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SECTION 260010

ELECTRICAL WORK GENERAL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including all General Conditions, Supplementary Conditions, Division 1 specification sections as well as Information to Bidders requirements that are included in the project documents, apply to the work of this Contract.

1.02 INTENT

A. The intent of the drawings and these specifications is to provide all systems complete and operative. Whether indicated on the drawings and/or included in the specification or not, provide all materials, equipment and labor usually furnished with such systems.

1.03 DEFINITIONS

As Called For	Materials, equipment including the execution specified/shown in the contract documents.
Code Requirements	Minimum requirements.
Concealed	Work installed in pipe and duct shafts, chases or recesses, inside walls, above ceilings, in slabs or below grade.
Design Make	Indicates minimum requirements for equipment.
X	Existing to remain. Make connections to maintain circuit.
XR	Existing to be relocated. (see definition of relocate).
Exposed	Work not identified as concealed.
Acceptance	Owner acceptance of the project from Contractor upon certification by Owner's Representative.
Furnished by Others	Receive delivery at job site or where called for and install.
Inspection	Visual observations by Owner's Site Representative.
Install	Mount or set equipment, device or fixture and make electric connections.
Labeled	Refers to classification by a standards agency.

Make	Refer to the article, BASIS OF DESIGN.
Provide	Furnish and install complete.
Relocate	Disassemble, disconnect, and transport equipment to new locations, then clean, test, and install ready for use.
Replace	Remove and provide new item.
Review	A general contractual conformance check of specified products.
Roughing	Pipe, duct, conduit, equipment layout and installation.
Satisfactory	As specified in contract documents.
Site Representative	Construction Manager or Owner's Inspector at the work site.

Refer to General Conditions of the Contract for additional definitions.

1.04 SCOPE OF WORK

A. In general, the scope of work includes, but is not necessarily limited to the following:
   1. Excavation and backfill for electrical services, Pressbox.
   2. Power distribution: Pressbox feeder, and underground pullboxes.
   3. Grounding of all services, raceway systems and devices, etc.
   4. Communications raceway.

1.05 BASIS OF DESIGN

A. The contract documents are prepared on basis of one manufacturer as "design equipment," even though other manufacturers' names are listed as acceptable makes. If Contractor elects to use one of the listed makes other than "design equipment," submit detailed drawings, indicating proposed installation of equipment. Show maintenance clearances, service removal space required, and other pertinent revisions to the design arrangement. Make required changes in the work of other trades, at no increase in any contract. Provide larger electrical feeders, circuit breakers, equipment, additional control devices and other miscellaneous equipment required for proper operation, and assume responsibility for proper location of roughing and connections by other trades. Remove and replace door frames, access doors, walls ceilings or floors required to install other than design make equipment. If revised arrangement submittal is rejected, revise and resubmit specified "design equipment" item which conforms to contract documents.

1.06 QUALITY ASSURANCE

A. Manufactures of equipment shall be firms regularly engaged in the production of factory fabricated systems and equipment whose products have been in satisfactory use in similar service for not less than (3) years.

B. Suppliers of equipment must have factory trained and authorized personnel for the service of all equipment provided.

1.07 LICENSING

A. Where required the contractor shall hold a license, issued or recognized by the authority having Jurisdiction, to perform electrical work.

1.08 INSPECTIONS

A. Provide rough in and final inspection by an electrical inspector certified by the AIAEI (the American International Association of Electrical Inspectors).

1.09 CONTINUITY OF UTILITY SERVICES

A. It is of paramount importance that each utility service operate continuously and without interruption. Whenever this contractor plans to make changes or alterations to any existing utility service, such plans shall result in no or minimum service interruption or inconvenience to Owner. This contractor shall plan and schedule any change or alteration to an existing utility service with Architect and Owner. Such planning, timing, and/or scheduling shall be approved by both these parties.

1.10 CODES AND STANDARDS

A. New York State Uniform Fire Prevention and Building Code: Provide all work in compliance with and meet the requirements of the latest issue.

B. National Electrical Code: All work covered under these Contract Documents shall conform to the latest issue of the National Electrical Code.

C. Standards: All equipment shall meet all the requirements of ANSI, NEMA, IES, and IEEE standards.

D. Listing: All equipment and devices for which Underwriters' Laboratory has a listing service, shall be UL listed and bear the UL listing label.

E. All materials and installation shall comply with:
1. Building Code of New York State.
2. Energy Conservation Construction Code of New York State.
3. Fire Code of New York State.
4. National Fire Protection Association (NFPA).
5. New York State Department of Labor Rules and Regulations.
6. New York Board of Fire Underwriters.
7. The Americans with Disabilities Act.
8. Local Utilities.
9. New York State Department of Health.
10. Local Municipality/City Codes and Ordinances and the Authority Having Jurisdiction.
11. Local Fire Department.
12. Insurance Carrier.

1.11 SUBMITTALS & SUBMISSION REQUIREMENTS

A. All submittals shall be in accordance with Division 1 requirements, the following requirements listed below, and also as indicated in each specification section. All submittals not complying with the listing above will be returned to the contractor without being reviewed. Rejection by Architect or Engineer of any items submitted shall require resubmittal of acceptable items.

1. Within (30) days after receiving signed contract or notice to proceed, submit to Architect for review complete descriptive dimensional data and ratings for equipment and materials proposed to be furnished and installed. Submit (8) copies of data unless otherwise specified by the Architect.
2. All materials submitted shall clearly state the job name and specification section(s) that it applies to.
3. Any package containing more than one piece of equipment or material shall also contain a schedule clearly listing all items in submittal. Schedule page (s) shall also indicate project name and building name.
4. All submittals must be clearly marked using nomenclature used in this specification for proper item identification, schedule of usages, model numbers, construction materials, performance, data, etc.
5. The Contractor shall insure that dimensions of equipment to be used conform to the space allocated for the equipment on the drawings.
6. Submittals traced or copied from contract drawings are not acceptable and will be returned without review.
7. In the event material and/or equipment is installed prior to obtaining approval of shop drawings, and in the sole opinion of the Owner's Representative, this material and/or equipment does not meet the specifications, the Contractor shall be liable for the removal and the replacement at no additional cost to the contract.

B. Samples: When requested by Engineer, provide samples of both specified equipment and proposed substitutions for review by the Owner's Representative. Such equipment shall be delivered to a location designated, or erected at the job site as directed. When neither is physically possible, arrange for the Owner's Representative to visit an acceptable site where the proposed equipment can be inspected.

C. Substitutions:

1. Submittals for equipment or materials other than as specified shall be accepted for review by the Owner's Representative.
2. Approval of substitute equipment shall be based on functional, physical and aesthetic compatibility to the equipment specified as determined by the Owner's Representative and approved by the Engineer.
3. Where substitute equipment is approved, the contractor shall be responsible for, and bear the cost of any necessary changes by his trade or other trades to make the system complete and operable.
4. Contractor is fully responsible for providing coordination between all trades affected by equipment substitution.
5. When requested, contractor shall submit layout drawings indicating new dimensions and arrangements of substituted equipment. Layout

drawings shall indicate all revisions necessary for all services affected by substitution.

1.12 FIELD INSPECTION

A. As there are various conditions at the site which do not show on the accompanying drawings, or which are at variance with the conditions indicated on the drawings, it is important that each bidder visit the site and acquaint himself with existing conditions, and take these conditions into consideration when preparing his proposal. Each bidder shall obtain information or make any measurement desired. Lack of knowledge relative to existing conditions will not be allowed as a basis for extra compensation.

B. This contractor and his subcontractors shall inspect existing equipment to remain prior to any of his new work in order to determine that all equipment is in good operating condition. If equipment is found to be lacking components, is inoperable, damaged, etc., contractor shall provide immediate written notice to the Owner. The Owner or his Representative shall determine if any additional work is necessary and the method by which any work shall be performed.

1.13 PERMITS, CERTIFICATES AND FEES

A. This Contractor shall obtain and pay for permits, certificates, fees etc. listed below. Costs for permits, fees etc. shall be included in the base bid amount.
   1. All required applications and permits to begin work.
   2. Certificate of inspection including Third-Party Agency.
   3. All municipal connection charges.
   4. All local utility charges (power, telephone, cable, etc.).
   5. Fees and charges shall be obtained directly from the respective authority having jurisdiction.

1.14 GUARANTEE

A. Contractor shall guarantee all work furnished through this contract including work performed by sub-contractors, for a period of (1) year (unless otherwise noted), from the date of final acceptance. Contractor agrees to repair or replace any defective work or materials at no additional cost to the Owner. Contractor shall also pay for any damage to other work resulting from repairs to defects. Contractor shall furnish written guarantees to the Owner's Representative in accordance with the general conditions.

1.15 TESTING AND INSPECTION

A. Inspections required for any ordinances, regulations, instructions, laws, rules, standards and practices that require any work to be inspected or tested shall be performed. Contractor shall give Owner, Architect and Engineer timely notice of readiness of work for inspection or testing and the date fixed for said inspection or testing.

B. Third-Party Agency must inspect completed installation and present Owner with Certificate of Inspection showing approval.

C. Required local or municipal inspection. Process and present Owner with certificate indicating approval of such governing bodies.

D. Contractor shall submit a written report to Architect, copy to Engineer, on results of each inspection or test on system or equipment supplied. Report shall contain all pertinent information, recommendations, approvals, additional work required, etc.

E. Contractor is responsible to check rotation on all three phase equipment prior to turning on equipment for temporary or permanent use.

F. Panelboard, Circuit Breaker, Transformer and Fuse Tests:
1. Energize all possible lighting and equipment loads for a period of not less than eight hours.
2. Check all fuses and circuit breakers for faulty tripping and excessive heat.
3. Tabulate phase current on all feeders.
4. Tabulate voltages at each panelboard (phase to phase and phase to neutral).
5. Reconnect branch circuits that vary over 5% between high and low current.
6. Reconnect transformer taps as required to adjust for high or low voltages.
7. All tabulation sheets shall be presented to the Engineer for approval, make any corrections determined by the Engineer.

1.16 RECORD DOCUMENTS

A. When required by general conditions or other Division 1 Section this Contractor shall prepare and turn over to Owner's Representative record as-built documents. As-built drawings will include actual equipment location layout, service connections, etc.

B. In all projects, contractor shall provide record drawings of all underground equipment and service runs. As-built drawings for underground work will include dimensions to actual locations finish grade elevations, and actual invert to underground structures equipment and service runs.

1.17 INTENT OF DRAWINGS

A. The drawings are diagrammatic, unless detailed dimensioned drawings are included. Drawings show approximate locations of equipment, fixtures, panelboards, and wiring devices. Exact locations are subject to the approval of the Owner's Representative. The general run of electrical feeders, branch circuits, and conduits, indicated on the drawings, is not intended to be the exact routing. Circuit designations, in the form of "Home Runs" on branches, indicate the designation of the branch circuit, and the panelboard or interconnection box from which the branch circuit is served.

B. Drawings show general design and arrangement. Verify exact location and elevations at the job location. Do not scale plans and diagrams.

C. Drawings do not show all offsets, fittings, interferences, and elevation changes. Adjust installation of conduit, equipment location, etc. to accommodate work with the obstacles and interferences. Where a major and important rearrangement is necessary, report same to Architect for review. Obtain written approval for all major changes.

D. Cooperate with all Contracts and Owners and determine the exact route of all raceway and location of all equipment.

PART 2 PRODUCTS

2.01 MATERIALS

A. All materials, unless otherwise specified, shall be new and be the standard products of the manufacturer. Used equipment or damaged material will be rejected.

B. The listing of a manufacturer as “acceptable” does not indicate acceptance of a standard or catalogued item of equipment. All equipment and systems conform to the Specifications.

2.02 U.L. LISTING

A. Equipment shall bear the Underwriter’s Laboratories (UL), or other approved agency listing label. This listing requirement applies to the entire assembly. Any modifications to equipment to suit the intent of the specifications shall be performed in accordance with the National Electric Code and listed by U.L.

2.03 FIRE STOPPING

A. Fire-stopping for Openings through Fire and Smoke Rated Walls and Floor Assemblies shall be listed or classified by an approved independent testing laboratory for "Through-Penetration Fire-Stop Systems." The system shall meet the requirements of "Fire Tests of Through-Penetration Fire-Stops" designated ASTM E814.

B. Acceptable Manufacturers:
1. Dow Corning Fire-Stop System Foams and Sealants.
2. Nelson Electric Fire-Stop System Putty, CLK and WRP.
3. Thomas & Betts - S-100 FS500/600.
4. Carborundum Fyre Putty.
5. Hilti Firestop Systems.

PART 3 EXECUTION

3.01 ROUGHING

A. Obtain approved roughing diagrams and exact locations of equipment for items furnished under other Divisions of the specifications. Do not rough in without approved drawing.

B. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, etc. Verify final locations for rough-ins with field measurements and with the equipment being connected. Verify exact location and elevations at work site prior to any rough in work. DO NOT SCALE PLANS. If field conditions, details, changes in equipment or shop drawing information require a significant change to the original documents, contact the Owner's Representative for approval before proceeding.

C. All equipment locations shall be coordinated with other trades to eliminate interference with required clearances for equipment maintenance and inspections.

D. Coordinate work with other trades and determine exact routing of all duct, pipe, conduit, etc., before fabrication and installation. Coordinate with Architectural Drawings.

E. Before roughing for equipment furnished by Owner or in other contracts, obtain from Architect and other Contractors, approved roughing drawings giving exact location for each piece of equipment. Do not "rough in" services without final layout drawings approved for construction. Cooperate with other trades to insure proper location and size of connections to insure proper functioning of all systems and equipment. Obtain written authorization from the Owner's Representative or other contractor for any "rough ins" that, due to project schedule, are required before approved coordination drawings are available. Any work installed without written authorization or approved coordination drawings, causing a conflict will be relocated by the electrical contractor at no expense to the Owner.

F. For equipment and connections provided in this contract, prepare roughing drawings as follows:
   1. New equipment: Obtain equipment roughing drawings and dimensions, then prepare rough-in drawings.
   2. Where more than one trade is involved in an area, space or chase, all shall cooperate and install their own work to utilize the space equally between them in proportion to their individual requirements. In general, ductwork shall be given preference except where grading of piping becomes a problem, followed by piping then electrical wiring. If, after installation of any equipment, piping, ducts, conduit, and boxes, it is determined that ample maintenance and passage space has not been provided, rearrange work and/or furnish other equipment as required for ample maintenance space. Any changes in the size or location of the material or equipment supplied, which may be necessary in order to meet field conditions or in order to avoid conflicts between trades, shall be brought to the immediate attention of the Owner's Representative and approval received before such alterations are made.

3.02 SEALING AND FIRESTOPPING

A. Installation of Fire-stopping for Openings Through Fire and Smoke Rated Walls and Floor Assemblies shall be as follows:
   1. Provide fire-stop system seals at all locations where piping, tubing, conduit, electrical busways/cables/wires, ductwork and similar utilities pass through or penetrate fire rated wall or floor assembly. Provide fire-stop seal between sleeve and wall for dry wall construction.
   2. The minimum required fire resistance ratings of the wall or floor assembly shall be maintained by the fire-stop system. The installation shall provide an air and watertight seal.
   3. The methods used shall incorporate qualities that permit the easy removal or addition of electrical conduits or cables without drilling or use of special tools. The product shall adhere to itself to allow repairs to be made with the same material and permit the vibration, expansion and/or contraction of any items passing through the penetration without cracking, crumbling and resulting reduction in fire rating.
   4. Provide rigid steel sleeves where non-armored cables pass through fire rated walls and barriers.

3.03 SUPPORTS

A. Provide required supports for work of this Contract, including beams, angles, channel, hangers, rods, columns, plates, bases, braces, etc. to properly support all work.

B. Provide steel angles, channels and other materials necessary for the proper support and erection of motor starters, distribution panelboards, large disconnect switches, pendant-mounted lighting fixtures, etc.

C. See Specification Section 26 0190 – Supporting Devices for additional requirements.

3.04 EQUIPMENT INSTALLATION

A. All installations shall comply with the following requirements:
   1. Provide code required disconnects for all electrical equipment that is furnished or connected by the electrical contractor.
   2. Coordinate electrical systems, equipment, and materials installation with other building components. Be responsible for any changes in openings and locations necessitated by the equipment installed.
   3. Verify all dimensions with field measurements.
   4. Arrange for all chases, slots and openings in other building components that are not indicated on drawings, to allow for electrical installations.
   5. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
   6. Coordinate ordering and installation of all equipment with long lead times or having a major impact on work by other trades so as not to delay the job or impact the construction schedule. Pay close attention to equipment that must be installed prior to building enclosure.
   7. Where mounting heights are not detailed or dimensioned, install systems, materials and equipment to provide the maximum headroom possible.

8. Install systems, materials and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer the conflict to the Architect.
9. Store Materials on dry base, at least 6" above-ground or floor. Store so as not to interfere with other work or obstruct access to buildings or facilities. Provide waterproof/windproof covering. Remove and provide special storage for items subject to moisture damage. Protect against theft or damage from any cause. Replace items stolen or damaged, at no cost to Owner.
10. Set all equipment to accurate line and grade, level all equipment and align all equipment components.
11. All tolerances in alignment and leveling, and the quality of workmanship for each stage of work shall be as required by the manufacturer and subject to approval by the Owner's Representative.
12. All finished equipment surfaces damaged during construction shall be brought to "as new" condition by touch up or repainting. Any rust shall be removed and primed prior to repainting.
13. Workmanship shall be as called for in the "Standard of Installation" published by the National Electrical Contractors Association (NECA).
14. No electrical equipment shall be hidden or covered up prior to inspection by the Owner's Representative. All work that is determined to be unsatisfactory shall be corrected immediately.
15. All electrical work shall be installed level and plumb, parallel and perpendicular to other building systems and components.

B. Provide complete power connections to all electrical equipment. Provide control connections to equipment where indicated on the drawings. Provide disconnect ahead of each piece of equipment. Ground all equipment in accordance with the latest version of the National Electrical Code.

C. Provide all power wiring, electric equipment, control wiring, switches, lights, receptacles, and connections as required for proper equipment operation of Owner-Furnished Equipment and Equipment furnished by other contracts.

D. Refer to Manufacturer's drawings/specifications for requirements of special equipment. Verify connection requirements before bidding and confirm prior to roughing.

E. This contractor shall coordinate scheduling and installation of work with other contractors, sub-contractors and other trades. The contractor is also required to coordinate all work with Owner supplied materials, direct contracts, and normal building operations, if any.

F. All finished work shall be neat and workmanlike. All work of a special nature shall be performed by skilled and qualified workmen who can present credentials showing experience in said trade. New systems shall be delivered to Owner complete in perfect working order, tested and balanced in full accordance with plans and specifications. Existing systems shall function in same manner as

before this work was performed. Any malfunctions which arise in existing systems as a result of demolition or alteration of parts of such systems shall be corrected.

G. Layout of equipment, accessories and electrical systems in plan is generally diagrammatic unless specifically dimensioned or detailed. Check project drawings and existing site conditions before installing work for interference's as governed by structural or other conditions. Owner reserves the right to make reasonable changes in location of equipment, accessories or electrical systems prior to "roughing-in" without involving additional expense. Exact dimensions shown upon plans will be subject to verification and confirmation of exact conditions at site at time of construction. "Plus or minus" dimensions are shown upon drawing as a guide only. Exact surrounding conditions are governed by final equipment selection and/or other like details.

H. Furnish all new equipment and materials as described herein. Any material, operation, method or device mentioned, listed or noted within this specification, if not specifically mentioned as furnished or installed by others, shall be furnished and installed by this contractor.

3.05 PAINTING

A. This Contract Includes the following :
1. Painting for all cut and patch work performed as part of Division 26 contract.
2. Painting required for touch-up of surfaces damaged due to the installation of electrical work.
3. Painting as required to repair finish of equipment furnished.

3.06 CLEANING

A. After all tests are made and installations completed satisfactorily:
1. Thoroughly clean entire installation, both exposed surfaces and interiors.
2. Remove all debris caused by work.
3. Remove tools, surplus, materials, when work is finally accepted.

3.07 CONTINUITY OF SERVICES

A. Refer to "General Conditions of the Contract for Construction" for temporary facilities for additional contract requirements. Schedules for various phases of contract work shall be coordinated with all other trades and with Owner's Representative. Provide, as part of contract, temporary mechanical and electrical connections and relocation as required to accomplish the above. Obtain approval in writing as to date, time, and location for shut-down of existing mechanical/electrical facilities or services.

3.08 START UP AND OWNER INSTRUCTIONS

A. Before acceptance of the work, furnish necessary skilled labor to operate all systems. Instruct the Owner’s designated personnel on the proper operation and maintenance of systems and equipment. Obtain written acknowledgment from

person instructed prior to acceptance repeat the instructions if asked to do so. Contractor is fully responsible for systems until acceptance, even though operated by Owner's personnel, unless otherwise agreed in writing. Provide, operating, maintenance and starting precautions and procedures to be followed by the Owner for operating systems and equipment. Mount the instruction in clear plastic holder on or adjacent to the equipment.

B. Where supervision by a manufacturer is called for, provide manufacturer's certified technician or Engineer to supervise the startup, testing and adjustment of the equipment or system. Where two or more manufacturers are involved (i.e., variable frequency drive and air handling unit) both manufacturer's shall be present at start up. The manufacturer shall provide a written report detailing the testing and start-up including problems that occurred and their method of resolution.

C. Training Session: A training session shall be held for each system and/or item listed below:

Item	Description	Training Hours
1.	Secondary Electric Service	2

D. The instruction shall include the following types of information:
1. System overview.
2. Major component designation.
3. System operation procedures.
4. Maintenance scheduling and procedures.
5. Provide a list of spare components each system would normally require.

E. Services: Provide services required, for all equipment specified under this contract, for a period of (1) year after written acceptance by the Owner.

3.09 OPERATION AND MAINTENANCE MANUALS

A. Provide Operation and Maintenance Manuals. Include the following:
1. Equipment wiring diagrams.
2. Manufacturer's instructions.
3. Include typewritten instructions, describing equipment, starting/operating procedures, emergency operating instructions.
4. Recommended maintenance procedures.
5. Include name, address, and telephone number of supplier manufacturer.
6. Representative and service agency for all major equipment items.
7. Panel schedules in hard copy and word or excel format.
8. Bind above items in a three-ring binder with name of project on the cover.
9. Provide CD or DVD with all data in word, pdf, or excel format.

B. Refer to specific specification electrical specification sections for additional requirements.

C. Deliver to Owner's Representative before request for acceptance.

END OF SECTION

SECTION 260190

SUPPORTING DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including the General and Supplementary Conditions of Division 1 of the Specification Sections, apply to the work of this section.

1.02 SECTION INCLUDES

A. Conduit and equipment supports.

B. Anchors and fasteners.

1.03 REFERENCES

A. Refer to Division 1.

B. NECA Standard of Installation (National Electrical Contractors Association).

C. NFPA 70 - National Electrical Code.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

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

PART 2 PRODUCTS

2.01 ANCHORING DEVICES

A. Sleeve Anchors (FS FF-S-325 Group II, Type 3, Class 3): Molly/Emhart's Parasleeve Series, Phillips' Red Head AN, HN, FS Series, or Ramset's Dynabolt Series.

B. Wedge Anchors (FS FF-S-325 Group II, Type 4, Class 1): Hilti's Kwik Bolt Series, Molly/Emhart's Parabolt Series, Phillips' Red Head WS, or Ramset's Trubolt Series.

C. Self-Drilling Anchors (FS FF-S-325 Group III, Type 1): Phillips' Red Head Series S or Ramset's Ram Drill Series.

D. Non-Drilling Anchors (FS FF-S-325 Group VIII, Type 1): Hilti's Drop-In Anchor Series, Phillips' Red Head J Series, or Ramset's Dynaset Series.

E. Stud Anchors (FS FF-S-325 Group VIII, Type 2): Phillips' Red Head JS Series.

2.02 CAST-IN-PLACE CONCRETE INSERTS

A. Continuous Slotted Type Concrete Insert, Galvanized:
   1. Load Rating 1300 lbs./ft.: Kindorf's D-986.
   2. Load Rating 2400 lbs./ft.: Kindorf's D-980.
   3. Load Rating 3000 lbs./ft.: Hohmann & Barnard Inc.'s Type CS-H.
   4. Load Rating 4500 lbs./ft.: Hohmann & Barnard Inc.'s Type CS-HD.

B. Threaded Type Concrete Insert: Galvanized ferrous castings, internally threaded.

C. Wedge Type Concrete Insert: Galvanized box-type ferrous castings, designed to accept bolts having special wedge shaped heads.

2.03 MISCELLANEOUS FASTENERS

A. Except where shown otherwise on the Drawings, furnish type, size, and grade required for proper installation of the Work, selected from the following: Furnish galvanized fasteners for exterior use, or for items anchored to exterior walls, except where stainless steel is indicated.
   1. Standard Bolts and Nuts: ASTM A 307, Grade A, regular hexagon head.
   2. Lag Bolts: FS FF-B-561, square head type.
   3. Machine Screws: FS FF-S-92, cadmium plated steel.
   4. Machine Bolts: FS FF-B-584 heads; FF-N-836 nuts.
   5. Plain Washers: FS FF-W-92, round, general assembly grade carbon steel.
   6. Lock Washers: FS FF-W-84, helical spring type carbon steel.
   7. Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class and style as required to sustain load.

B. Stainless Steel Fasteners: Type 302 for interior Work; Type 316 for exterior Work; Phillips head screws and bolts for exposed Work unless otherwise specified.

2.04 "C" BEAM CLAMPS

A. With Conduit Hangers:
   1. For 1 Inch Conduit Maximum: B-Line Systems Inc.'s BG-8, BP-8 Series, Caddy/Erico Products Inc.'s BC-8P and BC-8PSM Series, or GB Electrical Inc.'s HIT 110-412 Series.
   2. For 3 Inch Conduit Maximum: Appleton Electric Co.'s BH-500 Series beam clamp with H50W/B Series hangers, Kindorf's 500 Series beam clamp with 6HO-B Series hanger, or OZ/Gedney Co.'s IS-500 Series beam clamp with H-OWB Series hanger.

2.05 CHANNEL SUPPORT SYSTEM

A. Channel Material: 12 gage steel.

B. Finishes:
1. Phosphate and baked green enamel/epoxy.
2. Pre-galvanized.
3. Hot dipped galvanized.
4. Polyvinyl chloride (PVC), minimum 15 mils thick.

C. Fittings: Same material and finish as channel.

D. UL Listed Systems:
1. B-line Systems Inc.'s B-22 (1-5/8 x 1-5/8 inches), B-12 (1-5/8 x 2-7/16 inches), B-11 (1-5/8 x 3-1/4 inches).
2. Grinnell Corp.'s Allied Power-Strut PS 200 (1-5/8 x 1-5/8 inches), PS 150 (1-5/8 x 2-7/16 inches), PS 100 (1-5/8 x 3-1/4 inches).
3. Kindorf's B-900 (1-1/2 x 1-1/2 inches), B-901 (1-1/2 x 1-7/8 inches), B-902 (1-1/2 x 3 inches).
4. Unistrut Corp.'s P-3000 (1-3/8 x 1-5/8 inches), P-5500 (1-5/8 x 2-7/16 inches), P-5000 (1-5/8 x 3-1/4 inches).
5. Versabar Corp.'s VA-1 (1-5/8 x 1-5/8 inches), VA-3 (1-5/8 x 2-1/2 inches).

2.06 MISCELLANEOUS FITTINGS

A. Side Beam Brackets: B-Line Systems Inc.'s B102, B103, B371-2, Kindorf's B-915, or Versabar Corp.'s VF-2305, VF-2507.

B. Pipe Straps:
1. Two Hole Steel Conduit Straps: B-Line Systems Inc.'s B-2100 Series, Kindorf's C-144 Series, or Unistrut Corp.'s P-2558 Series.
2. One Hole Malleable Iron Clamps: Kindorf's HS-400 Series, or OZ/ Gedney Co.'s 14-G Series, 15-G Series (EMT).

C. Supporting Fasteners (Metal Stud Construction): Metal stud supports, clips and accessories as produced by Caddy/Erico Products Inc.

PART 3 EXECUTION

3.01 INSTALLATION

A. Where specific fasteners are not specified or indicated for securing items to in-place construction, provide appropriate type, size, and number of fasteners for a secure, rigid installation.

B. Install anchoring devices and other fasteners in accordance with manufacturer's printed instructions.

C. Make attachments to structural steel wherever possible.

3.02 FASTENER SCHEDULE

A. Material:
1. Use cadmium or zinc coated anchors and fasteners in dry locations.
2. Use hot dipped galvanized or stainless steel anchors and fasteners in damp and wet locations.

B. Types and Use: Unless otherwise specified or indicated use:
1. Cast-in-place concrete inserts in fresh concrete construction for direct pull-out loads such as shelf angles or fabricated metal items and supports attached to concrete slab ceilings.
2. Anchoring devices to fasten items to solid masonry and concrete when the anchor is not subjected to pull out loads, or vibration in shear loads.
3. Toggle bolts to fasten items to hollow masonry and stud partitions.

3.03 ATTACHMENT SCHEDULE

A. General: Make attachments to structural steel or steel bar joists wherever possible. Provide intermediate structural steel members where required by support spacing. Select steel members for use as intermediate supports based on a minimum safety factor of 5.
1. Make attachments to steel bar joists at panel points of joists.
2. Do not drill holes in main structural steel members.
3. Use "C" beam clamps for attachment to steel beams.

B. Where it is not possible to make attachments to structural steel or steel bar joists, use the following methods of attachment to suit type of construction unless otherwise specified or indicated on the drawings:
1. Attachment to Cast-In-Place Concrete:
a) Fresh Concrete: Use cast-in-place concrete inserts.
b) Existing Concrete: Use anchoring devices.
2. Attachment to Cored Precast Concrete Decks:
a) New Construction: Use thru-bolts and fish plates before Construction Work Contractor has placed concrete fill over decks.
3. Attachment to Metal Stud Construction: Use supporting fasteners manufactured specifically for the attachment of raceways and boxes to metal stud construction.
a) Support and attach outlet boxes so that they cannot torque/twist. Either:
(1) Use bar hanger assembly, or:
(2) In addition to attachment to the stud, also provide far side box support.

3.04 CONDUIT SUPPORT SCHEDULE

A. Provide number of supports as required by National Electrical Code. Exception: Maximum support spacing allowed is 4'-0" for conduit sizes 3 inches and larger supported from wood trusses.

B. Use pipe straps and specified method of attachment where conduit is installed proximate to surface of wood or masonry construction.
   1. Use hangers secured to surface with specified method of attachment where conduit is suspended from the surface.

C. Use "C" beam clamps and hangers where conduit is supported from steel beams.

D. Use deck clamps and hangers where conduit is supported from steel decking having hanger tabs.
   1. Where conduit is supported from steel decking which does not have hanger tabs, use clamps and hangers secured to decking, utilizing specified method of attachment.

E. Use channel support system supported from structural steel for multiple parallel conduit runs.

3.05 CHANNEL SUPPORT SYSTEM SCHEDULE

A. Use channel support system where specified or indicated on the drawings.

B. Channel supports may be used, as approved, to accommodate mounting of equipment.

C. Material and Finish:
   1. Dry Locations: Use 12 gage steel channel support system having any one of the specified finishes.
   2. Damp Locations: Use 12 gage steel channel support system having any one of the specified finishes except green epoxy/enamel.
   3. Wet Locations: Use 12 gage steel channel support system having hot dipped galvanized, or PVC finish.

END OF SECTION

SECTION 260195

ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including the General and Supplementary Conditions of Division 1 of the Specification Sections, apply to the work of this section.

1.02 SECTION INCLUDES

A. Nameplates and labels.

B. Wire and cable markers.

C. Conduit markers.

1.03 REFERENCES

A. Refer to Division 1.

B. NFPA 70 - National Electrical Code.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

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

PART 2 PRODUCTS

2.01 NAMEPLATES AND LABELS

A. Nameplates: Engraved three-layer laminated plastic, black letters on white background.
   1. Locations:
      a) Outside of each electrical panel. Indicate panel name.
      b) Control equipment enclosure. Indicate equipment name and branch circuit.
      c) Disconnects. Indicate equipment name and branch circuit.
      d) Distribution panel breakers. Indicate load served.
   2. Letter Size: 1/8 inch letters.

B. Labels: Circuit designation shall be indicated with clear adhesive tape, 3/16 inch black letters on clear background. Use only for identification of individual wall

switches and receptacles and control device stations. Tape label shall be adhered to the faceplate of each device.

2.02 WIRE MARKERS

A. Description: Tape type wire markers.

B. Locations: Each conductor at panelboard gutters and each load connection.

C. Legend: Branch circuit or feeder number indicated.

2.03 UNDERGROUND WARNING TAPE

A. Location:
1. Along length of each underground conduit buried 12" below finished grade.
2. Red with black lettering, 6" wide tape, "CAUTION – Underground Electric".
3. Orange with black lettering, 6" wide tape, "CAUTION – Underground Telecommunications".

2.04 PANEL SCHEDULES

A. Provide complete type written directory for each panelboard listing room number, function, etc., for each circuit breaker.

B. Provide type written updated panelboard directories for existing panelboards affected by this work.

C. Panel directory must also include the upstream panel that services the panel. (i.e. "Fed from MDP Circuits 2,4,6")

D. Include a Microsoft word or excel file with all panel schedules as part of the close out submittals.

2.05 DEVICES

A. Provide a tape label on all receptacle and switch coverplates, power poles, etc. listing panel designation and circuit number. Tape shall be attached to outside of receptacle or switch coverplates.

B. In permanent marker write the panel and circuit number on the wall behind receptacle cover plate or inside receptacle back box.

2.06 JUNCTION AND PULL BOXES

A. Identify junction and pullboxes for particular service such as power, lighting, fire alarm, telephone, intercom, public address, nurse call, etc. using stencil lettering on cover.

2.07 CONDUIT

A. Provide adhesive marking labels for raceway and metal-clad cable. The labels shall indicate voltage and service, and be located above ceilings every 75 feet and on wall mounted conduit in mechanical and equipment rooms.

PART 3 EXECUTION

3.01 PREPARATION

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

3.02 INSTALLATION

A. Refer to Division 1.

B. Install nameplate and label parallel to equipment lines.

C. Secure nameplate to equipment front using adhesive.

D. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

END OF SECTION

SECTION 260519

WIRE AND CABLE (600 V AND BELOW)

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including the General and Supplementary Conditions of Division 1 of the Specification Sections, apply to the work of this section.

1.02 WORK INCLUDED

A. Conductors.

B. Terminations.

1.03 SUBMITTALS

A. Schedule of all wiring and cable usage.

B. Product data sheets for all wire and cable types.

PART 2 PRODUCTS

2.01 CONDUCTORS

A. Feeder, branch circuit and control wiring:
1. Annealed Copper, 98% conductivity.
2. Minimum wire size:
   a) #12 AWG for branch circuits.
3. #8 AWG Wire and above shall be stranded.
4. 600 volt insulation for all wiring above 50 volts.
5. 300 volt insulation permitted for all wiring below 50 volts.
6. Thermal plastic with PVC insulation with nylon jacket, suitable for wet or dry locations, THHN/THWN 90 degree Celsius.
7. 90 degree C maximum operating temperature rating.
8. UL 83 Listed.

B. Color Coding:
1. All circuits shall be color coded according to the following schedule:

Voltage	A PHASE NEUTRAL	B PHASE	C PHASE
240/120V, 1 Phase	Black White	Red	

*ALL GROUNDING CONDUCTORS SHALL BE GREEN

2. #6 AWG and smaller shall have insulation continuously colored as called for above.
3. #4 AWG and larger may by identified using a minimum 3" tape band.
4. Color code all conductors at all pullboxes, enclosures, and terminations.
5. Switched legs shall be identified with the same color insulation as the phase leg.

C. Acceptable manufacturers:
1. Cablec
2. Southwire
3. Okonite
4. Rome Cable
5. Pirelli

2.02 LOW VOLTAGE CONNECTORS AND TERMINATIONS

A. Straight Splices, #26 AWG to #10 AWG:
1. Nylon Insulated compression butt-splices.
2. 600 volt, 90 degree C rated.
3. Make: Burndy "Insulink", T&B "Sta-Kon" or approved equal.

B. Straight Splices, #8 AWG and Larger:
1. Two-way, long barrel, compression type, copper.
2. Provide heat shrink tubing over splice.
3. 600 volt rated.
4. Make: Burndy "Hylink", T&N 54800 Series or approved equal.

C. Pigtail Splices, #26 AWG to #10 AWG:
1. Twist type pressure connector.
2. 600 volt rated, 105 degree C.
3. Size as required for number and size of conductors used.
4. Make: T&B Scotchlock or approved equal.

D. Three Way Splices, #8 AWG and Larger:
1. Three-way, long barrel, compression type, copper.
2. Provide tape or heat shrink tubing over splice.
3. 600 volt rated.
4. Make: Burndy "Hylink", T&B 54700 Series or approved equal.

E. Lug Terminations for Control and Signal Wiring:
1. Nylon insulated fork with compression termination of #26 AWG to #10 AWG.
2. Nylon insulated ring with compression termination for #8 AWG and larger.
3. 300 volt rated.
4. Make: Burndy "Insulug", T&B "Sta-Kon" or approved equal.

F. Lug Terminations for Power Wiring:
1. Long barrel, compression type, copper body, one-hole for #8 AWG to #2/0 AWG.
2. Long barrel, compression type, copper body, two-hole, for #3/0 AWG

and larger.

3. 600 volt rated.
4. Make:
   a) One-hole lug: Burndy "Hylug", T&B 54900 Series or approved equal.
   b) Two-hole lug: Burndy "Hylug", T&B 54800 Series or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Route wire and cable as required to meet Project Conditions.

B. Install cable in accordance with the NECA "Standard of Installation."

C. Use conductor not smaller than 12 AWG for power and lighting circuits.

D. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 100 feet.

E. Identify and color code wire and cable under provisions of this section. Identify each conductor with its circuit number or other designation indicated.

F. Install cables in raceway as called for after the entire raceway system has been completed.

G. Install splices and connections in accessible outlet, pull, and junction boxes.

H. Insulate all splices and connections with UL Labeled plastic tape, heat shrink tubing, or plastic molded caps.

I. All wiring systems shall be properly grounded and continuously polarized throughout, following the color coding specified.

J. Provide a green equipment ground with all feeders and all branch circuits' size per the NEC.

K. Provide dedicated white insulated neutral conductor for each branch circuit. Shared neutrals are not allowed.

L. Install a maximum of three phase conductors, three neutral conductors, and one grounding conductor in each home run. (Obtain approval for additional conductor fill where field conditions require. Adhere to NEC de-rating requirements.)

M. Feeder conductors shall be continuous from point of origin to load termination without splice. If this is not practical, contact the Owner's Representative and receive written approval for splicing prior to installation of feeder(s). Where feeder conductors pass through junction and pull boxes, bind and lace conductors

of each feeder together. For parallel sets of conductors, match lengths of conductors.

N. Use pulling means including fish tape, cable, and rope and basket type grips which will not damage cables or raceways. Use approved mechanical pullers for feeders and branch circuits as required for #6 AWG cable and larger. Do not use mechanical means to pull conductors No. 8 or smaller.

O. Branch circuit conductors installed in panelboards, and control conductors installed in control cabinets and panels shall be neatly bound together using "Ty-Raps" or equivalent.

P. Reconnect branch circuit wiring at panelboards as required to obtain a balanced three phase load on the feeders.

Q. Wiring in panelboards and equipment enclosures etc. shall be neatly trained and arranged so as not to preclude access to the space or equipment contained therein. Provide all additional cable supports and ties required to comply.

R. The system shall be properly grounded and continuously polarized throughout, following the color coding specified.

S. Wiring within panelboards, control cabinets, pull boxes, wiring troughs and annunciator and/or alarm panels shall be neatly bundled together with ties not requiring tools to install. Two, three and four wire circuits emerging from the bundle shall be trained and tied individually.

T. Where multiple conductors are installed in a common raceway they shall be pulled simultaneously. Use of pulling compound or lubricant shall be avoided unless absolutely necessary. Where pulling lubricant is required, use UL approved compounds approved for cable type. Lubricant shall meet all OSHA and Toxic Control Act standards.

APPLICATION	CABLE TYPES	DESIGN MAKE
General purpose Construction & Maintenance	Rubber, Neoprene, Nylon, PVC, High Density XLP, Hypalon	Ideal - Yellow 77
High Temperature 190 Construction & Maintenance	Rubber, Neoprene, Nylon, PVC, High Density XLP, Hypalon, Low Density Polyethylene, Semiconducting Jacket	Ideal - Yellow
Utility construction & Maintenance	Rubber, Neoprene, Nylon, PVC, High Density XLP, Hypalon, Low Density Polyethylene, Semiconducting Jacket	Aqua-Gell II

Cold Weather Construction & Maintenance	Rubber, Neoprene, Nylon PVC, High Density XLP, Hypalon, Low Density Polyethylene, Semiconducting Jacket	Aqua-Gel CW

3.02 CIRCUITING

A. The following takes precedence over the drawings:
   1. General purpose receptacle and lighting branch circuits may be combined in single conduits in accordance with NEC requirements and restrictions.
   2. Conductors serving individual pieces of equipment or grouped equipment or isolated ground branch circuits shall not be combined.
   3. Provide dedicated Neutrals.

3.03 SPLICES

A. Dry locations: For conductors #10 AWG and smaller use standard spring type pressure connectors or compression type connectors with insulating jackets.

B. For conductors #8 AWG and larger use compression type connectors and insulate in accordance with manufacturer's recommendations.

C. Damp locations: Use same type splices as indicated for dry locations and wrap with moisture sealing tape.

D. Wire runs shall be continuous. All splicing shall be done only in accessible boxes.

3.04 LOW VOLTAGE CONTROL WIRING

A. Low voltage control wiring shall not be run in same conduit system as power feeds. All low voltage control wiring in equipment shall be neatly bundled, identified and installed remote from any and all mechanical moving parts. All low voltage control wiring in walls shall be installed in conduit, the same as required for power wiring. All low voltage wiring above inaccessible ceilings shall be installed in conduit. All low voltage wiring exposed in finished spaces shall be installed in wiremold surface raceway. All low voltage wiring exposed in unfinished spaces shall be installed in conduit. All low voltage control wiring above accessible ceilings shall be bundled, neatly run at right angles and/or parallel to building steel, tied to steel as high as possible with no more than 3" sags; wire may not be laid on ceiling framing or supported by ceiling framing. Low voltage wiring shall not be run between decking flutes or above structural members.

END OF SECTION

SECTION 260526

GROUNDING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including the General and Supplementary Conditions of Division 1 of the Specification Sections, apply to the work of this section.

1.02 SECTION INCLUDES

A. Grounding electrodes materials.

B. Grounding and bonding conductor materials.

C. Equipment grounding and bonding requirements.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. B3: Soft or Annealed Copper Wire.
   2. B8: Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, or Soft.
   3. B33: Tinned Soft or Annealed Copper Wire for Electrical Purposes.

B. Institute of Electrical and Electronic Engineers (IEEE):
   1. 81: Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
   2. 1100: Powering and grounding sensitive electronic equipment.

C. International Electrical Testing Association (NETA).

D. National Fire Protection Association (NFPA):
   1. 70: National Electrical Code (NEC).
   2. 780: Lightning Protection Code.

E. Occupational Safety and Health Administration (OSHA):
   1. 29CFR 1910.7 Definitions and requirements for Nationally Recognized Testing Laboratories (NRTL).

F. Underwriters Laboratories (UL):
   1. 486A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.
   2. 467: Grounding and Bonding Equipment.

1.04 GROUNDING SYSTEM DESCRIPTION

A. Use the existing service entrance grounding system.

1.05 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 5 ohms.

B. All grounding systems shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the Contract Documents shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

C. Materials specified herein shall comply with the applicable requirements of:
1. The National Electrical Code, Article 250.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: A NRTL as defined in OSHA Regulation 1910.7, or a full member company of NETA.
1. Testing Agency Field Supervision: Use persons currently certified by NETA or the National Institute for Certification in Engineering Technologies to supervise on-site

B. Comply with UL 467.

C. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications: A NRTL as defined in OSHA Regulation 1910.7.

1.07 SUBMITTALS FOR REVIEW

A. Refer to Division 1.

B. Product Data: Provide for grounding electrodes and connections.

1.08 SUBMITTALS FOR INFORMATION

A. Refer to Division 1.

B. Test Reports: Indicate overall resistance to ground.

1.09 SUBMITTALS FOR CLOSEOUT

A. Refer to Division 1.

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

C. Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

1.10 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Kearney/Cooper Power Systems.
2. Lyncole XIT Grounding.
3. Salisbury: W. H. Salisbury & Co.
4. Thomas & Betts, Electrical.
5. Chance/Hubbell.
6. O-Z/Gedney Co.; a business of the EGS Electrical Group.

2.02 WIRE AND CABLE GROUNDING CONDUCTORS

A. Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding. The requirements below apply for new cables installed as well as for upgrading of identification of existing cables as indicated on drawings.
1. Material: Copper. Use only copper wire for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

B. Equipment Grounding Conductors: Insulated with green color insulation.

C. Underground Conductors: Bare, tinned, stranded, except as otherwise indicated.

D. Bare Copper Conductors: Conform to the following:
1. Solid Conductors: ASTM B3.
2. Assembly of Stranded Conductors: ASTM B8.
3. Tinned Conductors: ASTM B33.

E. Color coding of ground cables - Where new or existing cables are concealed and not color-coded, any exposed portion of the cable and each end of the cable for a minimum of 2 feet shall be color coded by green tape overlaid with bright tracer

color tape to form the tracer. Where routed through raceways, wire ways, cable trays or under raised floors, the color-coding shall be such that by removing or opening any cover, color-coding shall be visible. Where conductors are routed through cable trays, color-coding for a minimum length of 4 inches shall be accomplished at intervals not exceeding three feet between marking.

2.03 MISCELLANEOUS CONDUCTORS

A. Mechanical Connectors:
   1. Bronze.

B. Grounding Plates:
   1. Bare or tinned, annealed-copper. Size as per specifications or larger as indicated on drawings.

C. Grounding Rods:
   1. Bare or tinned, annealed-copper. 3/4” diameter and 10 feet long.

D. Braided Bonding Jumpers: Where electrical continuity across shock mounts is necessary, bonding jumpers shall be installed across each shock mount. Jumpers of this application should have a maximum thickness of 0.025 inch, so that the damping efficiency of the mount is not impaired. In severe shock and vibration environments, solid straps may be corrugated, or flexible tinned copper wire braid may be used. Braids are to be terminated with tinned copper ferrules.

E. Raceway Bonding Jumpers: Copper, minimum size #6 AWG unless otherwise noted.

2.04 CONNECTOR PRODUCTS

A. Exothermic-Welded Connections: Provided in kit form and selected per manufacturer's written instructions for specific types, sizes, and combinations of conductors and connected items.

PART 3 EXECUTION

3.01 GENERAL

A. A separate ground conductor (green wire) shall be installed in all raceways for feeders, power and receptacle branch circuits and where called for on drawings.

B. All distribution and branch circuit panels shall have a separate ground bar.

C. All metallic conduits 1-1/4" or larger shall have grounding bushings.

D. All type SO cord, or equivalent, shall have a separate ground wire (green) of equal size to circuit conductor.

E. Equipment ground conductor shall be copper with Type THHN insulation, green only, up to and including #4; larger sizes may be bare conductor, or black and

identified with green tape.

F. Paint, grease or other contaminates shall be cleaned from all surfaces before bonding ground conductor. (Painted surfaces shall be sanded and cleaned.)

G. Equipment Grounding Conductors: All metallic non-current carrying parts of electrical equipment shall be grounded with equipment grounding conductors whether or not shown on the drawings. Equipment grounding conductors shall be green insulated copper conductors unless otherwise indicated.
   1. Install green, equipment grounding conductor with all feeder and branch circuit conductors.

H. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

I. Enclosures: Ground all enclosures of electrical and electronic wiring and distribution equipment in accordance with requirements of the NEC.

J. Conduit or cable shields shall not be used as the equipment grounding conductor.

K. Equipment Enclosure Grounding: Bare wire, wrapped around connecting screws or mounting bolts and screws is not acceptable as a grounding connection. All ground lugs shall be of a noncorrosive material suitable for use as a grounding connection, and must be compatible with the type of metal being grounded. Ground lugs shall be mounted on clean, bare metal surfaces that are free of paint, rust, etc. Wire brush clean each surface to remove paint or oxidation prior to bolting jumper connectors in place. In general use tinned copper connectors for connections of dissimilar metals. Use of bimetal connectors shall only be allowed in special circumstances and only with the prior written approval.

3.02 CONNECTIONS

A. General: Make connections so possibility of galvanic action or electrolysis 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 assure high conductivity and to make contact points closer in order of galvanic series.
   2. Make connections with clean, bare metal at points of contact.
   3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Use for connections to structural steel, for underground connections, and were indicated on drawings. Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable and will be redone at the contractor's expense. Utilize 'smokeless' type weld kits for all exothermic welds performed in interior of structure.

C. Terminate insulated equipment grounding conductors for feeders with pressure-type grounding lugs. Where metallic raceways terminate at non-metallic or non-conductive housings, terminate each conduit with a grounding bushing. Connect

grounding bushings with a bare grounding conductor to the ground bus in the housing. Bond electrically non-continuous conduits at both entrances and exits with grounding bushings and bare grounding conductors.

D. Raceway Grounding: Surface metal raceways or wireways shall be installed in a manner that ensures electrical continuity. Short insulated green copper bonding jumpers shall be installed between adjacent raceway sections, on both sides of each joint, to ensure proper bonding. Unless otherwise indicated, the minimum size for these bonding jumpers shall be No. 6 AWG. Jumpers shall be provided with compression connectors at each end of cable. Surface metal raceways or wireways shall be field drilled to provide bolting point for securing bonding jumper. Wire brush clean each surface to remove paint or oxidation prior to bolting jumper connectors in place. Bolts and hardware shall be as per details or as approved for grounding purposes. All metallic raceway penetrations into a facility structure shall be bonded to the earth electrode system.

E. Other Grounding Systems: Any additional grounding systems used for electronic equipment shall be connected to the facility main ground plate, structural steel or exterior earth electrode system as shown on drawings.

F. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with torque tightening values specified in UL 486A.

3.03 RACEWAY SYSTEMS

A. All metal supports, cable trays, frames, sleeves, brackets, braces, etc. for the raceway system, panelboards, switchboards, switches, enclosures, starters, controls, etc., which are not rigidly secured to and in contact with the raceway system, or which are subject to vibration and loosening, shall be bonded to the raceway system. Size the bonding conductor in accordance with NEC Article 250, Table 250-122.

B. Terminate rigid conduit at all boxes, cabinets, and enclosures tightly with two locknuts and a bushing.

C. Conduit which runs to or from all boxes, cabinets, or enclosures having concentric or eccentric knockouts which partially perforate the metal around the conduit and hence impair the continuity of system ground circuits shall be provided with bonding jumpers sized in accordance with NEC Article 250, Table 250-122. Connect the bonding jumper between a grounding type bushing on the conduit and a ground bus or stud inside the box, cabinet, or enclosure.

D. Provide bonding jumpers sized in accordance with NEC Article 250, Table 250-122 for all conduit expansion joints.

E. Provide a grounding conductor in all nonmetallic runs of conduit and raceway, sized in accordance with NEC Article 250, Table 250-122.

F. Provide bonding bushings and connections in all of the following:
   1. Service equipment enclosures.
   2. Openings with eccentric or concentric knockouts.

3. Openings using reducing washers.
4. Greater than 250V to ground systems.

3.04 SECONDARY ELECTRICAL SYSTEMS

A. Solidly ground all transformer neutral conductors and enclosures in accordance to the National Electrical Code.

B. Provide an equipment grounding conductor from the point of termination back to the ground bus of the serving panelboard, switchboard, or transformer. Do not splice equipment grounding conductors.

3.05 TESTS

A. Grounds and grounding systems shall have a resistance to solid earth ground not exceeding following values:
   1. For grounding secondary service neutral: 25 Ohms.
   2. For grounding non-current carrying metal parts associated with secondary distribution system: 25 Ohms.

B. Providing grounding tests to verify the above values. Where these values are not met, add additional ground rods or connections in order to meet these values.

END OF SECTION

SECTION 260533

CONDUIT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including the General and Supplementary Conditions of Division 1 of the Specification Sections, apply to the work of this section.

1.02 WORK INCLUDED

A. Metal conduit.

B. Non-metallic conduit.

C. Fittings and conduit bodies.

1.03 SUBMITTALS

A. Submit for approval a list of each product and the manufacturer.

1.04 REFERENCES

A. ANSI-C80.2, 1983: Specification for Rigid Steel Conduit, Enameled.

B. ANSI/NEMA FB 1: Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

C. NECA "Standard of Installation."

D. NEMA TC 3: PVC Fittings for Use with Rigid PVC Conduit and Tubing.

E. NEMA, TC 6, 1983: PVC and ABS Plastic Utilities Duct for Underground Installations.

F. NEMA, TC 8, 1983: Extra strength PVC Plastic Utilities Duct for Underground Installations.

G. NEMA, TC 9, 1983: Fittings for ABS and PVC Plastic Utilities Duct and Fittings for Underground Installation.

H. NEMA, TC 10, 1983: PVC and ABS Plastic Communications Duct and Fittings for Underground Installation.

I. The following U.L. Standards:
1. UL 6, 1981: Rigid Metal Electrical Conduit.

2. UL 514B, 1982: Fittings for Conduit and Outlet Boxes.
3. UL 651, 1981: Schedule 40 and 80 PVC Conduit.
4. UL 870, 1985: Electrical Wireways, Auxiliary Gutters and Associated Fittings.

PART 2 PRODUCTS

2.01 CONDUIT REQUIREMENTS

A. Minimum Size: 3/4" unless otherwise specified.

B. Underground Installations:
1. Use thickwall non-metallic conduit.
2. Under Slab on Grade: Use thickwall non-metallic conduit.
3. Minimum Size: 1".

C. Outdoor Locations, Above Grade: Use rigid steel conduit.

D. In Slabs Above Grade:
1. Use rigid steel conduit.

2.02 RIGID GALVANIZED STEEL CONDUIT

A. Steel, hot dipped galvanized on the outside and inside, UL categorized as Rigid Ferrous Metal Conduit (identified on UL Listing Mark as Rigid Metal Conduit - Steel or Rigid Steel Conduit).

B. Acceptable manufacturers:
1. LTV Steel
2. Triangle
3. Allied Tube
4. Steel Duct
5. Wheatland

2.03 RIGID NON-METALLIC PVC CONDUIT

A. Extra-Heavy wall conduit: Schedule 80, constructed of polyvinyl chloride, rated for use with 90 degree C conductors, and UL listed for direct burial and normal above ground use.

B. Heavy wall conduit: Schedule 40, constructed of polyvinyl chloride, rated for use with 90 degree C conductors, and UL listed for direct burial and normal above ground use.

C. UL categorized as Rigid Nonmetallic, Schedule 40 and Schedule 80 PVC conduit (identified on UL Listing Mark as Rigid Nonmetallic Conduit Aboveground and Underground Schedule 40; Rigid Nonmetallic Conduit Aboveground and Underground Extra Heavy Wall Schedule 80).

D. Acceptable manufacturers:

1. Carlon/Div. of Lamson and Sessions
2. Beck Mfg./Picoma Industries
3. Cantex Inc.
4. National Pipe & Plastics Inc.
5. Ipex Inc.

2.04 FITTINGS AND ACCESSORIES

A. Rigid galvanized steel fittings shall be fully threaded and shall be of the same material as the respective raceway system.

B. Fittings for rigid non-metallic conduit shall be solvent cemented in accordance with the manufacturer's instructions.

C. Connectors shall have insulated throat up to and including 1" size. For sizes 1-1/4" and larger, provide plastic insulating bushing.

D. Die-cast or pressure cast fittings are not permitted.

E. Provide conduit bodies' types, shapes and sizes as required to suit application and NEC requirements. Provide matching gasketed covers secured with corrosion-resistant screws.

F. Insulated Bushings:
1. Threaded, malleable iron/zinc electroplate with 105 degrees C minimum plastic insulated throat; Appleton Electric Co.'s BU50I Series, Cooper/Crouse-Hinds' 1031 Series, OZ/Gedney Co.'s IBC-50 Series, Raco Inc.'s 1132 Series, Steel City/T & B Corp.'s BI-901 Series, or Thomas & Betts Corp.'s 1222 Series.
2. Threaded malleable iron with 150 degrees C plastic throat; Appleton Electric Co.'s BU501 Series, Cooper/Crouse-Hinds' H1031 Series, or OZ/Gedney Co.'s IBC-50 Series.

G. Plastic Bushings for 1/2 and 3/4 Inch Conduit:
1. 105 degrees C minimum temperature rating; Appleton Electric Co.'s BBU50, BBU75, Blackburn (T & B Corp.'s) 50 BB, 75 BB, Cooper/Crouse-Hinds' 931,932, or OZ/Gedney Co.'s IB-50, IB-75, Raco Inc.'s 1402, 1403, Steel City/T & B Corp.'s BU-501, BU-502, or Thomas & Betts Corp.'s 222, 223.
2. 150 degrees C temperature rating; Appleton Electric Co.'s BBU50H, BBU75H, Cooper/Crouse-Hinds' H-931, H-932, or OZ/Gedney Co.'s A-50, A-75.

H. Insulated Grounding Bushings:
1. Threaded, malleable iron/zinc electroplate with 105 degrees C minimum plastic insulated liner, and ground lug; Appleton Electric Co.'s GIB-50 Series, Cooper/Crouse-Hinds' GLL Series, OZ/Gedney Co.'s IBC-50L Series, Raco Inc.'s 1212 Series, Steel City/T & B Corp.'s BG-801 (1/2 to 2") Series, or Thomas & Betts Corp.'s 3870.

2. Threaded malleable iron/zinc electroplate with 150 degrees C plastic insulated liner, and ground lug; Appleton Electric Co.'s GIB Series, Cooper/Crouse-Hinds' HGLL Series, or OZ/Gedney Co.'s IBC-50L Series, or Thomas & Betts Corp.'s 3870.

I. Sealant for Raceways Exposed to Different Temperatures: Sealing compounds and accessories to suit installation; Appleton Electric Co.'s DUC, or Kwiko Sealing Compound with fiber filler, Cooper/Crouse-Hinds' Chico A Sealing Compound with Chico X fiber, Electrical Products Division 3M Scotch products, OZ Gedney Co.'s DUX or EYC sealing compound with EYF damming fiber, or Thomas & Betts Corp.'s Blackburn DX.

J. Vertical Conductor Supports: Kellems/Hubbell Inc.'s Conduit Riser Grips, or OZ/Gedney Co.'s Type M, Type R.

K. Pulling-In-Line for Installation in Spare and Empty Raceways: Polypropylene monofilament utility line; Greenlee Textron Inc.'s Poly Line 430, 431, or Ideal Industries Powr-Fish Pull-Line 31-340 Series.

L. Acceptable manufacturers:
1. O.Z. Gedney
2. Steel City
3. Thomas & Betts
4. Cooper Crouse-Hinds
5. Carlon
6. Raco

2.05 EXPANSION FITTINGS

A. Galvanized steel expansion joints for RGS conduit, PVC for PVC conduit. Minimum 4" movement in either direction.

B. Weatherproof for outdoor applications.

C. At expansion joints in concrete pours, provide Deflection/Expansion fittings capable of movement of 3/4" in all directions from the normal**.**

D. Design Make: O.Z./Gedney, Type "AX" (exposed), "DX" (Concrete Pour)

E. Acceptable manufacturers:
1. O.Z./Gedney
2. Crouse-Hinds
3. Appleton

PART 3 EXECUTION

3.01 GENERAL

A. Install conduit in accordance with NECA "Standard of Installation".

B. All conduit penetrations through fire-rated construction must be sealed with UL listed fire stopping. Refer to architectural drawings for locations.

C. Size raceways as indicated on the drawings. Where sizes are not indicated, raceways shall be sized as required by the National Electrical Code in accordance with the quantity, size, type and insulation of conductors to be installed.

D. Minimum 1” trade size for branch circuit "Home Runs" to panelboards.

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

F. Provide a code compliant ground path between all outlets and the established electrical system ground.

G. Coordinate all raceway runs with other trades.

H. Do not install raceways adjacent to hot surfaces or in wet areas. Maintain 12" clearance between conduit and surfaces with temperatures exceeding 104^{o} F (40^{o} C).

I. Provide expansion fittings with external grounding straps at building expansion joints.

J. Arrange neatly to permit access to the raceway, outlet, pull, and junction boxes, and work installed by other trades.

K. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations.

L. All exposed conduit mounted to a painted surface shall be painted to match that surface.

M. No conduit shall be run in or through a Stairwell unless it contains circuitry specifically required for the Stairwell related equipment.

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

O. Provide at least one junction or pullbox for each 360 degrees of bends.

P. Provide green ground wire in all non-metallic conduit.

3.02 INSTALLATION

A. Install raceways parallel or perpendicular to building walls, floors and ceilings.

B. Cut raceways square, ream ends to remove burrs, and bush where necessary.

C. Route conduit in and under slab from point to point. Do not cross conduits in slab. Provide U.L. approved rain-tight and concrete tight couplings and connectors. All conduit in concrete floor slabs shall be rigid galvanized steel with concrete tight threaded fittings. Install conduit below the reinforcing mesh. Locate conduits to provide a minimum of 1" of concrete around conduit. Obtain approval from the Owner's Representative prior to installing conduit larger than 1" trade size in concrete slabs.

D. Install with a minimum of bends and offsets. Bends shall not kink or destroying the interior cross section of the raceway. Factory made bends shall be used for raceways 1" trade size and larger.

E. Support raceways from building construction. Do not support raceways from ductwork, piping, or equipment hangers. Arrange supports to prevent misalignment during wiring installation. Support conduit using coated steel or malleable iron straps, lay in adjustable hangers, clevis hangers, and split hangers. Do not attach conduit to ceiling support wires. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

F. Plug the ends of each roughed-in raceway with an approved cap or disc to prevent the entrance of foreign materials during construction.

G. Secure conduit within three feet of each outlet box, junction box, cabinet or fitting.

H. Provide a #14 AWG fish wire in all "Spare" or "Empty" conduit runs to facilitate future installation of conductors.

I. Provide expansion fittings where conduits cross building expansion joints.

J. Wherever a cluster of (4) or more conduits rise out of floor exposed, provide neatly formed 4 in. high concrete envelope, with chamfered edges, around raceways.

K. Provide 4 spare 3/4-in. raceways from each flush mounted panelboard or cabinet to an area above the nearest accessible ceiling space. Make 90^{o} turn above the ceiling, arranged for further continuation of raceway, and cap.

L. Join non-metallic conduit using cement as recommended by manufacturer. Wipe non-metallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

M. If it is necessary to burn holes through webs of beams or girders, call such points to the attention of the Owner's Representative and receive written approval both as to location and size of hole before proceeding with work. All holes shall be burned no larger than absolutely necessary.

N. Core drill, sleeve, and fire stop all penetrations through floors.

O. In exterior or wet locations, provide minimum 1/4" air space between raceway and wall. Secure raceway within 3 ft. of each outlet box, junction box, cabinet or fitting.

P. Provide conduit supports based on the following table:

Conduit Trade Size	Type of Run	Horizontal Spacing in Feet	Vertical Spacing in Feet
3/4"	Concealed	7	10
1", 1-1/4"	Concealed	8	10
1-1/2" & larger	Concealed	10	10
3/4"	Exposed	5	7
1", 1-1/4"	Exposed	7	8
1-1/2" & larger	Exposed	10	10

3.03 RACEWAYS FOR FUTURE USE (SPARE RACEWAYS AND EMPTY RACEWAYS)

A. Draw fish tape through raceways in the presence of the Owner's Representative to show that the raceway is clear of obstructions. Leave a pulling-in line in each spare and empty raceway.

3.04 RACEWAY INSTALLATION - SPECIAL AREAS

A. Raceways Exposed to Different Temperatures: Where portions of an interior raceway system are exposed to widely different temperatures, seal interior and exterior of raceway to prevent circulation of air from a warmer to a colder section through the raceway installation.

B. Heated Areas to Unheated Areas: After conductors are installed, seal interior of the raceway at the nearest conduit body, outlet or junction box in the heated area adjoining the unheated area.

3.05 RACEWAY SCHEDULE

A. Rigid Ferrous Metal Conduit: Install in all locations unless otherwise specified or indicated on the drawings.

B. Rigid Nonmetallic PVC Conduit:
   1. Schedule 40:
      a. Exterior underground encased in concrete.
      b. Exterior above ground only when specifically noted on plans.
   2. Schedule 80:
      a. Exterior underground.
      b. Exterior above ground only when specifically noted on plans.

3.06 FITTINGS AND ACCESSORIES SCHEDULE

A. General:
1. Use fittings and accessories that have a temperature rating equal to, or higher than the temperature rating of the conductors to be installed within the raceway.
2. Use zinc electroplate or hot dipped galvanized steel/malleable iron or cast-iron alloy fittings and accessories in conjunction with ferrous raceways in dry and damp locations unless otherwise specified or indicated on the drawings.
3. Use insulated grounding bushings or grounding wedges on ends of conduit for terminating and bonding equipment grounding conductors, when required, if cabinet or boxes are not equipped with grounding/bonding screws or lugs.
4. Use caps or plugs to seal ends of conduits until wiring is installed to exclude foreign material.
5. Use insulated grounding bushings on the ends of conduits that are not directly connected to the enclosure, such as stub-ups under equipment, etc., and bond between bushings and enclosure with equipment grounding conductor.
6. Use expansion fittings where raceways cross expansion joints (exposed, concealed, buried).
7. Use deflection fittings where raceways cross expansion joints that move in more than one plane.
8. Use 2 locknuts and an insulated bushing on end of each conduit entering sheet metal cabinet or box in dry or damp locations.
9. Plastic bushing may be used on 1/2 and 3/4 inch conduit in lieu of insulated bushing.
10. Terminate conduit ends within cabinet/box at the same level.

B. For Rigid Metal Conduit: Use threaded fittings and accessories. Use 3 piece conduit coupling where neither piece of conduit can be rotated.

C. For Rigid Nonmetallic PVC Conduit: Use conduit manufacturer's standard fittings and accessories.

END OF SECTION

SECTION 260540

BOXES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including the General and Supplementary Conditions of Division 1 of the Specification Sections, apply to the work of this section.

1.02 WORK INCLUDES

A. Pull and junction boxes.

1.03 REFERENCES

A. NECA - Standard of Installation.

B. NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.

C. NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

D. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

F. NFPA 70 - National Electrical Code.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Provide Products listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel. Shall be constructed of not less than 14 gauge galvanized steel with trim for flush or surface mounting in accordance with the location to be installed. Provide screw-on type covers. Boxes installed in damp or wet locations shall be of raintight construction with gasketed cover and threaded conduit hubs. In no case shall boxes be sized smaller than as indicated in Article 314 of the National Electrical Code for

conduit and conductor sizes installed. Boxes shall be approved for the environmental condition of the location where they will be installed.

2.02 TERMINAL AND EQUIPMENT CABINETS IN NON-HAZARDOUS LOCATIONS

A. Steel Equipment Cabinets shall be code gauge galvanized steel with removable end walls. Fronts shall be of code gauge steel, flush or surface type (as indicated) with concealed trim clamps, concealed hinges, flush lock, and grey baked enamel finish. Boxes and front shall be U.L. listed and shall be minimum 24"H x 24"W x 6"D or as called for on plans. Provide provisions for terminal board mounted on inside back wall of cabinet as required.

B. Fiber glass equipment cabinets shall be Compression-molded fiberglass for chemical and temperature-resistance. Gasketed for water-tight and dust-tight seal. Polyester mounting brackets and stainless-steel attachment screws, molded-in-place threaded brass inserts and plated steel screws for mounting optional panels and terminal block kits. Removable hinged cover attached to body with Type 316 stainless steel hinge pin or Screw-cover enclosure secured with two captivated Type 316 stainless steel slotted cover screws.

C. Stainless Steel terminal and equipment cabinets shall have continuous hinge, seamless foam-in-place gasket and stainless-steel screw-down clamps for a reliable seal that protects components from corrosive environments. 14 gauge Type 304 stainless steel with seams continuously welded and ground smooth, seamless foam-in-place gasket. Weldnuts for mounting optional panels and terminal block kits. Provide bonding provision on door and body.

D. Poly carbonate boxes shall be non-glass-filled polyester material offers superior UV resistance. Chemical resistance to a broad range of solvents, alkalis and acids. Crack and impact resistant. Shall be recyclable.

E. Provide following accessories and options where called for.
   1. Continuous hinged door (unless otherwise noted provide screw type covers).
   2. Scratch-resistant polycarbonate windows permanently bonded in place.
   3. Quick-release latches and corrosion-resistant polyester latches located in corners that provide unobstructed access to enclosure.
   4. Padlock provisions in latch.

F. Provide the NEMA type listed below as required for the environment and use:
   1. Type 1: for indoor use to provide a degree of protection to personnel against access to hazardous parts and to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt).
   2. Type 3R: for either indoor or outdoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt); to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of

water (rain, sleet, snow); and that will be undamaged by the external formation of ice on the enclosure.

G. Acceptable Manufacturers:
1. Hoffman
2. Thomas & Betts
3. Wiegmann
4. Appleton

2.03 HIGH CAPACITY WALL BOXES

A. Four gang, removable dividers, flush mounted with adjustable mounting brackets. Single station box shall be complete with device mounting bracket, trim ring and device and data plates. Boxes used for backfeeding two-piece raceway shall be complete with extended dividers, trim plate and cutout template.

B. Design Make: Wiremold Co. #WSA42-4 (box/divider/mounting bracket), #WSA07-4 (device mounting bracket and trim ring), #WSA86 (backfeed kit).

C. Acceptable Manufacturers:
1. Wiremold
2. Hubbell
3. Approved equal

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify locations of boxes and outlets prior to rough in. Thoroughly examine the architectural elevations and millwork shop drawings.

3.02 INSTALLATION

A. Install boxes in accordance with NECA "Standard of Installation."

B. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements. Install junction and pull boxes in readily accessible locations. Access to boxes shall not be blocked by equipment, piping, ducts and the like. Provide all necessary junction or pull boxes required due to field conditions and size as required by the National Electrical Code.

C. Consider location of outlets shown on drawings as approximate only. Study architectural, process piping, mechanical, plumbing, structural, roughing-in, etc., drawings and note surrounding areas in which each outlet is to be located. Locate outlet so that when fixtures, motors, cabinets, equipment, etc., are placed in position, outlet will serve its desired purpose. Where conflicts are noted between drawings, contact Owner's Representative for decision prior to installation. Comply with Article 314 of National Electrical Code relative to position of outlet boxes in finished ceilings and walls. Adjust box location up to

10 feet if required to accommodate intended purpose.

D. Install pull boxes and junction boxes and in unfinished areas only.

E. Support boxes independently of conduit.

F. Use gang box with plaster ring for single device.

G. Use cast outlet box in exterior locations exposed to the weather and wet locations.

H. Surface wall mounted outlet boxes shall be cast type boxes having threaded or compression type threadless hubs. Exterior boxes shall be cast type with threaded hubs and gasketed cover plates secured by non-ferrous screws.

I. Unless otherwise noted, mount devices and equipment at heights measured from finished floor to device/equipment centerline as follows:
   1. Terminal cabinets, control cabinets 72"
   2. Where structural or other interferences prevent compliance with mounting heights listed above, consult Owner's Representative for approval to change location before installation.

3.03 INTERFACE WITH OTHER PRODUCTS

A. Coordinate installation and location of outlet box for equipment with equipment supplier and other trades as applicable.

3.04 ADJUSTING

A. Adjust vertical and horizontal alignment of boxes as required.

B. Install knockout closures in unused box openings.

3.05 CLEANING

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

B. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 260541

UNDERGROUND ENCLOSURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including the General and Supplementary Conditions and Division 1 Specifications Sections, apply to the work of this section.

1.02 SUBMITTALS

A. Manufacturer's catalog sheets, specifications and installation instructions.

B. Shop Drawing; show dimensions and construction details.
   1. Include drawings showing location if different from Contract Documents.

PART 2 PRODUCTS

2.01 POLYMER CONCRETE AND FIBERGLASS POLYMER CONCRETE PULL BOX

A. Designed for use in pulling, splicing, and storing cable, as well as for access to underground electric utilities, telephone, power, communications or CATV. They are an alternative to traditional concrete service boxes.

B. Polyester resin with concrete aggregate reinforced with fiberglass for strength and durability.

C. Construction:
   1. Designed for Tier 8 (12,000lbs).
   2. Exceeds SCTE 77-2007, W.U. C. 3.6 requirements.
   3. 3 times the compressive strength of concrete.
   4. Exceptional resistance to chemicals, fertilizers and sunlight.
   5. Made from non-metallic, non-conductive and non-flammable material.
   6. Not affected by freeze/thaw conditions.
   7. Impact and corrosion resistant.
   8. Skid resistant cover.
   9. Non-Conductive.
   10. Constructed of fire-retardant materials.
   11. Hex bolts for securing cover.
   12. Provide appropriate logo (i.e. "Electric", "Communications", "Fiber Optic")

D. Straight Wall All Polymer Concrete Splice Box, Pull Box:
   1. Designed for Tier 8 (12,000lbs) applications.

2. Exceeds SCTE 77-2007, W.U. C. 3.6 requirements.
3. Straight wall design for minimal excavation.
4. Stackable.
5. Design Make: Quazite PG Series.

E. Acceptable Manufacturers:
1. Highline
2. Quazite
3. Oldcastle
4. Armorcast

2.02 WATERPROOFING SEALS

A. Provide expanding link type seal, for installation between duct/conduit, and sleeve or core-drilled hole in concrete.

B. Design Equipment/Make: Link Seal, manufactured by Thunderline Corp.

2.03 MISCELLANEOUS HARDWARE

A. Provide miscellaneous bolts, washers, nuts, clips, lock nuts, lock washers, anchor bolts, inserts, braces, boxes, clamps, fittings, pins, rods, shims, supports, etc., to make installations and work complete and operational.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Coordinate installation of other equipment associated with the service and distribution system.

B. Provide installation for equipment, in accordance with the equipment manufacturer's instructions, drawings, and recommendations, and as called for.

C. In the event of conflict, discrepancy or difference between manufacturer's instructions and Contract Documents, the more stringent requirements shall apply.

D. Repair or replace all existing utilities and facilities damaged due to installation, as part of contract.

3.02 PULLBOX INSTALLATION

A. Excavation and size as recommended by manufacturer.

B. Install concrete bottom pullboxes on minimum of 6 in. of "pea gravel" placed on undisturbed earth in accordance with manufacturer's recommendations. Coat exterior with bitumastic.

C. Set true and level.

D. Avoid installing pullboxes in vehicular traffic areas. Where pullboxes are required in drives or parking areas, locate at adjacent walk or lawn areas if possible and provide tier 15 rated covers as a minimum.

E. Make grounding connections at pullboxes.

3.03 PREVENTION OF CORROSION

A. Protect Metallic Materials Against Corrosion:
   1. Aluminum shall not be used in contact with earth and where connected to dissimilar metal shall be protected by approved fittings and treatment.
   2. Ferrous metals such as bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts not of corrosion resistant steel shall be hot dipped galvanized in accordance with ASTM A123 or A153.

END OF SECTION

SECTION 262400

POWER DISTRIBUTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including the General and Supplementary Conditions of Division 1 of the Specification Sections, apply to the work of this section.

1.02 SECTION INCLUDES

A. Circuit Breakers.

1.03 REFERENCES

A. The equipment referenced herein are designed and manufactured according to the following appropriate specifications.
   1. ANSI/NFPA70 - National Electric Code (NEC).
   2. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
   3. UL 50 - Cabinets and Boxes.
   4. UL 489 - Molded Case Circuit Breakers.
   5. CSA 22.2 No. 5 - M1986 Molded Case Circuit Breakers.
   6. Federal Specification W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit and Service.
   7. NECA Standard of Installation (published by the National Electrical Contractors Association).
   8. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment (published by the International Electrical Testing Association).
   9. NFPA 70 - National Electrical Code.

1.04 SUBMITTAL FOR REVIEW

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

1.05 SUBMITTALS FOR CLOSEOUT

A. Maintenance Data: Include spare parts listing; source of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum (10) years' experience.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products in conformance with manufacturer's recommended practices as outline in applicable Installation and Maintenance Manuals.

B. Inspect and report concealed damage to carrier within their required time period.

C. Store in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

PART 2 PRODUCTS

2.01 CIRCUIT BREAKERS

A. General:
1. Molded case circuit breakers shall be constructed of a glass reinforced insulating material. All current carrying components shall be completely insulated and isolated from the outside of the circuit breaker.
2. Provide an over-center, trip-free handle to provide quick-make, quick-break contact action.
3. Provide multi-pole breakers with common trip.
4. When the circuit breaker has tripped, the handle shall move to a position between the "on" and "off" positions. Provide a visual indication that the circuit breaker has tripped.
5. The ampere rating shall be clearly marked on the face of the circuit breaker.
6. Any series rated fuse/circuit breaker installations shall be UL listed as recognized component combinations. Provide a label at the Series rated device reading "Caution - Series Rated System. _____A available". Provide identical replacement of equipment".
7. Make provisions to add circuit breaker handle locks.
8. Circuit breakers shall have voltage, ampere, and interrupting ratings as called for on the Panelboard Schedule.

B. Thermal Magnetic Molded Case Branch Circuit Breakers:
1. Permanent trip unit containing individual thermal and magnetic trip elements.

2. Thermal trip unit shall be long time, non-adjustable, thermal overload trip.
3. Magnetic trip unit shall be instantaneous, electro-magnetic trip.
4. 60°C terminal temperature rating for circuit breakers rated 125 amperes or below.
5. All 20 and 30 ampere, single pole circuit breakers shall be UL listed for switching duty.
6. Circuit breakers shall be bolt-on. I-Line type distribution circuit breakers are acceptable.
7. Circuit breakers rated 250 amperes and below shall be UL listed HACR type.
8. Where ground fault circuit breakers are required, provide a shunt trip circuit breaker with a zero-sequence sensing ground fault module.
9. Design Make: Square D QO, QOB (250 volt), EH, EHB (480 volt), I-Line style (600 volt).
10. Acceptable Manufacturers:
    a) Square D.
    b) General Electric.
    c) Eaton/Cutler Hammer.
    d) Siemens.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install equipment to coordinate with installation details of other equipment associated with the power distribution system.

B. Provide miscellaneous bolts, washers, nuts, clips, lockwashers, small hardware, etc., of durium or equal rust resistant material, to make a complete installation.

C. Provide complete installation in strict accordance with the equipment manufacturer's instructions, drawings and recommendations and as called for.

D. In the event of conflict, discrepancy or difference between manufacturer's instructions and Contract Documents, the more stringent requirements shall apply.

E. Unload, move, handle, set in place, install, erect, assemble, connect, test, and operate, etc. all items of electrical equipment as required.

F. Provide grounding as called for.

G. Provide minimum working clearance as described in NEC Article 110-26 and 110-34 for all electric equipment.

H. Provide additional working or aisle clearance as called for.

I. Verify cable/lug sizes for terminations. Where a feeder is sized larger than the lug, provide in-line splice to reduce conductor size to match equipment or breaker terminations.

3.02 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.4 for switches, and Section 7.5 for circuit breakers.

3.03 ADJUSTING

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

END OF SECTION