

SECTION 16000 –ELECTRICAL - GENERAL**PART 1 GENERAL****1.1 REQUIREMENTS**

Reference Specification 01100 “General Provisions”.

1.2 CODES AND STANDARDS

- A. All work under these specifications shall be constructed in accordance with the latest editions of all relevant codes and standards listed herein. All equipment, material and installations shall comply with applicable codes, standards, and installation practices. Comply with the requirements of the applicable local codes, all local rules and regulations including those of the fire authorities. These standards shall apply to the pertinent materials, equipment, and installation practices.

Where no specific method or form of construction is called for in the Contract Documents, the CONTRACTOR shall comply with code requirements when carrying out such work. Where code conflicts exist, the most stringent requirement applies.

The latest edition of each of the following publications shall be used unless stated otherwise:

- 1) Local Laws and Ordinances
- 2) American National Standards Institute (ANSI):

ANSI C2	This Code is referenced by the NESC and covers basic provisions for safeguarding of persons from hazards arising from the installation, operation, or maintenance of (1) conductors and equipment in electric supply stations, and (2) overhead and underground electric supply and communication lines. It also includes work rules for the construction, maintenance, and operation of electric supply and communication lines and equipment.
ANSI C119.1	Electric Connectors - Sealed Insulated Underground Connector Systems Rated 600 Volts.
ANSI/ICEA	Standards S-94-649 and S-97-682.
ANSI C136	ANSI/TIA Standard 606-B for Generic Labeling Practices
- 3) American Society for Testing and Materials (ASTM)

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| | ASTM B3 | Soft or annealed Copper Wire |
| | ASTM B8 | Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft. |
| | ASTM B-496 | Standard Specification for Compact Round Concentric-Lay-Stranded Copper Conductors |
| 4) | Institute of Electrical and Electronics Engineering, INC (IEEE) | |
| 5) | National Electrical Manufacturers Association (NEMA) | |
| | NEMA TC2 | Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80) |
| | NEMA TC3 | PVC Fittings for Use with Rigid PVC Conduit and Tubing |
| | NEMA TC9 | Fittings for ABS and PVC Plastic Utilities Duct for Underground Installation |
| 6) | National Fire Protection Association (NFPA) | |
| | NFPA 70 | National Electric Code |
| 7) | Underwriters Laboratories Inc. (UL) | |
| | UL 6 | Rigid Metal Conduit |
| | UL 44 | Rubber-Insulated Wires and Cables |
| | UL 83 | Thermoplastic-Insulated Wires and Cables |
| | UL 467 | Grounding and Bonding Equipment |
| | UL 486A | Wire Connections and Soldering Lugs for Use With Copper Conductor |
| | UL 510 | Insulating Tape |
| | UL 514A | Metallic Outlet Boxes |
| | UL 514B | Fittings for Conduit and Outlet Boxes |
| | UL 854 | Standard for Service Entrance Cables |
| | UL 1072 | Medium Voltage Power Cables |
| | UL 1242 | Intermediate Metal Conduit |
| 8) | Power Cable Engineers Association (IPCEA) Method K-2 chart. | |
| 9) | ACI Standard Code for reinforced concrete (ACI 318-14, Chapter 20) | |

1.3 DEFINITIONS

Reference Specification 01100 “General Provisions” for definitions.

1.4 DRAWINGS AND SPECIFICATIONS

- A. The civil, structural, and electrical drawings and specifications shall be considered as mutually explanatory and complementary. Any electrical work called for by one and not by the other shall be performed as though required by all. All sections and subsections of the Electrical work shall be governed by and subject to the general and supplementary conditions. Any discrepancies in or between the drawings and specifications, or between the drawings and actual field conditions shall be reported to the OWNER in sufficient time to issue an addendum for clarification.
- B. The electrical drawings are diagrammatic, and some circuit runs have been distorted to avoid confusion of lines. The drawings indicate the general layout of the complete electrical system however, field verification of scale dimensions on plans is directed since actual locations, distance, and levels will be governed by actual field conditions.

1.5 FIELD MEASUREMENTS AND COORDINATION

- A. Separate divisional Drawings and Specifications shall not relieve the CONTRACTOR or Subcontractors from full compliance of work of his trade indicated on any of the Drawings or in any Section of the Specifications. Report conflicts prior the start of work.
- B. Verify all field dimensions and locations of equipment to insure close, neat fit with other trade's work. Do not scale electrical drawings; rely on dimensions shown on architectural, civil or structural drawings.
- C. Coordinate work with all other trades in proper sequence to insure that the total work is completed within Contract time schedule and with minimum cutting and patching. Locate all equipment, materials, and apparatus symmetrical with architectural elements. Install to exact height and locations when shown on architectural drawings. When locations are shown only on mechanical drawings, be guided by structural details and conditions existing at job and correlate this work with that of others.
- D. Install work as required to fit structure, avoid obstructions, and retain clearance, headroom, openings, and passageways. CONTRACTOR shall not cut any structural members without written approval from ENGINEER.
- E. Carefully examine any existing conditions, piping, and premises. Compare Drawings with existing conditions. Report any observed discrepancies. Written instructions will be issued by the ENGINEER to resolve discrepancies.

- F. Because of the small scale of the Drawings, it is not possible to indicate all offsets and fittings or to locate every accessory. Drawings are essentially diagrammatic. Study carefully the sizes and locations of structural members and take actual measurements on the job. Locate material, equipment, and accessories with sufficient space for installing and servicing. CONTRACTOR is responsible for accuracy of his measurements and shall not order materials or perform work without verification. No extra compensation will be allowed because field measurements vary from the dimensions on the Drawings. If field measurements show that equipment or material cannot be fitted, the ENGINEER shall be consulted. Remove and relocate, without additional compensation, any item that is installed and is later found to encroach on space assigned to another use.

1.6 GUARANTEE AND SERVICE

Reference Specification 01100 "General Provisions".

1.7 SUBMITTALS

- A. Before ordering any materials or equipment, the CONTRACTOR shall submit one complete schedule showing the make, type, manufacturer's name, and trade designation of all equipment. This schedule shall be accompanied by the manufacturer's printed specifications and shop drawings for each piece of equipment or specialty and shall give dimensions, diagrams, descriptive literature, capacity or rating, kind of material, finish, guarantee, etc., and such other detailed information as the ENGINEER may require. When approved, such schedule shall become part of these Specifications, and shall be of equal force in that no deviation will be permitted except with the approval of the ENGINEER.
- B. If shop drawings show variation from the requirements of the Contract Documents, the CONTRACTOR shall make specific mention of such variation in his letter of transmittal. Approval of shop drawings by ENGINEER shall not relieve the CONTRACTOR of the responsibility for executing the work in accordance with the Contract at no additional cost.
- C. Review of shop drawings, descriptive literature, catalog data, or schedules by the ENGINEER shall not relieve the CONTRACTOR of the responsibility for deviations from Contract Drawings or Specifications, unless he has in writing called to the attention of the ENGINEER such deviation at the time of submission, nor shall it relieve the CONTRACTOR from responsibility for errors of any sort in shop drawings, descriptive literature, catalog data, or schedules.

- D. Submit shop drawings and any other drawings specifically called for in other sections. Shop drawings shall consist of plans, sections, elevations, and details to scale (not smaller than 1/4" per foot), with dimensions clearly showing the installation. Direct copies of small scale project drawings issued to the CONTRACTOR are not acceptable. Drawings shall take into account equipment furnished under other Sections and shall show space allotted for it. Include construction details and materials. Submit product data after award of the Contract and before any equipment or materials are purchased. Product data are defined as manufacturer's printed literature specifically marked to indicate size and model and accompanied by rating sheets listing values showing that equipment meets scheduled or specified values. Properly coded stamp from the ENGINEER on returned submittal is required before ordering equipment.

PART 2 PRODUCTS

2.1 EQUIPMENT AND MATERIALS

- A. All materials shall be new and unused unless otherwise stated, the best of their respective kinds, suitable for the conditions and duties imposed on them. The description, characteristics, and requirements of materials to be used shall match existing installed materials and products. When in doubt consult the ENGINEER.
- B. Equipment and materials furnished under this Section shall be the product of a manufacturer regularly engaged in the manufacture of such items for a period of at least three (3) years. Where practical, all of the components shall be products of a single manufacturer in order to provide proper coordination and responsibility. Where required, CONTRACTOR shall furnish proof of installation of similar equipment or materials.
- C. Each item of equipment shall bear a nameplate showing the manufacturer's name, trade name, model number, serial number, ratings and other information necessary to fully identify it. This plate shall be permanently mounted in a prominent location and shall not be concealed, insulated, or painted. The label of the approving agency, such as UL or NEMA, by which a standard has been established for the particular item, shall be in full view. Materials shall be UL-listed for the application specified or indicated on the Drawings or Specifications.
- D. All electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, motor control centers, or other similar devices or equipment shall be field marked per NEC Article

110.16 to warn qualified personnel of potential electrical arc flash hazards. Labels shall be Brady Cat # 94913 or equal.

- E. Materials and equipment are specified herein by a single or by multiple manufacturers to indicate quality, material, and type of construction desired. Manufacturer's products shown on the Drawings have been used as basis for design; it shall be the CONTRACTOR's responsibility to ascertain that alternate manufacturer's products meet detailed specifications and that size and arrangement of equipment are suitable for installation. Prior to shop drawing submittals CONTRACTOR shall obtain written approval from the ENGINEER prior to substitution of alternate manufacturer's product.
- F. Catalog numbers and model numbers indicated in the drawings and specifications are used as a guide in the selection of the equipment and are only listed for the CONTRACTOR's convenience. The CONTRACTOR shall determine the actual model numbers for ordering equipment and materials in accordance with the written description of each item and with the intent of the Drawings and Specifications.
- G. Ground rods and grounding connections – Reference Specification 16060 Part 2, 2.1.

PART 3 EXECUTION

3.1 WORKMANSHIP

- A. All materials, fixtures, and equipment shall be installed and completed in a first-class workmanlike manner and in accordance with the best modern methods and practice. Any materials installed which do not present an orderly and reasonably neat and/or workmanlike appearance, or do not allow adequate space for maintenance, shall be removed and replaced when so directed by the ENGINEER at no additional cost.

3.2 COORDINATION

- A. The CONTRACTOR shall be responsible for full coordination of the electrical systems with site drawings of the construction area so that the proper openings and sleeves or supports etc., are provided for conduit, devices, or other equipment passing through slabs or walls.
- B. Any additional steel supports required for the installation of any electrical equipment, etc., shall be provided by the CONTRACTOR.

- C. It shall be the CONTRACTOR's responsibility to see that all equipment that may require maintenance and operation are made easily accessible, regardless of the diagrammatic location shown on the Drawings.
- D. All connections to fixtures and equipment shown on the Drawings shall be considered diagrammatic unless otherwise indicated by a specific detail on the Drawings. The actual connections shall be made to fully suit the requirements of each case and adequately provide for servicing.
- E. The CONTRACTOR shall protect equipment and fixtures at all times during storage and construction. He shall replace all equipment and fixtures which are damaged as a result of inadequate protection.
- F. Prior to ordering electrical equipment, starting and during the progress of work, the CONTRACTOR shall review and examine all work and materials to be supplied and installed by others as they apply to work in this Section. Any conflicts between equipment supplied and the requirements on the drawings shall be reported to the ENGINEER. The CONTRACTOR shall correct the conflicts and incorporate into the electrical submittals prior to ordering equipment. Start of work and installation of the electrical system will be construed as the CONTRACTOR's acceptance of suitability of work by others and equipment requirements. Any conflicts with equipment's electrical requirements after the electrical system has been installed shall be the responsibility of the contractor to make corrective action. Any corrective action shall be at the contractor's expense.
- G. Interruption of Service: Outages must be scheduled through the ENGINEER. Extent, length, and timing of outages shall be reviewed by the ENGINEER. Before any equipment is shut down for disconnecting or tie-ins, arrangements shall be made with the ENGINEER and this work shall be done at the time best suited to the OWNER. Services shall be restored the same day. CONTRACTOR shall provide all temporary power, lighting and other services as required for construction and outages. The CONTRACTOR shall remove such temporary services when no longer required.
- H. Cutting and Patching: CONTRACTOR shall be responsible for cutting and patching of all holes, chases, sleeves, and other openings required for installation of equipment furnished and installed under these Specifications and Drawings. Obtain written approval from ENGINEER before cutting any structural items. Where shown to cut and patch asphalt, the CONTRACTOR shall perform patch as specified in a first class manner.

- I. Equipment Setting: Bolt equipment directly to concrete pads or foundations, using hot-dipped galvanized anchor bolts, nuts, and washers. Level all equipment.
- J. Painting: Touch-up factory finishes on equipment located inside and outside shall be done in accordance with these specifications. The CONTRACTOR shall obtain matched color and type coatings from the manufacturer and apply as directed by manufacturer. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint as required.
- K. Clean-up: Thoroughly clean all exposed parts of apparatus and equipment of cement, plaster, and other materials and remove all oil and grease spots. Repaint or touch up as required to look like new and match original finish. During progress of work, CONTRACTOR is to carefully clean and leave premises free from debris and in a safe condition.
- L. Start-up and Operational Test: Start each item of equipment in strict accordance with the manufacturer's instructions; or where noted under equipment specification, start-up shall be done by a qualified representative of the manufacturer at the expense of the CONTRACTOR. Alignment, lubrication, safety, and operating control shall be included in start-up check.
- M. Record Drawings: During the progress of the work the CONTRACTOR shall record on their field set of Drawings the corrections, variations, and deviations for systems which are not installed exactly as shown on the Contract Drawings. Upon completion of the work, "As-Built" record drawings shall be prepared and submitted to the OWNER.
- N. Acceptance: Acceptance will be on the basis of regular inspections of the work. Request inspections as required per this specification. Conceal no work until inspected. It is the CONTRACTORs responsibility to document that all inspections are conducted in accordance with these specifications. A representative of the CONTRACTOR's firm shall be in attendance to assist during inspections. CONTRACTOR shall furnish necessary electricians to assist during inspections and make any necessary adjustments.
- O. Punch List: Submit written confirmation that all punch lists have been checked and the required work completed. The CONTRACTOR, at the ENGINEER's current billing rate, shall pay for additional field time required by the ENGINEER to report or check on past punch list deficiencies.

- P. Equipment Identification: Install engraved plastic nameplates or tags on controls, panels, switches, starters, timers, and similar operable equipment, keyed by number to operating instructions. Reference Specification 16100 2.9(E) for Equipment Identification Requirements.

END OF SECTION