicians with training in the proper testing techniques.
3. All cables and wires shall be tested for shorts and grounds following installation and connection to devices. Replace shorted or grounded wires and cables.
4. Any electrical apparatus if grounded or shorted on any integral "live" part, shall have all defective parts or materials replaced.
5. Test cable insulation of service and panel feeder conductors for proper insulation values. Tests shall include the cable, all splices, and all terminations. Each conductor shall be tested and shall test free of short circuits and grounds and have an insulation value not less than Electrical Code Standards. Take readings between conductors, and between conductors and ground.
6. If the results obtained in the tests are not satisfactory, make adjustments, replacements, and changes as needed. Then repeat the tests, and make additional tests, as the Engineer or authority having jurisdiction deems necessary.

B. Other Equipment:

1. Give other equipment furnished and installed by the Contractor all standard tests normally made to assure that the equipment is electrically sound, all connections properly made, phase rotation correct, fuses and thermal elements suitable for protection against overloads, voltage complies with equipment nameplate rating, and full load amperes are within equipment rating.

C. If any test results are not satisfactory, make adjustments, replacements and changes as needed and repeat the tests and make additional tests as the Engineer or authority having jurisdiction deem necessary.

D. Contractor shall thermographic study all electrical panelboards at the end of construction to identify any unusual conditions/heating within the equipment. Coordinate with Owner/Engineer to have an Owner/Engineer representative present during testing.

E. Report shall include color printouts, in binder, of pictures taken to use as a baseline reading after building is occupied.

F. Upon completion of the project, the Contractor shall provide amperage readings for all panelboards and switchboards and turn the results over to the Owner for "benchmark" amperages.

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to requesting a final job observation.

1. Penetrations of fire-rated construction fire sealed in accordance with specifications.
2. Electrical panels have typed circuit identification.
3. Per Section 260500, cable insulation test results have been submitted.
4. Operation and Maintenance manuals have been submitted as per Section 260500.
5.Bound copies of approved shop drawings have been submitted as per Section 260500.
6. Report of instruction of Owner's representative has been submitted as per Section 260500.
7. Fire alarm inspection and testing report has been submitted as per Sections 26 05 00 and 28 31 00.
8. Start-up reports from factory representative have been submitted as per Section 260500.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Engineer so that the final observation can be scheduled.

It is understood that if the Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

END OF SECTION

SECTION 260503 - THROUGH PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Through-Penetration Firestopping.

1.2 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Section.

B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.3 REFERENCES

A. UL 263 - Fire Tests of Building Construction and Materials

B. UL 723 - Surface Burning Characteristics of Building Materials

C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops

D. UL 2079 - Tests for Fire Resistance of Building Joint Systems

E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)

F. Intertek / Warnock Hersey - Directory of Listed Products

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops

I. The Building Officials and Code Administrators National Building Code

J. 2018 International Building Code

K. NFPA 5000 - Building Construction Safety Code

1.4 SUBMITTALS

A. Submit under provisions of Section 260500.

B. Submit Firestopping Installers Certification for all installers on the project.

C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Interek / Warnock Hersey Assembly number.

D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

1. Types of penetrating items.
2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.

E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.

B. Install material prior to expiration of product shelf life.

1.6 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.

B. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

C. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

D. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.7 MEETINGS

A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.

1. Review foreseeable methods related to firestopping work.
2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

1.8 WARRANTY

A. Provide one year warranty on parts and labor.

B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.

1. 3M; Fire Protection Products Division
2. Hilti, Inc.
3. RectorSeal Corporation, Metacaulk

2.2 THROUGH PENETRATION FIRESTOP SYSTEMS

A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.

B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.

C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.

D. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.

E. Provide firestopping systems allowing continuous insulation for all insulated pipes.

Penetrating Item	UL System No.
No Penetrating Item	FC 0000-0999*
Metallic Pipe or Conduit	FC 1000-1999
Non-Metallic Pipe or Conduit	FC 2000-2999
Multiple Penetrations	FC 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

Penetrating Item	UL System No.
No Penetrating Item	WL 0000-0999*
Metallic Pipe or Conduit	WL 1000-1999
Non-Metallic Pipe or Conduit	WL 2000-2999
Multiple Penetrations	WL 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

F. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.

G. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.

B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.

C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.

D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.2 INSTALLATION

A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.

B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.

C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.3 CLEANING AND PROTECTING

A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.4 IDENTIFICATION

A. Provide and install labels adjacent to each firestopping location. Label shall be provided by the firestop system supplier and contain the following information in a contrasting color:

1. The words "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
2. Firestop System Supplier; UL or listed by Intertek / Warnock Hersey system number; date installed; contractor name and phone number; manufacturer's representative name, address, and phone number.

3.5 INSPECTION

A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.

B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.

C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.

D. The Contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the Contractor and witnessed by the Engineer and manufacturer's factory representative. The Engineer shall have sole discretion of which firestop system installations will be reviewed. The Contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the Engineer's discretion and the Contractor's expense.

END OF SECTION

SECTION 260505 - ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical demolition

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work shall be as specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. THE DRAWINGS ARE INTENDED TO INDICATE THE SCOPE OF WORK REQUIRED AND DO NOT INDICATE EVERY BOX, CONDUIT, OR WIRE THAT MUST BE REMOVED. THE CONTRACTOR SHALL VISIT THE SITE PRIOR TO SUBMITTING A BID AND VERIFY EXISTING CONDITIONS.

B. Verify that abandoned wiring and equipment serve only abandoned equipment or facilities. Extend conduit and wire to facilities and equipment that will remain in operation following demolition. Extension of conduit and wire to equipment shall be compatible with the surrounding area. Extended conduit and conductors to match existing size and material.

C. Coordinate scope of work with all other Contractors and the Owner at the project site. Schedule removal of equipment and electrical service to avoid conflicts.

D. Bid submittal shall mean the Contractor has visited the project site and has verified existing conditions and scope of work.

3.2 PREPARATION

A. The Contractor shall obtain approval from the Owner before turning off power to circuits, feeders, panels, etc. Coordinate all outages with Owner.

B. Coordinate utility service outages with Utility Company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations. Assume all equipment and systems must remain operational unless specifically noted otherwise on drawings.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Service changeover shall be completed on an overtime basis.

E. Existing Gemini Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Provide a watchman to make required premise observations during all outages, requirements as dictated by codes and Owner's insurance carrier.

F. Existing Generator System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from the Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. System downtime shall occur on an overtime basis.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Demolish and extend existing electrical work under provisions of Division 1 of Specifications and this Section.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring and raceway to source of supply. Existing conduit in good condition may be reused in place by including an equipment ground conductor in reused conduit. Reused conduit and boxes shall have supports revised to meet current codes. Relocating conduit shall not be allowed.

D. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces. Remove all associated clamps, hangers, supports, etc. associated with raceway removal.

E. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

F. Repair adjacent construction and finishes damaged during demolition and extension work. Patch openings to match existing surrounding finishes.

G. Maintain access to existing electrical installations that remain active. Modify installation or provide junction boxes as appropriate.

H. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified. Extended conduit and conductors to match existing size and material.

I. Disconnect and remove existing generator and ATS and existing Gemini Fire Alarm system.

J. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

K. Floor slab on grade is a structural slab. All penetrations shall be X-rayed prior to cutting and/or drilling to avoid rebar or utilities encased in floor construction. Provide rebar dowels to replace damaged rebar and pin existing slab with patched slab.

L. Floor slabs may contain conduit systems. This Contractor is responsible for taking any measures required to ensure no conduits or other services are damaged. This includes X-ray or similar non-destructive means. Where conduit is in concrete slab, cut conduit flush with floor, pull out conductors, and plug conduit ends.

M. This Contractor is responsible for all costs incurred in repair, relocations, or replacement of any cables, conduits, or other services if damaged without proper investigation.

3.4 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or 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. Provide typed circuit directory showing revised circuiting arrangement.

C. ELECTRICAL ITEMS (E.G., SWITCHES, CONDUIT, WIRE, ETC.) REMOVED AND NOT RELOCATED REMAIN THE PROPERTY OF THE OWNER. CONTRACTOR SHALL PLACE ITEMS RETAINED BY THE OWNER IN A LOCATION COORDINATED WITH THE OWNER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DISPOSAL OF MATERIAL THE OWNER DOES NOT WANT.

3.5 INSTALLATION

A. Install relocated materials and equipment under the provisions of Division 1 of Specifications.

END OF SECTION

SECTION 263600 - TRANSFER SWITCH

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Automatic transfer switch with closed transition and bypass/isolation switch

B. Portable generator and load bank connection cabinet (GCC-1)

1.2 RELATED SECTIONS AND WORK

A. Refer to the Transfer Switch Schedule for rating and configuration.

1.3 QUALITY ASSURANCE

A. Manufacturer: Company specializing in automatic transfer equipment with three (3) years documented experience.

1.4 REFERENCES

A. NEMA ICS 1 - General Standards for Industrial Control and Systems

B. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers, and Assemblies

C. NEMA ICS 6 - Enclosures for Industrial Controls and Systems

D. NEMA ICS 10 - Guide to Application of Low-Voltage Automatic Transfer Switch Equipment

E. UL 1008 - Standard for Automatic Transfer Switches

F. NFPA 110 - Standard for Emergency and Standby Power Systems

1.5 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 260500.

B. Submit product data for transfer switches showing overall dimensions, electrical connections, electrical ratings, and environmental requirements.

C. Submit manufacturer's installation instructions under provisions of Section 260500.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 260500.

B. Include instructions for operating equipment.

C. Include instructions for operating equipment under emergency conditions when engine generator is running.

D. Identify operating limits which may result in hazardous or unsafe conditions.

E. Document ratings of equipment and each major component.

F. Include routine preventive maintenance and lubrication schedule.

G. List special tools, maintenance materials, and replacement parts.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable code for emergency and standby electrical systems.

PART 2 - PRODUCTS

2.1 SERVICE CONDITIONS, ENCLOSURE, AND RATINGS

A. Service Conditions: NEMA ICS 1. Suitable for use as service entrance equipment. Provide line side (service style) barriers.

B. Enclosure: NEMA ICS 6; Type 3R.

C. Ratings: Refer to the electrical diagrams for the Withstand and Close Ratings WCR available interrupting capacity (AIC) at the transfer switch. The transfer switch shall be series rated with the equipment feeding the transfer switch. The series rating shall be the larger of the two Short Circuit Current Ratings SCCR values when the SCCR rating of the equipment feeding the normal and emergency sides of the transfer switch is not equal. Series rating with upstream devices shall be allowed per UL-1008.

2.2 AUTOMATIC TRANSFER WITH CLOSED TRANSITION AND BYPASS/ISOLATION SWITCH

A. Automatic transfer switch, microprocessor controlled, three-position switch mechanism with bypass isolation, closed transition make-before-break and load shed capable, with local manual operation.

B. Acceptable Manufacturers:

1. Schneider Electric ASCO 7ATB Series

C. Description: NEMA ICS 2; automatic transfer switch with center position closed transition make-before-break, center position off capable for load shed, and manual bypass switch.

D. Configuration: Draw-out type electrically-operated, mechanically-held transfer switch with manually-operated CONNECTED, TEST, and DISCONNECTED draw-out positions, and with mechanically-operated, mechanically-held transfer switch connected to bypass automatic switch.

E. Bypass Switch Ratings: Match automatic transfer switch for electrical ratings.

2.3 PORTABLE GENERATOR / LOAD BANK CONNECTION CABINET (TLCM GCC 00)

A. Acceptable Manufacturers:

1. Square D

2. Foxfab FFCC Series
3. Berthold Electric Co
4. Power Temp Systems Inc

B. Pad mount, powder coat painted NEMA 3R housing with lockable door, 400 amps, 600 volt. Color-coded cam-lock connectors. Submit product data and dimensioned drawings. Color selection by Engineer.

1. Load Bank Cam Lock Receptacle: Female plug, male cable.
2. Portable Generator Cam Lock Receptacle: Male plug, female cable.
3. Cam Lock Configuration: Power flow from female to male; note ground / neutral configurations are opposite of phase conductors at the same connection location.

C. Three-way Manual Transfer Switch: Provide-three-way switch to allow flexible connection between; onsite generator and load bank, portable generator and load, onsite generator and load. The switches may be transfer switch or circuit breaker technology.

D. Accessories: Provide the following required accessories.

1. Generator Start Signals: Provide parallel generator start cabling from the transfer switches to the portable generator cabinet. Provide quick connect type connections for the generator start signals.
2. Indicators:

a. Generator "ON" indicator
b. Utility "ON" indicator
c. Phase Monitor: A-B-C phase rotation monitor indicator.
d. Cabinet Heater: Provide cabinet heater with thermostat/humidistat sized per manufacturer recommendations to prevent condensation inside cabinet. EC to provide branch circuit wiring per approved shop drawings.

E. Provide engraved plastic label including:

1. System voltage
2. Maximum amps
3. Short Circuit Current Rating SCCR
4. Phase rotation direction
5. Phase, ungrounded conductor, and grounding identification

2.4 AUTOMATIC SEQUENCE OF OPERATION

A. Initiate Retransfer Load to Normal Source: Upon permission by normal source monitor.

B. Time Delay Before Transfer to Normal Power: 0 to 30 minutes, adjustable; bypass time delay in event of alternate source failure.

C. Time Delay Before Engine Shut Down: 0 to 30 minutes, adjustable, of unloaded operation.

2.5 REQUIRED ACCESSORIES

A. The following accessories, features, and characteristics shall be provided with each automatic style transfer switch.

B. Indicating Lights: Mount in cover of enclosure to indicate NORMAL SOURCE AVAILABLE, ALTERNATE SOURCE AVAILABLE, SWITCH POSITION.

C. Test Switch: Key operated or password protected switch. Mount in cover of enclosure to simulate failure of normal source.

D. Engine Start Signal: Rated 10 amps at 30VDC shall be provided to start the engine generator in the event of a normal source outage.

E. Remote Start Circuit Monitoring: Provide continuous monitoring of the generator start circuits. A failure shall initiate visual and audible alarms at the generator, remote annunciators, and start the generator.

F. Return to Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate to normal source.

G. Transfer Switch Auxiliary Contacts: 2 normally open; 2 normally closed indicating switch to normal source or emergency source.

H. Normal Source Monitor: Monitor each line of normal source voltage and frequency; initiate transfer when voltage drops below 85 percent or frequency varies more than 3 Hertz from rated nominal value, values shall be field adjustable.

I. Alternate Source Monitor: Monitor each line of alternate source voltage and frequency; inhibit transfer when voltage is below 85 percent or frequency varies more than 3 percent Hertz from rated nominal voltage, values shall be field adjustable.

J. Engine Exerciser: Start engine every 28 days. Run for 30 minutes before shutting down. Each event shall be configurable for Test with Load or Test Without Load. Bypass exerciser control if normal source fails during exercising period.

K. In-Phase Monitor: Inhibit transfer until source and load are within 30 electrical degrees.

L. Provide 2 N.O. and 2 N.C. isolated contacts to indicate:

1. Normal source available.
2. Emergency source available.
3. Exercise mode in operation.

M. Communication Port: Communication cable in conduit shall daisy chain all transfer switches with a remote annunciator.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify field measurements are as instructed by the manufacturer.

C. Verify that required utilities are available, in proper location, and ready for use.

D. Beginning of installation means acceptance of existing conditions.

3.2 CONTROL AND SIGNAL CABLING

A. Provide control and signal cabling per manufacturer recommendations for the following systems components:

1. Remote annunciator.
2. Generator start signal. The generator start signal cabling for the following transfer switches shall be fire protected for a minimum of 2 hours using an approved method:
   a. Optional standby transfer switches
   b. Approved Methods:

      1) Raceway or cable encased in a minimum of 2 inches of concrete cover.
      2) Listed fire resistive raceway / cable system.
      3) Raceway / cable is protected by a listed electrical circuit protective system.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 260513 - WIRE AND CABLE

PART 1 - GENERAL

1.1 RELATED WORK

A. Section 260553 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.2 REFERENCES

A. NFPA 70 - National Electrical Code (NEC)

B. UL 44 - Thermoset-Insulated Wires and Cables

C. UL 83 - Thermoplastic-Insulated Wires and Cables

D. UL 854 - Service-Entrance Cables

E. UL 1581 - Standard for Electrical Wires, Cables, and Flexible Cords

F. UL 2196 - Fire Resistive, Fire Resistant and Circuit Integrity Cables

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 CONTRACTOR CHANGES

A. The basis of design is copper conductors installed in raceway based on ambient temperature of 30°C,. Service entrance conductors are based on copper conductor installed in underground electrical ducts,

B. The Contractor shall be responsible for derating and sizing conductors and conduits to equal or exceed the ampacity of the basis of design circuits, if he/she chooses to use methods or materials other than the basis of design.

C. Underground electrical duct ampacity rating shall be in accordance with NEC Table B.2(7) (2011 - 2017 edition Table B310.15(B)(2)(7); 2008 or later edition B.301.7) or calculated in accordance with Annex B Application Information for Ampacity Calculation. Conductor length(s) listed on plans and schedules. The drawings are diagrammatic with intent to convey the components of the electrical distribution system. Conductor length(s) when listed on plans and schedules are for engineering calculation purposes. Conductor length(s) shall NOT be used for bidding purposes.

D. Record drawing shall include the calculations and sketches.

3.2 GENERAL WIRING METHODS

A. Use no wire smaller than 12 AWG for power circuits, and no smaller than 14 AWG for control wiring.

B. Use no wire smaller than 18 AWG for low voltage control wiring below 100 volts.

C. Use 10 AWG conductor for 20 ampere, 120-volt branch circuit home runs longer than 75 feet, and for 20 ampere, 277-volt branch circuit home runs longer than 200 feet.

D. The ampacity of multiple conductors in one conduit shall be derated per the Electrical Code. In no case shall more than 4 conductors be installed in one conduit to such loads as motors larger than 1/4 HP, panelboards, etc.

E. Where installing parallel feeders, place an equal number of conductors for each phase of a circuit in same raceway or cable.

F. Splice only in junction or outlet boxes.

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

H. Make conductor lengths for parallel circuits equal.

I. All conductors shall be continuous in conduit from last outlet to their termination.

J. Terminate all spare conductors on terminal blocks, and label the spare conductors.

K. Cables or wires shall not be laid out on the ground before pulling.

L. Cables or wires shall not be dragged over earth or paving.

M. Care shall be taken so as not to subject the cable or wire to high mechanical stresses that would cause damage to the wire and cable.

N. All wires in outlet boxes not connected to devices shall be rolled up, spliced if continuity of circuit is required, and insulated.

3.3 WIRING INSTALLATION IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires.

B. Pulling shall be continuous without unnecessary stops and starts with wire or cable only partially through raceway.

C. Where reels of cable or wire are used, they shall be set up on jacks close to the point where the wire or cable enters the conduit or duct so that the cable or wire may be unreeled and run into the conduit or duct with a minimum of change in the direction of the bend.

D. Conductors shall not be pulled through conduits until plastering or masonry work is completed and conduits are free from moisture. Care shall be taken so that long pulls of wire or pulls around several bends are not made where the wire may be permanently stretched and the insulation damaged.

E. Only nylon rope shall be permitted to pull cables into conduit and ducts.

F. Completely and thoroughly swab raceway system before installing conductors.

3.4 WIRING CONNECTIONS AND TERMINATIONS

A. Splice and tap only in accessible junction boxes.

B. Use solderless, tin-plated copper, compression terminals (lugs) applied with circumferential crimp for conductor terminations, 8 AWG and larger.

C. Use solderless, tin-plated, compression terminals (lugs) applied with indenter crimp for copper conductor terminations, 10 AWG and smaller.

D. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps.

E. Use compression connectors applied with circumferential crimp for conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.

F. Thoroughly clean wires before installing lugs and connectors.

G. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

H. Phase Sequence: All apparatus shall be connected to operate in the phase sequence A-B-C representing the time sequence in which the phase conductors so identified reach positive maximum voltage.

I. As a general rule, applicable to switches, circuit breakers, panelboards and the like, the connections to phase conductors are intended thus:

1. Facing the front and operating side of the equipment, the phase identification shall be:

a. Left to Right - A-B-C
b. Top to Bottom - A-B-C

END OF SECTION

SECTION 260526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Equipment grounding system

B. Bonding system

1.2 QUALITY ASSURANCE

A. Comply with UL 467 Grounding and Bonding Equipment.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code (NEC)

1.4 SUMMARY

A. This section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Division 26 Section 260513 "Wire and Cable".

2.2 CONNECTOR PRODUCTS

A. Comply with UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

PART 3 - EXECUTION

3.1 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.

3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

C. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

D. Moisture Protection: If insulated grounding conductors are connected to grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.2 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Each grounding conductor that passes through a below grade wall must be provided with a waterstop.

B. In raceways, use insulated equipment grounding conductors.

3.3 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

1. Measure ground resistance from system neutral connection at service entrance to convenient ground reference points using suitable ground testing equipment. Resistance shall not exceed 5 ohms.
2. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
3. Testing: Perform the following field quality-control testing:

    a. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.

    b. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

3.4 GRADING AND PLANTING

A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Maintain restored surfaces. Restore disturbed paving.

END OF SECTION

SECTION 260527 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Conduit and Equipment Supports

B. Fastening Hardware

1.2 REFERENCES

A. UL 62275 - Cable Management Systems - Cables Ties for Electrical Installations

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Allied Support Systems

B. Cooper B-Line

C. Erico, Inc.

D. Hilti

2.2 MATERIAL

A. Support Channel: ; painted steel.

B. Hardware: Corrosion resistant.

C. Conduit Sleeves and Lintels:

1. Each Contractor shall provide, to the General Contractor for installation, lintels for all openings required for the Contractor's work in masonry walls and conduit sleeves for floors.

2. Fabricate all lintels from structural steel shapes. All lintels and grouped wall openings shall be approved by a Structural Engineer.
3. Fabricate all sleeves from standard weight black steel pipe. Provide continuous sleeve. Cut or split sleeves are not acceptable. Sleeves through concrete walls may be high density polyethylene pipe penetration sleeve with a water stop collar, suitable for use with Link-Seal mechanical seals. Century-Line Model CS.
4. Sleeves shall not penetrate structural members without approval from a Structural Engineer.
5. Size sleeves large enough to allow expansion and contraction movement.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fasten conduit clamps, and junction boxes to building structure using expansion anchors in concrete and beam clamps on structural steel.

B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.

C. Do not fasten supports to ceiling systems, piping, ductwork, mechanical equipment, or conduit.

D. Do not use powder-actuated anchors without specific permission.

E. Do not drill structural steel members.

F. Install ATS and panelboard with minimum of four anchors. Provide horizontal backing/support framing in stud walls for rigid mounting.

G. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

END OF SECTION

SECTION 260533 - CONDUIT AND BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical metallic tubing and fittings (EMT)

B. Rigid polyvinyl chloride conduit and fittings (PVC)

C. Handholes

1.2 RELATED WORK

A. Section 260553 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.3 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI C80.3 - Electrical Metallic Tubing, Zinc-Coated and Fittings
   2. ANSI C80.4 - Fittings for Rigid Metal Conduit and Electrical Metallic Tubing

B. NECA "Standards of Installation"

C. National Electrical Manufacturers Association (NEMA):

   1. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
   2. TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit
   3. TC 9 - Fittings for PVC Plastic Utilities Duct for Underground Installation

D. NFPA 70 - National Electrical Code (NEC)

E. Underwriters Laboratories (UL): Applicable Listings
   1. UL514-B - Conduit Tubing and Cable Fittings
   2. UL651-A - Type EB and a PVC Conduit and HDPE Conduit
   3. UL797 - Electrical Metal Tubing

F. American Standard of Testing and Materials (ASTM):

   1. ASTM D 570 - Standard Test Method for Water Absorption of Plastics
   2. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics
   3. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics under Flexural Load in the Edge Wise Position
   4. ASTM D 2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
   5. ASTM D 2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter

6. ASTM D 3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Material

G. Definitions:

1. Fittings: Conduit connection or coupling.
2. Body: Enlarged fittings with opening allowing access to the conductors for pulling purposes only.
3. Mechanical Spaces: Enclosed areas, usually kept separated from the general public, where the primary use is to house service equipment and to route services. These spaces generally have exposed structures, bare concrete and non-architecturally emphasized finishes.
4. Finished Spaces: Enclosed areas where the primary use is to house personnel and the general public. These spaces generally have architecturally emphasized finishes, ceilings and/or floors.
5. Concealed: Not visible by the general public. Often indicates a location either above the ceiling, in the walls, in or beneath the floor slab, in column coverings, or in the ceiling construction.
6. Above Grade: Not directly in contact with the earth. For example, an interior wall located at an elevation below the finished grade shall be considered above grade but a wall retaining earth shall be considered below grade.
7. Slab: Horizontal pour of concrete used for a floor or sub-floor.

1.4 SUBMITTALS

A. Include fittings and conduits 1.5" and larger in coordination files. Include all in--floor and underfloor conduit in coordination files. Refer to Section 260500 for coordination drawing requirements.

PART 2 - PRODUCTS

2.1 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

A. Minimum Size Electrical Metallic Tubing: 3/4 inch, unless otherwise noted.

2.2 RIGID NON-METALLIC CONDUIT (PVC) AND FITTINGS

A. Minimum Size Rigid Smooth-Wall Nonmetallic Conduit: 3/4 inch, unless otherwise noted.

B. Construction: Schedule 40 and Schedule 80 rigid polyvinyl chloride (PVC), UL labeled for 90°C.

C. Fittings and Conduit Bodies: NEMA TC 3; sleeve type suitable for and manufactured especially for use with the conduit by the conduit manufacturer.

D. Plastic cement for joining conduit and fittings shall be provided as recommended by the manufacturer.

ASTM Test	Description	Values HDPE
D-1505	Density g/CM 3	less than 0.941

D-1238	Melt Index, g/10 min Condition E	greater than 0.55 grams/10 min.
D-638	Tensile Strength at yield (psi)	3000 min.
D-1693	Environmental Stress Crack Resistance Condition B, F 20	96 hrs.
D-790	Flexural Modulus, MPa (psi)	less than 80,000
D-746	Brittleness Temperature	-75°C Max

2.3 HANDHOLES

A. HH-1; Handhole, composite polymer concrete body and cover. Stainless steel hardware. Bolted non-skid cover rated for 5,000 pounds. Design load occasional non-deliberate vehicular traffic. Stack units to achieve depth shown on plans. Units in landscaped areas shall be green in color.

1. Manufacturers:

a. Hubbell/Quazite PG####BB18, PG####HA00
b. Carson Industries H Series
c. Armorcast

Model	Service	Element Material	Temperature Range
S	Standard (Stainless)	EPDM	-40°F to 250°F

PART 3 - EXECUTION

3.1 CONDUIT INSTALLATION SCHEDULE AND SIZING

A. In the event the location of conduit installation represents conflicting installation requirements as specified, a clarification shall be obtained from the Engineer. If this Contractor is unable to obtain a clarification as outlined above, concealed rigid galvanized steel conduit installed per these specifications and the Electrical Code shall be required.

B. Size conduit as shown on the drawings. Where not indicated in the contract documents, conduit size shall be according to the Electrical Code. Conduit and conductor sizing shall be coordinated to limit conductor fill to less than 40%, maintain conductor ampere capacity as required by the Electrical Code (to include enlarged conductors due to temperature and quantity derating values) and to prevent excessive voltage drop and pulling tension due to long conduit/conductor lengths.

C. Minimum Conduit Size (Unless Noted Otherwise):

1. Above Grade: 3/4 inch. Specifier: Edit size
2. Below Grade 5' or less from Building Foundation: 1 inch.
3. Below Grade More than 5' from Building Foundation: 1 inch.
4. Controls Conduit: 3/4 inch.

D. Conduit sizes shall change only at the entrance or exit to a junction box.

3.2 CONDUIT ARRANGEMENT

A. Conduit shall be installed parallel or perpendicular to walls, ceilings, and exposed structural members. In unfinished spaces, mechanical and utility areas, conduit may run either concealed or exposed as conditions dictate and as practical. Installation shall maintain headroom in exposed vicinities of pedestrian or vehicular traffic.

B. Conduit shall not share the same cell as structural reinforcement in masonry walls.

C. Conduit runs shall be routed as shown on drawings. Conduit routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatic. The correct routing, when shown diagrammatically shall be chosen by the Contractor based on information in the contract documents, in accordance with manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", in accordance with recognized industry standards, and coordinated with existing conditions.

3.3 CONDUIT SUPPORT

A. Conduit shall not be supported from ductwork, water, sprinkler piping, or other non-structural members. All supports shall be from structural slabs, walls, and structural members, and coordinated with existing conditions.

B. Conduit shall be held in place by the correct size of galvanized one-hole conduit clamps, two-hole conduit straps, patented support devices, and clamp back conduit hangers.

C. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

D. Group conduits in parallel runs where practical and use wall mounted from metal channels with conduit straps or clamps. Supports for metallic conduit shall be no greater than 10 feet. A smaller interval may be used if necessitated by building construction, but in no event shall support spans exceed the Electrical Code requirements. Conduit shall be securely fastened within 3 feet of each outlet box, junction box, cabinet, or fitting.

E. Finish:

1. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.

3.4 CONDUIT INSTALLATION

A. Conduit Connections:

1. Shorter than standard conduit lengths shall be cut square using industry standards. The ends of all conduits cut shall be reamed or otherwise finished to remove all rough edges.
2. Install expansion/deflection joints where conduit crosses structure expansion/seismic joints.

B. Conduit Bends:

1. Use a hydraulic one-shot conduit bender or factory elbows for bends in conduit 2" in size or larger. All steel conduit bending shall be done cold; no heating of steel conduit shall be permitted.
2. All bends of rigid polyvinyl chloride conduit (PVC) shall be made with the manufacturer's approved bending equipment. The use of spot heating devices will not be permitted (i.e. blow torches).
3. A run of conduit shall not contain more than the equivalent of four (4) quarter bends (360°), including those bends located immediately at the outlet or body.
4. Rigid polyvinyl chloride conduit (PVC) runs longer than 100 feet or runs which have more than two 90° equivalent bends (regardless of length) shall use rigid metal or RTRC factory elbows for bends.
5. Use conduit bodies to make sharp changes in direction (i.e. around beams).

C. Conduit Placement:

1. Conduit shall be mechanically continuous from source of current to all equipment. Conduit shall be electrically continuous from source of current to all equipment, unless a properly sized grounding conductor is routed within the conduit. All metallic conduits shall be bonded per the Electrical Code.
2. Route exposed conduit and conduit above suspended ceilings (accessible or not) parallel/perpendicular to the building structural lines, and as close to building structure as possible. Wherever possible, route horizontal conduit runs above water and steam piping.
3. Avoid moisture traps where possible. Where unavoidable, provide a junction box with drain fitting at conduit low point.
4. All conduits through walls shall be grouted or sealed into openings. Where conduit penetrates firewalls seal with a UL listed sealant.**;** refer to Section 260503 for through penetration firestopping requirements.
5. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL OPENINGS REQUIRED IN MASONRY OR EXTERIOR WALLS UNDER THIS DIVISION. A QUALIFIED MASON AT THE EXPENSE OF THIS CONTRACTOR SHALL REPAIR ALL OPENINGS TO MATCH EXISTING CONDITIONS.
6. Seal interior of conduit at exterior entries, and where the temperature differential can potentially be greater than 20°F, to prevent moisture penetration. Seal shall be placed where conduit enters warm space. Conduit seal fitting shall be a drain/seal, with sealing compound, identified for use with cable and raceway system.
7. Rigid polyvinyl chloride conduit (PVC) shall be installed when material surface temperatures and ambient temperature are greater than 40°F.
8. Where rigid polyvinyl chloride conduit (PVC) is used below grade, a transition to rigid galvanized steel conduit shall be installed before conduit exits earth. The conduit shall extend a minimum of 6" into the surface concealing the non-metallic conduit.
9. Contractor shall provide suitable mechanical protection around all conduits stubbed out from walls or ceilings during construction to prevent bending or damaging of stubs due to carelessness with construction equipment.

3.5 CONDUIT TERMINATIONS

A. Where conduit bonding is indicated or required in the contract documents, the bushings shall be a grounding type sized for the conduit and ground bonding conductor as manufactured by O-Z/Gedney, Appleton, Thomas & Betts, Burndy, Regal, Orbit Industries or approved equal.

B. Conduits with termination fittings shall be threaded for one (1) lock nut on the outside and one (1) lock nut and bushing on the inside of each box.

C. Where conduits terminate in boxes with knockouts, they shall be secured to the boxes with lock nuts and provided with approved screw type tinned iron bushings or fittings with plastic inserts.

D. Where conduits terminate in boxes, fittings, or bodies with threaded openings, they shall be tightly screwed against the shoulder portion of the threaded openings.

E. Rigid polyvinyl chloride conduit (PVC) shall be terminated using fittings and bodies produced by the manufacturer of the conduit. Prepare conduit as per manufacturer's recommendations before joining. All joints shall be solvent welded by applying full even coat of plastic cement to the entire areas that will be joined. Turn the conduit at least a quarter to one half turn in the fitting and let the joint cure for 1-hour minimum or as per the manufacturer's recommendations.

F. All conduit ends shall be sealed with plastic immediately after installation to prevent the entrance of any foreign matter during construction. The seals shall be removed and the conduits blown clear of all foreign matter prior to any wires or pull cords being installed.

3.6 UNDERGROUND CONDUIT INSTALLATION

A. Conduit Connections:

1. Conduit joints in a multiple conduit run shall be staggered at least one foot apart.

B. Conduit Bends (Lateral):

1. Conduits shall have long sweep radius elbows instead of standard elbows wherever special bends are indicated and noted on the drawings, or as required by the manufacturer of the equipment or system being served.

C. Conduit Elbows (vertical):

1. Minimum metal or RTRC elbow radiuses shall be 30 inches for primary conduits (greater than 600V) and 18 inches for secondary conduits (less than 600V). Increase radius, as required, based on pulling tension calculation requirements.

D. Expansion Fittings at Finished Grade: Provide underground raceways with an expansion fitting after emerging from finished grade. Field locate the expansion fitting above and within 24 inches of finished grade. Raceways extending less than 12 inches above finished grade, transitioning to LFMC within 12 inches of finished grade, do not require an expansion fitting unless required by code.

E. Conduit Placement:

1. Conduit runs shall be pitched a minimum of 4" per 100 feet to drain toward the terminations. Duct runs shall be installed deeper than the minimum wherever required to avoid any conflicts with existing or new piping, tunnels, etc.
2. For parallel runs, use suitable separators and chairs installed not greater than 4' on centers. Band conduit together with suitable banding devices. Securely anchor conduit to prevent movement during concrete placement or backfilling.

3. Where concrete is required, the materials for concreting shall be thoroughly mixed to a minimum f'c = 2500 and immediately placed in the trench around the conduits. No concrete that has been allowed to partially set shall be used.
4. Before the Contractor pulls any cables into the conduit, Contractor shall have a mandrel 1/4" smaller than the conduit inside diameter pulled through each conduit and if any concrete or obstructions are found, the Contractor shall remove them and clear the conduit. Spare conduit shall also be cleared of all obstructions.
5. All spare conduits not terminated in a covered enclosure shall have its terminations plugged as described above.
6. Ductbanks and conduit shall be installed a minimum of 24" below finished grade.
7. All non-metallic conduit installed underground outside of a slab shall be rigid.

F. Raceway Seal (Exterior to Raceway):

1. All power conduits shall be sealed between the raceway and the building foundation. The raceway penetration shall be sealed liquid-tight, water-tight, non-corrosive.

2. Above Grade Installation Options:

a. Masonry grout for masonry applications.
b. Caulk Sealant, interior/exterior rated, color per engineer. Approved Manufacturers include Sachco, Tremco Vulkem, Sika or approved equal.

G. Raceway Seal (Interior to Raceway, with Cables or Empty):

1. All electrical conduits, including those with cables, shall be sealed at the building entry. The seal shall prevent the entry of liquids or gases. Seal must be compatible with conductors and raceway system. Spare or unused raceways shall also be sealed.

2. Installation Schedule, nominal size:

a. 2" or less: Duct Seal Bushing or Duct Sealant
b. 2-1/2" through 4": Duct Seal Bushing

3.7 COORDINATION OF BOX LOCATIONS

A. Provide electrical boxes as shown on the drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.

B. Electrical box locations shown on the Contract Drawings are approximate, unless dimensioned.

C. Locate and install boxes to allow access. Avoid interferences with ductwork, piping, structure, equipment, etc. Where installation is inaccessible, provide access doors. Coordinate locations and sizes of required access doors with the Engineer and General Contractor.

D. Locate and install to maintain headroom and to present a neat appearance.

3.8 EXPOSED BOX INSTALLATION

A. Boxes shall be secured to the building structure with proper size screws, bolts, hanger rods, or structural steel elements.

B. On brick, block and concrete walls or ceilings, exposed boxes shall be supported with no less than two (2) Ackerman-Johnson, Paine, Phillips, or approved equal screw anchors or expansion shields and round head machine screws. Cast boxes shall not be drilled.

C. Boxes may be supported on steel members by APPROVED beam clamps if conduit is supported by beam clamps.

D. Wood, plastic, or fiber plugs shall not be used for fastenings.

E. Explosive devices shall not be used unless specifically allowed.

END OF SECTION

SECTION 260548 - SEISMIC REQUIREMENTS FOR EQUIPMENT AND SUPPORTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Seismic Requirements.

1.2 QUALITY ASSURANCE

A. General:

1. The contractor shall retain a specialty consultant or equipment manufacturer to develop a seismic restraint and support system and perform seismic calculations in accordance with these specifications, state, and local codes.
2. Items used for seismic restraint of equipment and systems shall be specifically manufactured for seismic restraint.
3. These requirements are beyond those listed in Section 260527 of these specifications. Where a conflict arises between the seismic requirements of this section and any other section, the Engineer shall be immediately notified for direction to proceed.

B. Manufacturer:

1. System Supports/Restraints: Company specializing in the manufacture of products specified in this Section.
2. Equipment: Each company providing equipment that must meet seismic requirements shall provide certification included in project submittals the equipment supplied for the project meets or exceeds the seismic requirements of the project.

C. Testing Agency: An independent testing agency, acceptable to Authorities Having Jurisdiction, with experience and capability to conduct the testing indicated.

D. Installer: Company specializing in performing the work of this Section.

1.3 REFERENCES

A. International Building Code, 2018.

B. ASHRAE - A Practical Guide to Seismic Restraint.

C. ASCE 7-02, Chapter 9.

D. ASCE 7-05, Chapter 13.

E. ASCE 7-10, Chapter 13.

F. ASCE 7-16, Chapter 13.

1.4 SUBMITTALS

A. Submit under provisions of Section 260500.

B. Shop Drawings:

1. Calculations, restraint selections, and installation details shall be designed and sealed by a Professional Structural Engineer licensed in the state where the project is located experienced in seismic restraint design and installation.
2. Coordination Drawings: Plans and sections drawn to scale, coordinating seismic bracing of electrical components with other systems and equipment in the vicinity, including other seismic restraints.
3. Manufacturer's Certifications: Professional Structural Engineer licensed in the state where the project is located shall review and approve manufacturer's certifications of compliance.
4. System Supports/Restraints - Submit for each condition requiring seismic bracing:

    a. Calculations for each seismic brace and detail utilized on the project.
    b. Plan drawings showing locations and types of seismic braces on contractor fabrication/installation drawings.
    c. Cross-reference between details and plan drawings to indicate exactly which brace is being installed at each location. Details provided are to clearly indicate attachments to structure, correctly representing the fastening requirements of bracing.
    d. Clear indication of brace design forces and maximum potential component forces at attachment points to building structure for confirmation of acceptability by the Structural Engineer of Record.

5. Equipment - Submit for each piece of equipment supplied:

    a. Certification that the equipment supplied for the project meets or exceeds the seismic requirements specified. Equipment certification is to be provided by the manufacturer
    b. Specific details of seismic design features of equipment and maximum seismic loads imparted to the structural support.
    c. Engineering calculations and details for equipment anchorage and support structure.

C. A seismic restraint designer shall be provided whether or not exceptions listed in the applicable building code are met. If seismic restraints are not provided for a system that requires seismic bracing, the seismic designer shall submit a signed and sealed letter to the Engineer and Authorities Having Jurisdiction stating the exceptions, along with code reference, utilized for each item. Seismic designer shall review system installation for general conformance to the exception requirements stated in the code and document, in writing, the system has been installed in accordance to the exception.

1.5 TESTING AND INSPECTION

A. Special Inspection and Testing shall be done in accordance with Chapter 17 of the Building Code.

B. The Contractor shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704 and 1705.

C. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specifications to the building official and Engineer of Record.

D. The Special Inspection Agency shall furnish inspection reports to the building official, the Owner, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work. A final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency's knowledge, in conformance with the approved plans and specifications shall be submitted.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site. Accept material on site in factory containers and packing. Inspect for damage. Protect from damage and contamination by maintaining factory packaging until installation. Follow manufacturer's instructions for storage.

1.7 DESIGN REQUIREMENTS

A. This project is subject to the seismic bracing requirements of the International Building Code, 2018 edition.

B. The following criteria are applicable to this project:

1. Seismic Use Group: [**I**][**II**][**III**]
2. Occupancy Category: [**I**][**II**][**III**][**IV**]
3. Risk Category: [**I**][**II**][**III**][**IV**]
4. Seismic Importance Factor: I_E = [**1.0**][**1.25**][**1.5**]
5. Seismic Design Category: [**A**][**B**][**C**][**D**][**E**][**F**]
6. Component Amplification Factors (ap) and Component Response Modification Factors (Rp) shall be taken from Table [**1621.3 in IBC 2000**][**9.6.3.2 in ASCE 7-02**][**13.6-1 in ASCE 7-05**][**13.5-1 in ASCE 7-10**][**13.5-1 in ASCE 7-16**][**1621.3r in CBC 2016**] for the individual equipment or system being restrained.
7. Component Importance Factors (Ip) shall be taken from Section [**1621.1.6 in IBC 2000**][**9.6.1.5 in ASCE 7-02**][**13.1.3 in ASCE 7-05**][**13.1.3 in ASCE 7-10**][**13.1.3 in ASCE 7-16**][**1621.1.6 in CBC 2016**] for the individual equipment or system being restrained.
8. The total height of the structure and the height of the system to be restrained within the structure shall be determined in coordination with architectural plans and the General Contractor.

C. Forces shall be calculated with the above requirements and Equation [**16-67, 68, & 69 in section 1621.1.4 of IBC 2000, unless exempted by 1621.1.1**][**9.6.1.3-1, -2, and -3 of ASCE 7-02, unless exempted by 9.6.1**][**13.3-1, -2, and -3 of ASCE 7-05, unless exempted by 13.1.413.3-1, -2, and -3 of ASCE 7-10, unless exempted by 13.1.4**][**13.3-1, -2, and -3 of ASCE 7-16, unless exempted by 13.1.4**][**of CBC 2016 unless exempted by 13.1.4**].

D. Equipment shall meet International Building Code and ASCE 7 seismic qualification requirements in concurrence with ICC ES AC156 Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems.

1.8 COORDINATION

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

1.9 WARRANTY

A. Provide one-year warranty on parts and labor for manufacturer defects and installation workmanship.

PART 2 - PRODUCTS

2.1 SUPPLIERS

A. Following is a partial list of manufacturer/supplier contact information for seismic restraints:

1. B-Line Systems, Inc. (800) 851-7415, www.b-line.com.
2. Unistrut Corporation http://www.unistrut.us/
3. Kinetics Noise Control (877) 457-2695, www.kineticsnoise.com.
4. Mason Industries, Inc. www.mason-ind.com.
5. Loos & Co., Inc. (800) 321-5667, www.loosnaples.com.
6. Tolco (909) 737-5599, www.tolco.com
7. ISAT 877.523.6060, www.isatsb.com
8. Vibro-Acoustics (416) 291-7371, https://virs.vibro-acoustics.com/

2.2 SEISMIC DESIGN CRITERIA

A. This section describes the requirements for seismic restraint of systems and equipment related to continued operation of the facility after a design seismic event.

B. Definitions:

1. Stay in Place:

a. All systems and equipment shall be anchored and restrained such that the anchoring system is intended not to fail and equipment and/or system components will not fall.

2.3 SEISMIC BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS

A. General:

1. Seismic restraint designer shall coordinate all attachments with a Structural Engineer; refer to submittal requirements.

2. The seismic restraint design shall be based on actual equipment data obtained from manufacturer's submittals or the manufacturer. The equipment manufacturer shall verify and provide written certification the attachment points on the equipment can accept the combination of seismic, weight, and other imposed loads.
3. 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.
4. Analysis shall detail anchoring methods, bolt diameter, embedment, and weld length.
5. All seismic restraint devices shall be designed to accept without failure the forces calculated per the applicable building code.
6. All seismic restraints and combination isolator/restraints shall have verification of their seismic capabilities witnessed by an independent testing agency.

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

2.4 SEISMIC RESTRAINT AND CONSTRUCTION OF EQUIPMENT

A. Equipment supplied for the project shall be designed to meet the requirements of lateral forces calculated using the applicable code and method described above.

B. The following is a partial list of equipment that shall be restrained and that shall be constructed to meet seismic forces described in this section:

1. Distribution Panelboards
2. Emergency Feeders
3. Ductbank
4. Automatic Transfer Switches
5. Emergency Power Supply
6. Engine Generator Systems
7. Uninterruptible Power Supplies
8. Fire Alarm Panel, Initiating and Notification Appliances

2.5 MATERIALS

A. Use the following materials for restraints:

1. Indoor Dry Locations: Steel, zinc plated.
2. Outdoors and Damp Locations: Galvanized steel.

2.6 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

A. Strength: Defined in reports by ICC Evaluation Service or another agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.

B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type. Comply with IBC, ACI and ICC ES requirements for cracked concrete anchors.

C. Concrete Inserts: Steel-channel type.

D. Through Bolts: Structural type, hex head, high strength. Comply with ASTM F3125, Grade A 325.

E. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.

F. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

2.7 SEISMIC BRACING COMPONENTS

A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch cross section, formed from 0.1046-inchthick steel, with 9/16-by-7/8-inch slots at a maximum of 2 inches o.c. in webs, and flange edges turned toward web.

1. Materials for Channel: ASTM A 1011, GR 33.
2. Materials for Fittings and Accessories: ASTM A 635, ASTM A 576, or ASTM A 36.
3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.
4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.

B. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.

C. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to the applicable code sections and Authority Having Jurisdiction for the exact seismic restraint requirements of conduit, equipment, etc.

B. All seismic restraint systems shall be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.

C. Installation of seismic restraints shall not cause any change in position of equipment or conduits resulting in stresses or misalignment.

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

E. Coordinate work with existing conditions to avoid rigid contact with the building. Any conflicts with other trades that will result in rigid contact with equipment or conduit due to inadequate space or other unforeseen conditions shall be brought to the Engineer's attention prior to specific equipment selection.

F. Prior to installation, bring to the Engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.

G. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or International Code Council approved seismic anchors for installation in concrete.

H. Cable restraints shall be installed slightly slack to avoid short-circuiting the isolated suspended equipment or conduit.

I. Cable assemblies shall be installed taut on non-isolated systems. Solid braces may be used in place of cables on rigidly attached systems only.

J. Do not install cables over sharp corners.

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

L. Provide reinforced clevis bolts when required.

M. The vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not acceptable.

N. Post-Installed anchors shall be provided to meet seismic requirements.

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

P. Conduit crossing building seismic or expansion joints, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the conduit, equipment connections, or support connections. Conduit offsets, loops, anchors, and guides shall be installed as required to provide required motion capability and limit motion of adjacent conduit.

Q. Do not brace a system to two different structures such as a wall and a ceiling.

R. Provide appropriately sized openings in walls for anticipated seismic movement. Provide fire seal systems in fire-rated walls.

3.2 SEISMIC RESTRAINT EXCLUSIONS

A. Refer to the applicable code sections and Authority Having Jurisdiction for allowable exclusions.

END OF SECTION

SECTION 260553 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Adhesive Markings and Field Labels

B. Nameplates and Signs

C. Product Colors

1.2 RELATED SECTIONS AND WORK

A. Section 260500 - Basic Electrical Requirements

1.3 REFERENCES

A. NFPA 70E - National Electrical Safety Code

B. NFPA 70 - National Electrical Code (NEC)

C. ANSI A13.1 - Standard for Pipe Identification

D. ANSI Z535.4 - Standard for Product Safety Signs and Labels

1.4 QUALITY ASSURANCE

A. Electrical identification products shall be suitable for the environment installed. Identification labels damaged by the environment due to ultraviolet light fading, damp or wet conditions, physical damage, corrosion, or other conditions shall be replaced with labels suitable for the environment.

1.5 SUBMITTALS

A. General: Submit the following in accordance with Division 1 Specification Sections and under provisions of Section 260500.

1. Product Data for each type of product specified.
2. Schedule of nomenclature to be used for identification signs and labels for each piece of equipment.
3. Identification required in this section shall apply to equipment furnished in Division 26.

PART 2 - PRODUCTS

2.1 ADHESIVE MARKINGS AND FIELD LABELS

A. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.

B. Underground Plastic Markers: Bright colored continuously printed plastic ribbon tape of not less than 6 inches wide by 4 mil thick, printed legend indicating type of underground line, manufactured for direct burial service. Tape shall contain a continuous metallic wire to allow location with a metal detector.

C. Text Sizes:

1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.

a. Font: Normal 721 Swiss Bold
b. Adhesive Labels: 3/16 inch minimum text height
c. Vinyl / Plastic Laminate Labels: 3/4" inch minimum text height

2.2 NAMEPLATES AND SIGNS

A. Engraved, Plastic-Laminated Labels, Signs and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8 inch thick for larger sizes. Labels shall be punched for mechanical fasteners.

B. Text Sizes:

1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.

a. Text Height: 3/8 inch minimum

C. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396 inch galvanized-steel backing: and with colors, legend, and size required for application. Mounting 1/4" grommets in corners.

D. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.

E. Fasteners for Plastic-Laminated Signs; Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.

2.3 PRODUCT COLORS

A. Adhesive Markings and Field Labels:

1. Normal Power and General Labels: Black letters on white face.
2. Emergency: Red letters on white face.

B. Nameplates and Signs:

1. NORMAL POWER: Black letters on white face
2. EMERGENCY: White letters on red face
3. GROUNDING: White letters on green face.
4. CAUTION or UPS: Black letters on yellow face

C. Box Covers:

1. Box covers shall be painted to correspond with system type as follows:

a. Normal Power and General: Silver
b. Emergency Power and Distribution:

1) All Emergency: Orange

c. Fire Alarm System: Red

D. Conductor Color Identification: Refer to Part 3 for additional information.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.

B. Install identification devices in accordance with manufacturer's written instruction and requirements of Electrical Code.

C. All mounting surfaces shall be cleaned and degreased prior to identification installation.

D. Circuit Identification: Tag or label conductors as follows:

1. Multiple Power Circuits in Same Enclosure: Where multiple branch circuits are terminated or spliced in a box or enclosure, label each conductor with source and circuit number.
2. Multiple Control Wiring and Communication/Signal Circuits in Same Enclosure: For control and communications/signal wiring, use wire/cable marking tape at terminations in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tape.
3. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.

E. Apply Danger, Warning, Caution and instruction signs as follows:

1. Install Danger, Warning, Caution or instruction signs where required by Electrical Code, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
2. 'Danger' indicates a hazardous situation which, if not avoided, will result in death or serious injury. ANSI standard red background, white letters.
3. 'Warning' indicates a hazardous situation which, if not avoided, could result in death or serious injury. ANSI standard orange background, black letters.
4. 'Caution' indicates a hazardous situation which, if not avoided, may result in minor or moderate injury. ANSI standard yellow background, black letters.
5. Emergency Operating Signs: Install, where required by Electrical Code, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect, engraved laminate signs with white legend on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.

F. Install labels parallel to equipment lines at locations as required and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

G. Install ARC FLASH WARNING signs on all power distribution equipment per Section 260573.

H. Install ARC FLASH WARNING signs on all new distribution panels.

1. Sample Label:

! WARNING
ARC FLASH AND SHOCK HAZARD
APPROPRIATE PPE REQUIRED
FAILURE TO COMPLY CAN RESULT IN DEATH OR INJURY
REFER TO NFPA 70E

END OF SECTION

SECTION 260573 - POWER SYSTEM STUDY

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Low voltage distribution system power study.

B. Short-circuit analysis and report.

C. Selective coordination analysis and report.

D. Arc-flash hazard analysis and report.

E. Voltage drop analysis and report.

1.2 RELATED SECTIONS

A. Section 260500 - Basic Electrical Requirements

B. Section 262416 - Panelboards

C. Section 263213 - Packaged Engine Generator Systems

D. Section 263600 - Transfer Switch

1.3 QUALITY ASSURANCE

A. Analyses shall be performed by an agent authorized by the manufacturer of equipment specified in the related specification sections.

1.4 SUBMITTALS

A. Documentation shall bear the seal/signature of the licensed Professional Engineer who performed the analysis.

B. The input for the power system study shall be based on the contract documents, with estimated conductor lengths and field investigation of existing equipment types, sizes, ratings provided by the Electrical Contractor.

C. Documentation of the analyses shall be submitted in a single bound electronic (PDF or equal) format and shall accompany the shop drawing submittals for equipment provided under the related work specification sections. The submittal of these related specification sections will not be reviewed without this documentation.

D. Power system study project model shall be submitted on electronic media for review and the Owner's operating and maintenance records.

1.5 REFERENCES

A. NFPA 70 - National Electrical Code (NEC)

B. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations, latest version

C. ANSI Z535.4 - Products Safety Signs and Labels

1.6 SCOPE

A. Provide a power system study of the electrical system shown on the plans. The study shall include short circuit analysis, voltage drop analysis, arc-fault analysis, selective coordination analysis and arc flash hazard analysis.

B. Contractor is required to provide a fully coordinated system for the normal and emergency electrical system and the associated normal side of each transfer switch and all other locations indicated on the one line diagram. Contractor shall provide overcurrent protective devices with the appropriate models, frame sizes, trip units, etc. as required to provide a selectively coordinated system.

PART 2 - PRODUCTS

2.1 POWER SYSTEM STUDY

A. Power systems study shall be completed in Power Tools for Windows (PTW) version 11 or pre-approved equivalent program.

B. Power system studies including, but not limited to short-circuit analysis, selective coordination, and arc-flash analysis are inherently iterative in nature. The initial and subsequent analysis commonly requires engineering evaluation, equipment modification, setting adjustments, and revised analysis report. The power system analysis scope shall not be considered complete until all outstanding engineering, equipment and device setting solutions have been resolved and documented by a final report. The power system study vendor shall provide inclusive bid provisions for the initial, subsequent, final analysis and associated reports.

PART 3 - EXECUTION

3.1 SHORT-CIRCUIT ANALYSIS

A. Provide a complete short-circuit analysis from the utility service to and including the entire building distribution as shown on the drawings.

B. Analysis shall include the entire distribution system from the point of connection to the utility power source to the distribution panels and branch circuit panelboards.

C. Short-circuit analysis documentation shall be made in one-line diagram form showing the magnitude and location of each calculated fault. Fault current calculations shall be made at the main bus of each switchboard, distribution panel, and branch circuit panel. A summary of the fault currents available shall also be submitted and made available to the AHJ if requested.

3.2 SELECTIVE COORDINATION ANALYSIS

A. Provide a complete selective coordination analysis comparing time/current curves of the protective devices to be installed to assure coordination between main and downstream devices. Overcurrent protection devices shall be coordinated based on the maximum available fault current results of the short-circuit analysis report.

B. Provide a complete selective coordination analysis, comparing time/current curves of the protective devices to be installed to assure complete selectivity between main and downstream devices for code-required branches and branches identified on one-line drawings. Overcurrent protective devices serving the essential electrical system shall selectively coordinate for the period of time that a fault's duration extends beyond 0.01 second. Overcurrent protective devices serving the normal shall selectively coordinate for the period of time that a fault's duration extends beyond 0.01 second.

C. Existing Distribution, Selective Coordination, and Analysis:

1. The scope of work includes replacement, adjustments, or additions of the emergency distribution system. A complete analysis and evaluation of the existing Emergency system is required in addition to the evaluation and analysis of the new distribution system components.
2. The contractor shall provide field investigation service to collect all pertinent information required for a complete analysis and evaluation including but not limited to:

    a. Over Current Protection Device (OCPD): Manufacturer, model, ratings, and settings
    b. Feeder and Branch Circuit Conductor: Wire gauge sizes, lengths, and material type
    c. Transformers: Manufacturer, model, transformer KVA, impedance, phase, voltage, configuration
    d. Transfer Switch: Manufacturer, model, transfer switch voltage, amp rating, 3 or 4 pole configurations, switch style, short circuit withstand current rating
    e. Emergency Power Supply: Manufacturer, model, power source type, voltage, amperage, ratings, fault current contribution values
    f. Existing Distribution System Documentation: One line or riser diagram relationship of all distribution equipment including switchboards, distribution panels, branch panelboards, transformers, transfer switches, emergency power supply, all line side normal and emergency power systems serving the applicable branches from the main electrical service and emergency power supply to the final branch circuit over current protection device.

D. Provide trip settings for all (selectively coordinated and non-selectively coordinated) adjustable trip over current protection devices including long time delay, long time pickup, short time delay, short time pickup, instantaneous and ground fault. Selectively coordinated branches shall be based on the selective coordination study results. Non-selective coordinated branches shall be based on the design trip ratings. Provide selective coordination between all ground fault trip settings.

E. The analysis shall include primary protective device, secondary main switchboard device(s), switchboard branch feeder devices, generator breaker, distribution panel, panelboard main devices, and branch feeder devices.

F. The analysis shall include all normal, optional standby overcurrent protection devices served by the same electrical bus and directly in parallel with the emergency branch requiring selective coordination.

G. The coordination plots provided shall indicate graphically the coordination proposed for the system on full-size log forms and shall define the types of protective devices selected, together with proposed time dial and pickup settings required. The plots shall include titles, representative one-line diagrams, legend, complete parameters for transformer(s), and complete operating bands for circuit breaker trip devices, fuses, etc.

1. The long-time region of the coordination plots shall designate the pickups required for the circuit breakers.
2. The short-time region shall indicate the magnetizing in-rush and ASA-withstand-transformer parameter, the circuit breaker, short-time and instantaneous trip devices, fuse-manufacturing tolerance bands, significant symmetrical fault currents, etc.

a. The study shall include verification of equipment ratings and settings. The Contractor shall keep the study up-to-date with any project changes which affect the study and submit the revised study for review. A final electronic copy shall be submitted with the record drawings.

H. Provide summary table of adjustable overcurrent protective devices settings for the operating and maintenance manual.

3.3 ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E.

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

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

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

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

F. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond 3 to 5 cycles.
2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g., contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).

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

H. Include Arc Energy Reduction (AER) analysis in the study when required by other specification sections.

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

J. Miscoordination should be checked among all devices within the branch containing the immediate protective device upstream of the calculation location, and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

K. Where it is not physically possible to move outside the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

L. Create and install NFPA 70E compliant labels describing the arc flash hazard level at all switchboards, panelboards, and other locations in the electrical distribution system where work could be performed on energized parts.

M. Labels shall be vinyl or laminated, with a self-adhesive backing, conform with ANSI Z535.4 Products Safety Signs and Labels standard, and include the following:

1. Arc flash boundary
2. Available incident energy calculated in the analysis and the corresponding working distance, or the arc flash personal protective equipment (PPE category) for the equipment, but not both.

N. A list of all hazard categories and the corresponding PPE requirements shall be posted in the main electric room, engineering office, or other location. The list shall be plastic laminate or typewritten and housed in a plastic frame.

3.4 ADJUSTMENTS

A. Manufacturer's authorized representative shall set all adjustable protective devices to values indicated in the approved coordination study. Apply settings prior to placing equipment into operation. When the scope of work or execution includes remodel or phases construction, the contractor shall adjust applicable settings as required prior to each system component placed in operation.

B. Wherever the arc flash incident energy exceeds Arc Flash Category 2 (i.e. greater than 8 cal/cm^2), provide options for adjusting breaker trip times, if possible, to reduce energies to Category 2 or below.

3.5 TRAINING

A. Provide four hours of Owner training to explain the implications of arc-flash requirements and work permit procedure.

END OF SECTION

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Distribution panelboards: DPH2

1.2 RELATED SECTIONS AND WORK

A. Refer to the Electrical Distribution Diagram and Electrical Schedules for size, rating, and configuration.

1.3 REFERENCES

A. NEMA AB 1 - Molded Case Circuit Breakers

B. NEMA PB 1 - Panelboards

C. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less

D. UL 67 - Panelboards

1.4 SUBMITTALS

A. Submit shop drawings for equipment and component devices under provisions of Section 260500.

B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker arrangement and sizes.

C. Submit manufacturer's instructions under provisions of Section 260500.

1.5 SPARE PARTS

A. Keys: Furnish four (4) each to the Owner.

PART 2 - PRODUCTS

2.1 RATINGS

A. Definitions:
   1. Fully rated equipment shall be defined as equipment where all devices in that equipment shall carry a minimum of the AIC rating that is specified.

B. The panelboards for this project shall be fully rated unless otherwise specifically noted in the Drawings or Specifications.

2.2 DISTRIBUTION PANELBOARDS

A. General

1. Manufacturers:

a. Square D QMB, I-Line
b. Eaton PRL4, PRL5

B. Panelboards: NEMA PB 1; type as shown on the drawings.

C. Provide cabinet front with concealed trim clamps and hinged trim on door to allow access to wiring gutters without removal of trim and flush lock. Door hardware shall provide swing clear operation (180-degree swing). Finish in manufacturer's standard gray enamel.

D. Provide panelboards with copper bus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.

E. All spaces shown on the one-line diagram shall be fully prepared spaces for future breakers.

F. Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards plumb as indicated on the drawings in conformance with NEMA PB 1.1.

B. Height: 6 feet to handle of highest device.

C. Provide filler plates for unused spaces in panelboards.

D. Provide custom typed circuit directory for each panelboard. Provide updated custom typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

3.2 FIELD QUALITY CONTROL

A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.

B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers.

END OF SECTION

SECTION 263213 - PACKAGED ENGINE GENERATOR SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Packaged engine generator system

B. Heat exchanger

C. Exhaust silencer and fittings

D. Fuel fittings

E. Remote annunciator panel

F. Battery and charger

G. Integrated on-board generator paralleling control

H. Weatherproof enclosure

I. Radiator mounted load bank

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 235700 - Heat Exchangers

1.3 REFERENCES

A. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)

B. ANSI/NEMA AB 1 - Molded Case Circuit Breakers

C. ANSI/NEMA MG 1 - Motors and Generators

D. NFPA 37 - Installation and Use of Stationary Combustion Engines and Gas Turbines

E. NFPA 70 - National Electrical Code (NEC)

F. NFPA 110 - Standard for Emergency and Standby Power Systems

G. IEEE 446 - Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications

H. Environmental Protection Agency EPA Emission Standards for Compressed Ignition Engines

I. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at property boundaries due to sound emitted by the generator set, its components and the operation thereof.

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 260500.

B. Submit shop drawings showing plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, and electrical diagrams including schematic and interconnection diagrams.

C. Submit product data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer, vibration isolators, and remote annunciator.

1. Include work clearance and equipment access information. Clearly identify required equipment access locations for installation, maintenance, testing, and repair.

D. Submit certificates for compliance with EPA Emissions Standards for Compressed Ignition Engines.

E. Submit manufacturer's installation instructions under provisions of Section 260500.

F. Submit complete control and operation sequences for on-board paralleling system.

1.5 EXTRA MATERIALS

A. Submit maintenance materials under provisions of Section 260500.

B. Furnish one set of tools required for preventative maintenance of the engine generator system. Package tools in adequately sized metal toolbox.

C. Provide two additional sets of each fuel, oil, and air filter element required for the engine generator system. Provide additional fuel polishing filters for one year of operation.

D. Provide one fuse for every type and rating used.

E. Provide five (5) extra DC incandescent lamps and five (5) compact fluorescent lamps.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 260500.

B. Store and protect products under provisions of Section 260500.

C. Accept packaged engine generator set and accessories on site in crates and verify damage.

D. Protect equipment from dirt and moisture by securely wrapping in heavy plastic.

1.7 SYSTEM DESCRIPTION

A. Engine generator system to provide source of emergency and standby power.

B. System Capacity: 250 KW, 300 KVA, starting KVA at specified voltage dip, at an elevation of 1,000 feet above sea level, and ambient temperature between -20F and 110F; rating using engine-mounted radiator.

C. Emergency Power Supply System (EPSS) shall be NFPA 110 Type 10 Class[**2**][**6**][**48**][**X**] Level[**1**][**2**].

D. Operation: In accordance with ANSI/NFPA 110.

1.8 COORDINATION DRAWINGS

A. Reference Coordination Drawings article in Section 260500 for required generator electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings. Show generator, fuel system components, battery system components, and exhaust system in 1/4" scale plan of room.

1.9 PROJECT RECORD DOCUMENTS

A. Submit record documents under provisions of Section 260500.

B. Accurately record location of engine generator and electrical connections.

1.10 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 260500.

B. Include instructions for normal operation, routine maintenance requirements, service manuals for engine, oil sampling and analysis for engine wear, and emergency maintenance procedures.

1.11 QUALIFICATIONS

A. Manufacturer: Company specializing in packaged engine generator system with minimum five (5) years documented experience.

B. Manufacturer: Company with minimum five (5) years of documented on-board paralleling system experience.

C. Supplier: Authorized distributor of engine generator manufacturer with service facilities within 50 miles of the project site.

1.12 WARRANTY

A. Provide a two (2) year warranty under provisions of Section 260500.

1.13 MAINTENANCE SERVICE

A. Furnish service and maintenance of packaged engine generator system for one (1) year from Date of Substantial Completion. Maintenance service shall be performed by skilled employees of manufacturer's designated service organization. Include quarterly exercising, and routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Maintenance agreements shall include parts, supplies, and labor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. MTU On Site Energy.

2.2 PACKAGED ENGINE-GENERATOR SET (GEN-1)

A. Packaged engine-generator set shall be a coordinated assembly of compatible components. Stationary generators shall be listed.

B. Safety Standard: Comply with ASME B15.1 and UL 2200.

C. Nameplates: Each major system component shall be equipped with a nameplate to identify manufacturer's name and address, model and serial number, and component rating in integrated set and as required by the contract documents.

D. Fabricate engine-generator set mounting frame and attachment of components to resist generator-set movement during a seismic event when generator-set mounting frame is anchored to building structure.

E. Mounting Frame: Adequate strength and rigidity to maintain alignment of mounted components without depending on concrete foundation. Mounting frame shall be free from sharp edges and corners and shall have lifting attachments arranged for lifting with slings without damaging components. Provide a rigging diagram permanently attached to the mounting frame to indicate the capacity of each lifting attachment and the generator-set center of gravity.

2.3 ENGINE

A. Type: Water-cooled in-line or V-type, ignition diesel electric ignition internal combustion engine.

B. Rating: Sufficient to operate at 100 percent load for two hours at specified elevation and ambient limits.

C. Fuel: Appropriate for use of No. 2 fuel oil.

D. Engine Speed: 1800 RPM.

E. Governor: Isochronous type with speed sensing.

F. Safety Devices: Engine shutdown on high water temperature, low oil pressure, overspeed, and engine overcrank. Limits as selected by manufacturer.

G. Frequency Response:

1. Steady State Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
2. Transient Response: Less than 5 percent for a 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady state operating band within 5 seconds.

H. Fuel System:

I. Fuel Supply System:

1. Base-Mounted Fuel Tank: UL 142 listed fuel tank with 24 hour rated (NFPA 110 minimum run time by class) capacity. Integral rupture basin with leak detection. Provide fueling port with an overfill prevention type receptacle and lockable cap for exterior units. The tank shall include structural steel supports for top mounted engine generator set. Furnish complete with flexible fuel line connectors lockable cover, and analog level gauge. Furnish complete with float switches to indicate 5%, 25%, 50%, 75% and 100% fuel level. The footprint of the base-mounted fuel tank shall not exceed the footprint of the generator frame of the enclosure for exterior installations.

J. Lubrication System: Engine or skid mounted filter and strainer, thermostatic control valve capable of full flow and designed to be fail safe, and crankcase drain arranged for gravity drainage with siphon or pump.

K. Engine Jacket Heater: Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90F, and suitable for operation on 208-3Ø volts AC. The minimum wattage of the heater shall be watts or as recommended by the manufacturer.

L. Cooling System: Closed loop, liquid cooled, with and integral engine-driven coolant pump.

1. Fan and Core: Nonferrous-metal construction sized to contain expansion of total system. Blower type fan, sized to maintain safe engine temperature in ambient temperature of 110F. Radiator Airflow Restriction: 0.5 inches of water, maximum.
2. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anti-corrosive additives.
3. Provide expansion tank with gage glass and petcock, and self-contained, thermostatic-control temperature control valve.

M. Engine Starting: DC starting system with positive engagement, number and voltage of starter motors in accordance with manufacturer's instructions. Include remote starting control circuit, with MANUAL-OFF-REMOTE selector switch on engine-generator control panel. Provide the following accessories:

1. Battery: Voltage to match starter with capacity for three cranking cycles without recharge. Provide with battery cables and acid resistant battery tray.
2. Battery-Charging Alternator: Factory mounted on engine with solid state voltage regulation.
3. Remote Start Circuit Monitoring: Provide continuous monitoring of the generator start circuits. A failure shall initiate visual and audible alarms at the generator, remote annunciators, and start the generator.
4. Battery Charger: Current limiting type designed to float at 2.17 volts per cell and equalize at 2.33 volts per cell. Include overload protection, full wave rectifier, DC voltmeter and ammeter, and 120 volts AC fused input. Provide wall-mounted enclosure to meet ANSI/NEMA 250, Type 1 requirements.
5. Provide two battery strings, two DC power supply/chargers with monitoring, and a best battery selector system. Each shall be sized to provide total starting capacity.

6. DC Power Supply/Charger: Utility grade current limiting type with battery temperature compensation designed to float at 2.17 volts per cell and equalize at 2.33 volts per cell. Include overload protection, full wave filtered rectifier, digital DC voltmeter and ammeter, and 120 volts AC fused input. Provide wall-mounted enclosure to meet ANSI/NEMA 250, Type 1 requirements.
7. Best battery selector system for dual battery single load configuration. Solid-state design must isolate battery strings from each other.

N. Exhaust System: Critical type silencer (85 dBA max at 10 feet), side inlet with muffler companion flanges and flexible stainless steel exhaust fitting, suitable for horizontal orientation, sized in accordance with engine manufacturer's instructions. Silencer shall include a threaded opening for connection of ¾" drain line. Opening shall be flush on inside of silencer.

O. The packaged engine generator shall comply with the current Environmental Protection Agency EPA Emissions standards.

P. Engine Accessories: Fuel filter, lube oil filter, intake air filter, lube oil cooler, fuel transfer pump, fuel priming pump, gear-driven water pump. Include fuel pressure gauge, water temperature gauge, and lube oil pressure gauge on engine-generator control panel.

Q. Mounting: Provide unit with suitable spring-type vibration isolators.

2.4 GENERATOR

A. Generator: ANSI/NEMA MG 1; three phase, re-connectible brushless synchronous generator with brushless exciter and PMG alternator excitation.

B. Rating: As indicated on the drawings, at 0.8 power factor, 60 Hertz at RPM to match engine rating.

C. Insulation: ANSI/NEMA MG 1, Class F.

D. Temperature Rise: 105C continuous.

E. Enclosure: ANSI/NEMA MG 1; open drip-proof.

F. Voltage Regulation:

1. The maximum instantaneous voltage dip (IVD) shall be 28 percent for building loads.
2. Include solid-state type voltage regulator, separate from exciter to match engine and generator characteristics, with voltage regulation ±1 percent from no load to full load. Include manual controls to adjust voltage drop ±5 percent voltage level, and voltage gain.

G. Subtransient Reactance (X"d): Maximum 15 percent.

H. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

2.5 CONTROLS AND INDICATION

A. Operating and safety indications, protective devices, basic system controls, and engine gauges shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.

B. Engine-Generator Control Panel: ANSI/NEMA 250, Type 1 generator mounted control panel enclosure with engine and generator controls and indicators. Include provision for padlock and the following equipment and features:

1. Alarm indication as required by NFPA 110 for a Level[1][2] system.
2. AC frequency meter.
3. AC output voltmeter with phase selector switch.
4. AC output ammeter with phase selector switch.
5. Output voltage adjustment.
6. DC voltmeter (alternator battery charging).
7. Engine start/stop selector switch.
8. Engine running time meter.
9. Oil pressure gauge.
10. Engine coolant temperature gauge.
11. Shut down devices for overspeed, coolant high-temperature, coolant low-level, and oil low-pressure.
12. Fuel derangement alarm.
13. Generator overload.
14. Auxiliary Relay: 3PDT, operates when engine runs, with contact terminals prewired to terminal strip.
15. Remote Alarm Contacts: Pre-wire SPST contacts to terminal strip for remote alarm functions required by ANSI/NFPA 99.
16. Ground fault indication.
17. Generator control and start signal failure.
18. On-board paralleling controls.
19. 80% load alarm.
20. Key switch, three-position selection switch.
21. Generator will be monitored by the campus building automation system, which is a Johnson Controls system.

C. GANN-1; Remote Engine Annunciator Panel: ANSI/NFPA 99 and NFPA 110 for a Level[1][2] system. Include the listed pre-alarm and alarm points, audible alarm, alarm silencing means, repetitive alarm circuitry, and lamp test switch in a[surface][flush] mounted panel with brushed stainless steel finish. Provide all interconnecting wiring in conduit per manufacturer's requirements by the Electrical Contractor. The remotely reported alarms shall include the following.

1. Overcrank
2. Low water (engine) temperature
3. High engine temperature pre-alarm
4. High engine temperature
5. Low lube oil pressure pre-alarm
6. Low lube oil pressure
7. Overspeed
8. Low fuel main tank

9. Low coolant level
10. Not in auto
11. Emergency Power Supply (EPS) supplying load
12. High battery voltage
13. Low battery voltage
14. Battery charger failure (includes AC failure)
15. Generator running
16. Normal utility power
17. Emergency stop
18. Rupture basin alarm
19. Emergency Power Off Switch activated (EPO)
20. Alarm for power supply or UPS serving motorized breakers
21. Generator control and start signal failure.
22. On-board paralleling controls.
23. 80% load alarm.

D. Building Automation System Integration:

1. Provide a terminal block to allow the Facility Monitoring and Control System (FMCS) to report generator alarms. Provide individual terminal points for each of the annunciator alarms and pre-alarms. Provide an additional terminal point to combine all generator alarms under a single terminal point. Provide a permanent label for each terminal point. Each terminal will provide a binary output for the FMCS to read.

2.6 ON-BOARD GENERATOR PARALLELING CONTROLS

A. Provide microprocessor based integral generator on-board paralleling control system with automatic generator start, paralleling, load sequence control and load shed, system monitoring, and overcurrent-overload protection.

2.7 ACCESSORIES

A. Generator Circuit Breaker: Molded or insulated case, service-rated thermal-magnetic type; 100% rated breaker complying with NEMA AB1 and UL 489. The disconnect shall simultaneously open all associated ungrounded conductors and be lockable in the open position.

1. Tripping Characteristic: Designed specifically for generator protection.
2. Trip Rating: Matched to generator rating.
3. Shunt Trip: Connected to trip breaker when generator is shut down by other protective devices.
4. Mounting: Provide freestanding enclosure or mount integrally with control and monitoring panel.
5. The disconnecting means shall also shut down the prime mover, disable all start control circuits, and be configured with a mechanical reset.

B. EPO; Remote Manual Stop Station (Emergency Power Off EPO): Provide a remote manual stop station with weather proof stainless steel or die cast housing, red mushroom button - push to stop operation, breakable cover/lens to access mushroom button, 120-volt rated. The manufacturer shall provide automatic monitoring of the EPO switch. Placing the EPO switch in the "Generator Powered OFF" status shall initiate a visual and audible alarm at generator annunciator panel.

1. The Remote Manual Stop Station may be located within the generator enclosure when allowed by code. Provide an engraved plastic nameplate "EMERGENCY DISCONNECT - define location", red background, white letters, minimum 4" letters. Provide one nameplate on each side of the generator enclosure with accessible doors.

2.8 RADIATOR MOUNTED LOAD BANK

A. The generator load bank shall be a completely self-contained unit that includes all resistive load elements, load control devices, load element branch circuit fuse protection, terminal, system protection devices and NEMA enclosure.

B. System protection shall include protection against overheating by disconnecting the load elements and activating an alarm. Load element control shall be a magnetic contactor with fuses. A remote load dump circuit shall remove the load bank upon opening of a contact in the automatic transfer switches.

C. Control power shall be derived internally from the main load bus. Control and protective circuits shall operate at 120 volt via a control power transformer and shall be fused.

D. The load bank shall be installed within the air outlet of the engine unit-mounted radiator. Coordinate mounting with ventilation contractor.

E. The control section shall be thermally isolated from the load elements and airflow. Load bank power and control wiring shall be 150C XLP insulated.

F. Load Bank Rating:

1. Capacity: <Insert> KW, 1.0 power factor.
2. Load Steps:[25 KW][50 KW][maximum per step].
3. Voltage:[480 volts][208 volts][AC, 3 phase 3 wire plus ground].
4. Load Bank Controls:

a. Manual controls including:

1) Power ON/OFF switch
2) Master load ON/Off switch
3) Load step control switches
4) Over-temperature alarm indicator.

G. Load Bank Wiring:

1. Contractor shall wire load bank power and controls. Wire remote load dump control to all automatic transfer switches connected to generator distribution.

a. Manufacturers:

1) Simplex, Inc.
2) LBD series
3) Avtron Loadbank, Inc. K711 series.

2.9 OUTDOOR GENERATOR-SET ENCLOSURE SKIN-TIGHT

A. Prefabricated or pre-engineered skintight enclosure with the following features:

1. Construction: Reinforced galvanized steel, metal clad, integral structural steel framed housing anchored to a concrete foundation. Construction shall allow access to control panels and service points. The panels shall enclose all components, including intake/exhaust louvers and sound attenuators. Extend the enclosure base frame as required for panels.
2. The generator control panel shall be located no greater than 5'-0" above finished grade for ease of access.
3. Structural Design and Anchorage: Wind resistant up to 100 mph.
4. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents. Motor operators shall be spring open, power close operating at 24 volts DC. The louvers shall be connected to the generator starting batteries through appropriate control relays.
5. Hinged Doors: Provide a minimum of four doors with padlocking provisions. Single doors shall be 36" wide and 84" high. Double doors shall be 60" wide and 84" high. As standard, doors shall include rain-rail moldings above all door openings, recessed, keyed mortise locks, panic bar door hardware and full weather-stripping. Doors shall be removable.
6. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits as required by engine-generator-set components.
7. Fuel Tank Vent: Provide vent piping from the fuel tank to the exterior of the enclosure.
8. Fuel Fill: Provide fill access on the exterior of the enclosure at an elevation not to exceed 5'-0" above finished grade.
9. The exhaust system silencer shall be installed within the enclosure housing.
10. Acoustical Treatment: Provide acoustical treatment of the generator enclosure including wall panels, intake and exhaust air paths, ventilation openings, and tailpipe exhaust. Maximum sound level horizontally from the generator set shall be 85 dBA at 10 feet in a hemispherical free field. Sound attenuators shall be concealed within the enclosure panels. Panels shall extend from the enclosure base frame to the height of the generator section.
11. Acoustical Treatment: Provide all acoustical treatment required to conform to Illinois Administrative Code, Title 35, Subtitle H for daytime hours. Noise levels shall include enclosure and tailpipe noise. Sound attenuators shall be concealed within the enclosure.

a. Generator Site:[Class A][Class B][Class C] Land-Based Classification Standards.
b. Adjacent Property:[Class A][Class B][Class C] Land-Based Classification Standards.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work and field dimensions are as shown on the drawings.

B. Verify that required utilities are available in proper location and ready for use.

C. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install remote manual stop station in location shown on plans. Provide 120 Volt power and wiring in conduit as required. Coordinate installation with the manufacturer approved shop drawings and wiring diagrams. The remote manual stop station shall shunt trip the generator mounted circuit breaker and signal the engine prime mover to stop.

C. The A-B-C phase rotation of the generator source shall match the A-B-C phase rotation of the utility source. The Contractor shall verify the generator and utility phase rotation match to prevent three phase motors and similar loads from operating backwards while being served by the generator.

3.3 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 260500 and in compliance with NFPA 110 requirements.

B. Provide portable test bank for full load test, if required. Simulate power failure including operation of transfer switch, automatic starting cycle, and automatic shutdown, and return to normal.

C. Fill fuel tank prior to start of test.

D. The on-site installation test shall be conducted as follows:

1. With the prime mover in a "cold start" condition and the emergency load at standard operating level, a primary power failure shall be initiated by opening all switches or breakers supplying the primary power to the building or facility.
2. The test load shall be that load that is served by the Emergency Power Supply System (EPSS).
3. The time delay on start shall be observed and recorded.
4. The cranking time until the prime mover starts and runs shall be observed and recorded.
5. The time taken to reach operating speed shall be observed and recorded.
6. The voltage and frequency overshoot shall be recorded.
7. The time delay on transfer to emergency power for switch shall be recorded.
8. The time taken to achieve a steady-state condition with all switches transferred to the emergency position shall be observed and recorded.
9. The voltage, frequency, and amperes shall be recorded.

10. The prime mover oil pressure and water temperature shall be recorded, where applicable.
11. The battery charge rate shall be recorded at 5-minute intervals for the first 15 minutes and at 15-minute intervals thereafter.
12. When primary power is returned to the building or facility, the time delay on retransfer to primary for switch with a minimum setting of 5 minutes shall be recorded.
13. The time delay on the prime mover cool down period and shutdown shall be recorded.
14. Allow prime mover to cool for 5 minutes.
15. A load shall be applied for 4 hours total. The building load shall be permitted to serve as part or all of the load, supplemented by a load bank of sufficient size to provide a load equal to 100 percent of the nameplate rating of the Emergency Power Supply (EPS), less applicable derating factors for site conditions. Observe and record load changes and the resultant effect on voltage and frequency.
16. The full load test shall be initiated immediately after the cooling time has expired by any method that starts the prime mover and, immediately upon reaching rated rpm, picks up 100 percent of the nameplate kW rating on one step, less applicable derating factors for site conditions.
17. During test, record the following at 5-minute intervals for the first 15 minutes and every 15 minutes for the rest of the test:

    a. Kilowatts
    b. Amperes
    c. Voltage
    d. Frequency
    e. Coolant temperature
    f. Enclosure temperature (interior)
    g. Oil pressure
    h. Engine exhaust temperature
    i. Engine inlet temperature
    j. Oil Temperature
    k. Battery charge rate

18. Upon completion of the test and after a cool down period, the crank/rest cycle shall be tested.

    a. Any method recommended by the manufacturer for the cycle crank test shall be utilized to prevent the prime mover from running.
    b. The control switch shall be set at "run" to cause the prime mover to crank.
    c. The complete crank/rest cycle shall be observed and recorded.

19. Test alarm and shutdown circuits by simulating conditions.

E. Contractor shall fill fuel tanks upon completion of test.

F. Testing documentation shall be submitted to the Engineer for review and approval.Generator testing worksheets are included with this specification section.

3.4 MANUFACTURER'S FIELD SERVICES

A. Prepare, start, test, and adjust systems under provisions of Section 260500.

B. Provide UL field inspection of generator.

3.5 ADJUSTING

A. Adjust generator output voltage and engine speed.

3.6 CLEANING

A. Clean work under provisions of Section 260500.

B. Clean engine and generator surfaces. Replace oil and fuel filters.

3.7 DEMONSTRATION

A. Provide systems demonstration. Coordinate the demonstration schedule with the Owner and Engineer.

B. Describe loads connected to emergency and standby systems and restrictions for future load additions.

C. Simulate power outage by interrupting normal source and demonstrate that system operates to provide emergency and standby power.

END OF SECTION

SECTION 283100 - FIRE ALARM AND DETECTION SYSTEMS

PART 1 - GENERAL

1.1 RELATED WORK

A. Section 260553 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.2 QUALITY ASSURANCE

A. Manufacturer: JCI/Simplex.

B. Installer: A factory-authorized Electrical or Security Contractor licensed with the State and local jurisdiction with five years' experience in the design, installation, and maintenance of fire alarm systems by that manufacturer.

C. Qualifications: The person managing/overseeing the preparation of shop drawings and the system installation/programming/testing shall be trained and certified by the system manufacturer and shall be Fire Alarm Certified by NICET, minimum Level 2. This person's name and certification number shall appear on the start-up and testing reports.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code (NEC)

B. NFPA 72 - National Fire Alarm and Signaling Code

C. NFPA 101 - Life Safety Code

D. UL 2017 - General Purpose Signaling Devices and Systems

E. UL 217 / 268 - Standard for Smoke Alarms / Smoke Detectors for Fire Alarm Systems

F. International Fire Code 2018

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 260500 and as noted below.

1. Failure to comply with all the following and all the provisions in 26 05 00 will result in the shop drawing submittal being rejected without review.
2. Failure to submit the fire alarm without all requirements fulfilled in a single comprehensive submittal will be grounds to require a complete resubmittal.

B. Provide product catalog data sheets as shop drawings.

1. Provide a product catalog data sheet for each item shown on the Electrical Symbols List and for each piece of equipment that is not shown on the drawings, but required for the operation of the system.
2. Where a particular Electrical Symbols List item has one or more variations (such as those denoted by subscripts, etc.) a separate additional product catalog data sheet shall be provided for each variation that requires a different part number to be ordered. The corresponding Electrical Symbols List symbol shall be shown on the top of each sheet.
3. Where multiple items and options are shown on one data sheet, the part number and options of the item to be used shall be clearly denoted.

C. Submit CAD Floor Plans as Shop Drawings:

1. The complete layout of the entire system, device addresses, auxiliary equipment, and manufacturer's wiring requirements shall be shown.
2. Indicate the precise routing of notification appliance circuits under the provisions of circuit survivability. Refer to "Wiring" under Part 3 - Execution of this specification section for requirements.
3. A legend or key shall be provided to show which symbols shown on the submittal floor plans correspond with symbols shown on the Contract Documents.

D. About all fire alarm circuits, provide the following: manufacturer's wiring requirements (manufacturer, type, size, etc.) and voltage drop calculations.

E. Provide installation and maintenance manuals under provisions of Section 260500.

F. Submit manufacturer's certificate that system meets or exceeds specified requirements.

G. Provide information on the system batteries as follows: total battery capacity, total capacity used by all devices on this project, total available future capacity.

H. Submit photocopy proof of NICET certification of the person overseeing the preparation of drawings and installation/testing.

I. When required to comply with local or state regulatory reviews, the fire alarm submittal shall have a Professional Engineer's stamp and signature of the state in which the project is completed. NOTE: The Engineer cannot stamp and seal submittal drawings not prepared under their supervision.

1.5 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Provide quantity equal to 2 percent (2%) of amount of each type installed, but no less than two (2) units of each type.

a. Smoke detectors, duct smoke detectors, monitor modules, control modules and relays.
b. Notification Appliances: Speakers, speaker strobes, and strobes.

2. Keys: The installing contractor shall collect all equipment spare keys provided with each lockable or resettable device/cabinet minimum of one (1) set each and shall turn over to the Owner upon completion.
3. All spare parts shall be housed in metal cabinet labeled "Fire Alarm Spare Parts."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 260500.

B. Store and protect products under provisions of Section 260500.

1.7 REGULATORY REQUIREMENTS

A. System: UL listed.

B. Conform to requirements of NFPA 101.

C. Conform to requirements of Americans with Disabilities Act (ADA).

D. Conform to UL 864 Fire Alarm and UL2017 General Signaling.

1.8 SYSTEM DESCRIPTION

A. Performance Statement: This specification section and the accompanying fire alarm specific design documents describe the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment described and the performance required of the system, as presented in these documents, the Vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.

B. This section of the specifications includes the furnishing, installation and connection of the microprocessor controlled, intelligent reporting, fire alarm equipment required to form a complete coordinated system that is ready for operation. It shall include, but is not limited to, alarm initiating devices, auxiliary control devices, power supplies, and wiring as indicated on the drawings and specified herein.

C. Extending the Existing Fire Alarm System: Provide all items, components, devices, hardware, software, programming, expansion components, conduit, wiring etc. needed to extend the existing fire alarm system with the new fire alarm devices. This includes, but is not limited to, additional power supplies, initiating devices and circuits, signaling devices and circuits, monitoring devices and circuits, auxiliary control and related devices such as, fan shutdown. The existing fire alarm system shall be extended such that the existing fire alarm system's functionality, integrity and annunciation shall be equivalent to pre-construction conditions, unless noted otherwise. The functionality and integrity shall be maintained during construction. The entire system shall be able to be completely reset from any single reset location point. The entire system shall be annunciated at any annunciation location.

D. Extending the Existing JCI/Simplex Fire Alarm System: The existing control panel shall remain and shall be operational throughout construction. The system shall only be disabled to make new connections and to modify the programming. A fire watch shall be provided for all areas affected during outages. All system outages must be scheduled with the Owner at least one week prior. Individual devices may be disabled as needed based on construction activities to reduce the potential for false alarms, but all devices must be operational when the Contractor is not physically on site. New initiating devices may be connected to the existing signaling line circuits where capacity is available. Provide additional signaling line circuits as needed based on existing and new device quantity, including replacement of existing panel components. Provide new notification circuits to serve the new devices, including all necessary power supplies, amplifiers, batteries, and 120-volt input circuits. All new devices shall be programmed to provide the same sequence of operation as the existing devices of the same type, unless noted otherwise.

E. Fire Alarm System: NFPA 72; Automatic and manual fire alarm system, non-coded, analog-addressable with automatic sensitivity control of certain detectors, multiplexed signal transmission.

F. System Supervision: Provide electrically supervised system, with supervised Signal Line Circuit (SLC) and Notification Appliance Circuit (NAC). Occurrence of single ground or open condition in initiating or signaling circuit places circuit in TROUBLE mode. Component or power supply failure places system in TROUBLE mode.

G. Drawings: Only device layouts and some equipment have been shown on the contract drawings. Wiring and additional equipment to make a complete and functioning system has not been shown, but shall be submitted on the shop drawings.

1.9 PROJECT RECORD DOCUMENTS

A. Submit documents under the provisions of Section 260500.

B. Include location of end-of-line devices.

C. Provide a CAD drawing of each area of the building (minimum scale of 1/16" = 1'-0") showing each device on the project and its address. The devices shall be shown in their installed location and shall be labeled with the same nomenclature as is used in the fire alarm panel programming.

D. Submit test results of sound pressure level (dBA) and intelligibility (STI) with the rooms tested designated on the floor plan. Notification devices shall have the tap wattage designated.

1.10 OPERATION AND MAINTENANCE DATA

A. Submit data under provisions of Section 260500.

B. Include operating instructions, and maintenance and repair procedures.

C. Include results of testing of all devices and functions.

D. Include manufacturer's representative's letter stating that system is operational.

E. Include the CAD floor plan drawings.

F. Include shop drawings as reviewed by the Engineer and the local Authority Having Jurisdiction.

1.11 WARRANTY

A. Provide one (1) year warranty on all materials and labor from Date of Substantial Completion.

B. Warranty requirements shall include furnishing and installing all software upgrades issued by the manufacturer during the one (1) year warranty period.

1.12 ANNUAL INSPECTION/TESTING AND SERVICE CONTRACT

A. Provide cost to furnish service, inspect, and test all devices of the fire alarm system per the requirement of NFPA for one (1) year, starting one year after the Date of Substantial Completion. Submit written reports of inspection testing per NFPA 72, Chapter 14.

B. Provide an alternate cost for a complete inspection/testing and service/maintenance contract for the fire alarm system for one two (2) years, starting one year after the Date of Substantial Completion. Submit sample contract terms and conditions for review with shop drawings.

C. The Owner may enter into a contract directly with the vendor after shop drawing submittals. This specification is not a contract between the Owner and the vendor to perform these services.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Johnson Controls - Simplex

2.2 Fire Alarm Pathway Class and Survivability Level

A. Pathway Class:
   1. Pathway Class B: Circuits NOT capable of transmitting an alarm beyond the location of the fault condition. Wiring of outgoing and return conductors is permitted to be run in the same conduit or cable.
   2. Pathway Class: SLC for addressable devices with less than 50 devices can be Class A or B, and more than 50 devices shall be Class A.

B. Pathway Survivability Level:

   1. Pathway Survivability Level 0: Circuits have no requirements for pathway survivability beyond the requirements of the code.
   2. Pathway Survivability Level 1: Circuits are protected by an automatic sprinkler system and installed in metal raceways.

2.3 FIRE ALARM TERMINAL CABINET (FATC)

A. Fire Alarm Terminal Cabinet with locked hinged door. Provide as an extension of the main fire alarm system, if required.

2.4 SIGNALING LINE CIRCUIT DEVICES

A. Combination Devices: Subscripts identify combination type devices when applicable. Contractor shall provide the combination device or provide multiple device(s) to meet the functionality when the manufacturer does not offer the required functionality with a single device.

B. Signal Line Device(s):

1. Subscripts: Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

a. Device type as follows:

1) W = Weatherproof
2) Candela Ratings:

a) ## = 15 Candela, 30 Candela; 75 Candela; 110 Candela; 177 Candela
b) CD = NICET designer shall select Candela rating as required to provide full coverage of the space.

b. Sequence of operation as follows:
1) D = HVAC Control

C. FA-120; Smoke Detectors:

1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

a. Device types as follows:

1) Blank = Photoelectric

2. Each smoke detector shall connect directly to an SLC loop, unless listed as stand alone.
3. Each detector shall be mounted, where shown on the drawings, on a twist-lock base with all mounting hardware provided. Provide a two-piece head/base design.
4. Each detector shall have a manual switching means to set the internal identifying code (address) of that detector, which the control panel shall use to identify its address with the type of sensor connected.
5. Dual alarm and power indicators shall be provided that flash under normal conditions and remain continuous under alarm or trouble conditions. Remote indicator terminals shall be provided. Provide a remote LED indicator device if detector is not visible from a floor standing position.
6. A test means shall be provided to simulate an alarm condition.

7. Where operation is noted as required below 32°F and/or above 120°F, a conventional device shall be installed with a unique monitor module located in the nearest available location with maintained temperatures between 32°F and 120°F.

D. FA-122; Duct Smoke Detectors, Sampling Tube Type:

a. Duct-type smoke detectors shall use the same analog photoelectric sensor technology, with the same features specified for standard smoke detectors, except with additional features as specified below.
b. Provide sampling tubes and mounting hardware to match the duct to which it is attached. Where the detector housing is larger than the duct height, Contractor shall fabricate a mounting bracket for the detector and attach according to the fire alarm manufacturer's recommendations.
c. Provide a remote alarm LED indicator device (FA-241) or (FA-242) if detector is not visible from a floor-standing position. If detector is located above a suspended ceiling, mount remote indicator in ceiling directly below detector with a white single-gang faceplate labeled: Duct Smoke Detector above ceiling.

E. FA-161; Addressable Control Module:

1. Relay that represents an addressable control point used primarily for the control of auxiliary devices as indicated on the drawings. Contractor to provide additional child relay(s), as required, rated for the electrical load being controlled (Contractor to match voltage, amps, etc.).
2. Relay shall connect directly to an SLC loop and receive power from a separate 24 VDC circuit.
3. The relay shall be mounted in an enclosure located in an accessible service location as near as possible to the device(s) being controlled. All mounting hardware shall be provided.
4. The relay shall supply 24 VDC power to the device(s) being controlled.

2.5 NOTIFICATION APPLIANCE DEVICES

A. Combination Devices: Subscripts identify combination type devices when applicable. Contractor shall provide the combination device or provide multiple device(s) to meet the functionality when the manufacturer does not offer the required functionality with a single device.

B. Notification Appliance Device(s):

1. Subscripts: Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

a. Device types as follows:

1) W = Weatherproof
2) Candela Ratings:

a) ## = 15 Candela; 30 Candela; 75 Candela; 110 Candela; 177 Candela

C. Notification Device(s):

1. Wall Mounted: Red housing with white lettering or pictogram.
2. Ceiling Mounted: White housing with red lettering or pictogram.

D. FA-211; Combination Audio Horn and Visual Alarm Device:

1. Wall or ceiling mounted, refer to plans.
2. Combine audio and visual components into a single device. Refer to the corresponding paragraphs above for requirements of each component.
3. (W) Weatherproof Audio/Visual Notification Device: Electronic horn with high intensity strobe, square housing, 75 Candela, suitable for wet locations. Provide with weatherproof back box.

    a. Mounting: Semi-flush wall.
    b. Conduit shall not be exposed.

2.6 NOTIFICATION APPLIANCE CIRCUIT PANEL (NAC)

A. Furnish and install NAC extender panels as necessary to provide remote power supply for notification appliance circuits (NAC). Contractor shall indicate quantity and locations of each NAC on the shop drawing submittals.

B. Each NAC shall be self-contained remote power supply with batteries, and battery charger mounted in a surface lockable cabinet. Battery capacity shall be sufficient for operation for 24 hours in a non-alarm state followed by alarm for 15 minutes, plus 25% spare capacity for future devices. Each NAC provides a minimum of up to 4 outputs, 2A continuous, or 6A full load total capacity.

C. Power for each NAC shall be from a local 120 VAC emergency circuit. Provide two #12 conductors and one #12 ground in 1/2" conduit to each NAC from a dedicated 20A/1P circuit breaker with a red handle and a manufacturer's standard handle lock-on device. Coordinate panel and circuit number with the Engineer prior to installation.

D. Mounting: Surface.

2.7 WIRING

A. Fire alarm wiring/cabling shall be furnished and installed by the Contractor in accordance with the manufacturer's recommendations and pursuant to National Fire Codes. Cabling shall be UL listed and labeled as complying with the Electrical Code for power-limited fire alarm signal service.

B. Fire Alarm Cable:

1. Manufacturers:

    a. Comtran Corp.
    b. Helix/HiTemp Cables, Inc.
    c. Rockbestos-Suprenant Cable Corp.
    d. West Penn Wire/CDT.
    e. Radix.

PART 3 - EXECUTION

3.1 SEQUENCES OF FIRE ALARM OPERATION

A. General:

1. Refer to the Fire Alarm Operation Matrix on the drawings for basic requirements and system operation.
2. The GUI/graphic annunciator shall display audible and visual alarms. The device activated shall be immediately displayed on a CAD floor plan at approximately 1/8" scale. Visual indication shall further indicate the device by utilizing an easily recognized color change of the symbol. The use of flashing symbols is encouraged.
3. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.

B. Panel/Annunciator Alarm, Trouble, Supervisory Indication:

1. Appropriate system Alarm, Trouble, or Supervisory LED shall flash at the control panel, transponder, and annunciator locations.
2. A local signal in the control panel shall sound.
3. The LCD display shall indicate all information associated with the condition, including the name of the item, type of device and its location within the protected premises.
4. History storage equipment shall log the information associated with the fire alarm control panel (FAP) condition, along with the time and date.
5. Transmit the appropriate signal (supervisory, trouble, alarm) to the central station via the digital communicator.
6. Transmit the appropriate signal (supervisory, trouble, alarm) to the building automation system via addressable relays tied to contact monitors on the system.

C. Audible Alarms Sequence:

1. Audible alarms throughout the building shall sound.

D. Visual Alarms Sequence:

1. Visual alarms throughout the building shall flash.

E. HVAC System Sequence:

F. AHU and Mechanical Fan Shutdown Sequence:

1. The fire alarm system shall utilize addressable relays to de-energize all AHU motor controllers and mechanical fans. Coordinate other requirements with HVAC installer.
2. All AHUs and mechanical fans shall be shutdown simultaneously throughout the building.

3.2 INSTALLATION

A. Install system in accordance with manufacturer's instructions and referenced codes.

B. Devices:

1. General:

    a. All ceiling-mounted devices shall be located where shown on the reflected ceiling and floor plans. If not shown on the reflected ceiling or reflected floor drawings, the devices shall be installed in the relative locations shown on the floor drawings in a neat and uniform pattern.
    b. All devices shall be coordinated with luminaires, diffusers, sprinkler heads, piping and other obstructions to maintain a neat and operable installation. Mounting locations and spacing shall not exceed the requirements of NFPA 72.
    c. Where the devices are to be installed in a grid type ceiling system, the detectors shall be centered in the ceiling tile.
    d. The location of all fire alarm devices shall be coordinated with other devices mounted in the proximity. Where a conflict arises with other items or with architectural elements that will not allow the device to be mounted at the location or height shown, the Contractor shall adjust location of device so that new location meets all requirements in NFPA 72 and all applicable building codes.

2. Per the requirements of NFPA, detector heads shall not be installed until after the final construction cleaning unless required by the local Authority Having Jurisdiction (AHJ). If detector heads must be installed prior to final cleaning (for partial occupancy, to monitor finished areas or as otherwise required by the AHJ), they shall not be installed until after the fire alarm panel is installed, with wires terminated, ready for operation. Any detector head installed prior to the final construction cleaning shall be removed and cleaned prior to closeout.
3. Protection of Fire Alarm System:

4. A smoke detector shall be installed within the vicinity of every NAC extender panel per NFPA 72. Duct-type Analog Smoke Detectors:

    a. Duct-type analog smoke detectors shall be installed on the duct where shown on the drawings and details. The sampling tubes shall be installed in the respective duct at the approximate location where shown on the electrical drawings to meet the operation requirements of the system.
    b. All detectors shall be accessible.
    c. Duct-type detectors shall be installed according to the manufacturer's instructions.

5. Addressable Relays and Monitor Modules:

    a. Modules shall be located as near to the respective monitor or control devices as possible, unless otherwise indicated on the drawings.
    b. All modules shall be mounted in or on a junction box in an accessible location.
    c. Where not visible from a floor standing position, a remote indicator shall be installed to allow inspection of the device status from a local floor standing location.

6. Notification Appliance Devices:

    a. Devices shall be located where shown on the drawings.

b. Wall-mounted audio, visual and audio/visual alarm devices shall be mounted as denoted on the drawings.

C. Wiring:

1. Fire alarm wiring/cabling shall be provided by the Contractor in accordance with the manufacturer's recommendations and pursuant to National Fire Codes.
2. Wiring shall be installed in conduit.
3. All junction boxes with SLC and NAC circuits shall be identified on cover.

4. Fire Alarm Power Branch Circuits: Building wiring as specified in Section 260513.
5. Notification Appliance Circuits shall provide the features listed below. These requirements may require separate circuits for visual and audible devices.

   a. Fire alarm temporal audible notification for all audio appliances.
   b. Synchronization of all visual devices where two or more devices are visible from the same location.
   c. Ability to silence audible alarm while maintaining visual device operation.

6. Notification Appliance Circuits shall not span floors.
7. Signal line circuits connecting devices shall not span floors.
8. No wiring other than that directly associated with fire alarm detection, alarm or auxiliary fire protection functions shall be in fire alarm conduits. Wiring splices shall be avoided to the extent possible, and if needed, they shall be made only in junction boxes, and enclosed by plastic wire nut type connectors. Transposing or changing color coding of wires shall not be permitted. All conductors in conduit containing more than one wire shall be labeled on each end, in all junction boxes, and at each device with "E-Z Markers" or equivalent. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its terminal. Cabinet terminals shall be numbered and coded, and no unterminated conductors are permitted in cabinets or control panels. All controls, function switches, etc. shall be clearly labeled on all equipment panels.

D. Fire Alarm Cabling Color Code: Provide circuit conductors with insulation color coding as follows,

1. Power Branch Circuit Conductors: In accordance with Section 260553.
2. Signaling Line Circuit: Overall red jacket with black and red conductors.
3. DC Power Supply Circuit: Overall red jacket with violet and brown conductors.
4. Notification Appliance Circuit: Overall red jacket with blue and white conductors.

E. Devices surface mounted in finished areas shall be mounted on surface backboxes furnished by fire alarm equipment supplier. Backboxes shall be painted to match device**,** shall be the same shape and size as the device shall not have visible knockouts.

F. Make conduit and wiring connections to door release devices, sprinkler flow and pressure switches, sprinkler valve monitor switches, fire suppression system control panels, duct analog smoke detectors and all other system devices shown or noted on the Contract Documents or required in the manufacturer's product data and shop drawings.

3.3 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 260500.

B. Test in accordance with NFPA 72, Chapter 14 and local fire department requirements. Submit documentation with O & M manuals in accordance with Section 14.6 of the Code.

C. Contractor shall test and adjust the fire alarm system as follows:

1. Speaker taps shall be adjusted to the lowest tap setting which achieves a sound level higher than or equal to the greatest of the following:
   a. 15 dBA above ambient levels as indicated in NFPA 72 Table A.18.4.3.

2. Sound level measurement procedure shall meet the following requirements:

   a. All measurements shall use the 'A' weighted, dBA, sound measurement scale.
   b. All measurements shall be taken after furnishings, wall coverings and floor coverings are in place.
   c. All measurements shall be taken after fixed equipment (HVAC units, etc.) producing ambient noise is installed and is in operation.
   d. Final ambient sound measurements shall be taken during occupancy and the units shall be re-adjusted at that time, if necessary.
   e. All sound level measurements shall be taken at a height of 5' above the finished floor level.
   f. Measurements shall be taken in every unique room. If there are multiple rooms, which have the identical dimensions and function, 10%, or a minimum of two (2) rooms shall be tested. The results from the rooms tested shall be averaged and the remaining rooms may be adjusted per the average.
   g. Measurements shall be taken on a 20' x 20' grid and the results for all points taken shall be averaged. If the room is smaller than 20' x 20' a minimum of two measurements are required.
   h. Measurements shall be taken halfway between speakers or halfway between a speaker and the wall. No measurements shall be taken at the extreme edges of the room, nor directly under speakers.

3.4 MANUFACTURER'S FIELD SERVICES

A. Provide manufacturer's field services under provisions of Section 260500.

B. Include services of the manufacturer's software programmer to write initial custom-user program (for Color Graphics Annunciation System).

C. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

D. Note that room numbers depicted on the engineering drawings will not necessarily reflect the actual room (signage) numbers that the Owner selects. Contractor and fire alarm manufacturer shall coordinate the actual room numbers as the Owner directs to identify each device. This list shall be a part of the floor plan record drawing to be turned in at the project closeout.

E. Include the services to train up to three of the Owner's staff in operation, maintenance, and programming of the fire alarm system at the manufacturer's factory. Airfare and lodging expenses for the Owner's staff will be by the Owner.

F. System Occupancy Adjustments: When requested by Owner within 12 months of date of Substantial Completion, provide on-site system adjustments to suit actual occupied conditions. For this purpose, provide up to two (2) site visits, four (4) hours each visit, outside normal occupancy hours.

3.5 SYSTEM TRAINING

A. System training shall be performed under provisions of Section 260500.

B. Minimum on-site training times shall be:

1. System Operators: One (1) day.

END OF SECTION