

SECTION 16000 – ELECTRICAL

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

- A. This work shall include the General Conditions, Supplementary General Conditions, Information for Bidders and applicable parts of Division 1 as part of this Section.
- B. The Contractor must be familiar with all other Divisions and Sections of the Specifications which affect his work.

1.02 SCOPE

- A. All labor, supervision, materials, tools, equipment, supplies, transportation and services for a complete and operational electrical system as specified shall be provided.
- B. All materials and equipment are to be installed in accordance with all standards of the National Electrical Code, OSHA and all local codes and ordinances.

C. Work under this Section shall include, in general:

1. Distribution system
2. Power wiring
3. Emergency system
4. Fire Alarm system
5. Grounding system
6. Panels and circuit breakers
7. Wiring devices
8. Lighting fixtures and lamps
9. Any other system hereinafter called for or shown on the drawings.

1.03 EXAMINATION OF SITE

- A. Before submitting a Bid, the Contractor must visit the job site to determine the conditions under which the work is to be done.

1.04 DRAWINGS AND SPECIFICATIONS

- A. Drawings and specifications are complementary to each other. Any labor and material which is called for by either, whether or not by both, or which is necessary for the successful operation of all systems shall be furnished and installed. Discrepancies should be brought immediately to the attention of the Engineer.

- B. All plans and specifications for this project should be examined to determine the scope and character of the work, the building design and function and the required coordination with the General Contractor and other Trades before and during construction.

- C. Any questions regarding the plans and specifications shall be addressed in writing to the Architect five days before bids close; otherwise, after the closing of the Bids, the Architect's interpretation of the meaning and intent of the plans and specifications shall be final.

- D. Shop drawings and submissions on all materials shall be made within thirty days after the signing of the Contract; they are to be separately bound by section and submitted as a complete section. Eight copies for approval shall be provided: 2 copies for the Electrical Contractor; 2 copies for the General Contractor; 1 copy for the Architect; 1 copy for the Engineer and 2 copies to be held by the Electrical Contractor until job completion, at which time they are to be bound in two binders and transferred to the Owner.

1.05 COORDINATION OF WORK

- A. The Electrical Contractor shall confer with the General Contractor and other Trades to coordinate his work and to properly locate systems to avoid conflict and interference.

- B. Any interference with the work of the other Trades or with architectural or structural details shall be brought to the attention of the Engineer for decision before installation. Contractor's failure to so coordinate his work will not relieve him of the responsibility to correct his work to suit building conditions.

1.06 INSURANCE

- A. Insurance is to conform to the provisions and requirements as set forth in Section 1.

1.07 CHANGES AND REVISIONS

- A. Costs for changes and/or revisions shall be submitted to the General Contractor with breakdown of charges and credits clearly itemized.
- B. Work shall not be executed until approval has been received in writing from the Architect.

1.08 WORKMANSHIP

- A. All materials shall be new and shall conform with the standards of UL, Inc., in every case where such a standard has been established for the particular type of material in question. All work shall be executed in a workmanlike manner and a competent Foreman shall be provided for the entire project.

- B. After wires are pulled in and all fixtures and equipment are installed, the Electrical Contractor shall make tests for performance, grounds, etc., and shall immediately remedy any defects. Equipment for tests shall be provided by the Electrical Contractor.

- C. The work under this Contract must be so performed that the progress of the entire project, including work of all Trades, shall not cause delays or interference. Materials and apparatus shall be installed as fast as the condition of the building will permit.

- D. It will be the responsibility of the Electrical Foreman to instruct the Owner in the function, operation and maintenance of all electrical systems and equipment. This is to be done on completion of the installation, before leaving the job site and to the satisfaction of the Owner and Engineer.

1.09 MANUFACTURER'S NAMES AND TRADE NAMES

- A. Throughout the specification, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not to limit competition.

1.10 MATERIAL STORAGE AND OFFICE SPACE

- A. This Contractor shall maintain at his own expense, where directed on the premises, suitable, neat, covered storage for material and office space where drawings and specifications shall be kept for record purposes.

- B. Equipment or material damaged during the construction period shall be replaced at the Electrical Contractor's expense.

1.11 GUARANTEE

- A. All materials and labor incorporated in the work are to be guaranteed against defects for a period of one year from date of acceptance. The Electrical Contractor shall correct such defects that occur within the guarantee period to the satisfaction of the Engineer, without cost to the Owner.

- B. The Electrical Contractor shall not be responsible for failures through normal usage nor for those caused by neglect or abuse on the part of the Owner or his employees.

1.12 WORK BY OTHERS

- A. The following work is not included in this Section and shall be performed by the General Contractor under the direction of the Electrical Contractor.

1. Concrete work
2. Major cutting, patching and fireproofing
3. Painting of electrical equipment having prime coat only.
4. Access panels required for concealed electrical items.
5. Wiring and system equipment for New England Telephone and data.

1.13 CUTTING AND PATCHING

- A. This contractor, as part of his work and without extra charge, shall do all fitting and cutting for conduit up to 1" as required for the complete installation of electrical work. Any cutting for conduit over 1" shall be done by the General Contractor.

- B. All patching of holes drilled shall be done by the General Contractor.

1.14 NAMEPLATES

- A. The Electrical Contractor shall furnish and install on all new panels, black, bakelite 1"x3" with white letters, screwed on nameplates indicating purpose and voltage.

1.15 TEMPORARY LIGHT AND POWER

- A. This Contractor shall maintain the existing service for temporary light, power and additional wiring and shall be carried as part of this Contract.

- B. All panelboards, switches, receptacles and accessories required for temporary light and power installation shall be provided.

- C. The Electrical Contractor shall furnish, install and maintain all feeders and panels for sufficient capacity for requirements for the building to meet all safety and working conditions.

- D. The General Contractor and all Subcontractors, individually, shall furnish all cords, sockets, lamps, motors and accessories for their work.

- E. All temporary wiring, service equipment and accessories thereto installed shall be removed at the expense of the Electrical Contractor after they have served their purpose.

- F. The General Contractor shall pay for electricity consumed by all Trades.

- G. The General Contractor is required to pay the cost of electricity consumed by himself and by all of his Subcontractors. He shall pay for replacement of all lamps broken and/or removed from the premises during the construction period and until the date of substantial completion, as determined by the Architect.

- H. All temporary work shall be furnished and installed in conformity with local ordinances and OSHA.

- I. Outlets shall be located at convenient points so that extension cords of not over 50' will reach all work requiring temporary light and power.

- J. Temporary light shall be based on 100W lamp for rooms up to 500 sq. ft. and two 200W lamps for every 1000 sq. ft. or fraction thereof.

1.16 PERMITS

- A. The Electrical Contractor shall obtain all permits for electrical and fire alarm systems. Any back charges made by the utility co., fire department or telephone co. shall be carried by this Contractor as part of his Bid.

1.17 RECORD DRAWINGS

- A. A set of record drawings shall be maintained at the Job site for reference by the Engineer. Weekly, the Electrical Foreman shall note changes and review the drawings periodically with the Engineer. Changes, including feeders, lighting, power, panel schedules and other schedules shall be recorded on the drawings. At conclusion of the work, drawings shall be ordered from the Architect and changes shall be recorded on AutoCAD 2013 or compatible versions. A set of mylar drawings and disc will be returned to the Architect for approval. Final payment is contingent upon receipt of the record drawings. Cost for drawings will be borne by the Electrical Contractor.

PART 2 – PRODUCTS

2.01 SCOPE

- A. The scope of the work under this Section consists of the installation of all materials to be furnished under this Section and all work incidental thereto.

2.02 RACEWAYS AND FITTINGS

- A. Conduit installed in the building shall run in a neat and workmanlike manner, parallel to the building walls.

- B. Minimum size of conduit used shall be 3/4" for all home runs to first outlet; switch legs and branch circuit runs, minimum 1/2".

- C. Conduit shall be kept at least 6" away from adjacent heating piping. Conduit shall not be placed in contact with any copper piping or other copper work on the project.

- D. During building construction, the ends of all conduit shall be tightly plugged to exclude plaster, dirt, dust, moisture, etc.

- E. The ends of all conduit entering boxes shall be equipped with galvanized locknuts or bushings. All cut ends of conduit shall be reamed free of burrs and sharp edges.

- F. Electrical metallic tubing couplings shall be of the set screw type – Appleton, Crouse Hinds or T&B.
- G. Hangers, clips and other fastening devices for conduit, outlet boxes, etc., shall be zinc coated or otherwise protected against corrosion.

2.03 WIRING SYSTEM

- A. Joints in all wiring shall be made with approved solderless connectors of the self-insulating type with an insulation equal to that of the conductors being joined. They shall be Minnesota Mining & Manufacturing Co., type "yt", "yt" or "B" Scotchlok, T&B, Twist-on-Piggy or T&B one-piece, pressure type self-insulated wire joints.

- B. In making splices, connectors shall be brought up securely upon the conductors so that no bare wire is exposed and will not loosen due to cycling or vibration.

- C. Wiring and conduit shall be installed in a neat and workmanlike manner, parallel to building walls.

- D. Wiring underground shall be rigid galvanized conduit or Type PVC 40 plastic conduit. All other conduit runs may be EMT.

2.04 WIRE

- A. Cable shall be in accordance with the latest requirements of the Insulated Power Cable Engineers Association.

- B. Conductors in conduit shall be copper type THW, THHN or XHHW, 600 volt rated 75°C for dry locations and 90°C for wet locations – Anaconda, Collyer or equal.

- C. All wire #12 and larger shall be stranded or solid used unless otherwise specified.

- D. All wiring shall be #12 gauge type THW or THHN copper for power wiring and lighting and 105 UL approved fire alarm cable unless otherwise noted. Branch circuit runs over 100' shall have #10 gauge wire. MC cable with green ground may be used when conforming to code requirements.

- E. The covering of wires and cables designed to meet the above specifications shall have distinctive markings as required by the latest standards of UL, Inc., so that they may be readily identifiable in the field. The neutral covering shall be furnished to show white 120/208V, the entire length in junction boxes and panels and green for the equipment ground cable. A color coding system as follows shall be used as a basis for balancing the loads in all panels. Solid color feeder wires shall have visible ends identified with color tape.

120/208 VOLTS

Phase	Color
A	Black
B	Red
C	Blue
Neutral	White
Ground	Green

2.05 OUTLET BOXES

- A. Outlet boxes shall be Raco, Steel City, Appleton or equal, galvanized, of a type best adaptable to their respective use, and in general, 4" square or octagon.

- B. Boxes in plaster areas shall be equipped with plaster rings or trim.

2.06 PULL AND JUNCTION BOXES

- A. All pull and junction boxes shall conform to the requirements of the National Electrical Code. They shall be galvanized code gauge steel construction with removable cover plates secured by 1/4" brass machine screws. All junction boxes shall be supported to the building structure.

2.07 SYSTEM OF LIGHT AND POWER

- A. Building distribution shall be 120/208V, three phase, 4 wire, 60 cycle.

- B. Lighting shall feed from 3 phases and neutral of the three wire system. A solid neutral system shall be used, panels shall be built accordingly and a white braid used on the neutral wire.

- C. Power supply to motors 1/2 HP and larger shall be 208V, single phase; under 1/2 HP shall be 120V, single phase.

2.08 GROUNDING

- A. The entire electrical system shall be well grounded in accordance with the National Board of Fire Underwriters, OSHA, State and local requirements.

- B. Final grounds shall be made to cold water piping and the main water meter.

- C. No ground wire shall be spliced. Cadweld copper taps shall be used. Ground clamps shall be non-corrosive, cast brass or bronze.

- D. The Electrical Contractor shall supply a green ground wire for all Greenfield connections, either power or lighting.

- E. Panels shall be equipped with equipment ground bar.

2.09 WIRING DEVICES

- A. Switches, in general, shall be Hubbell Co. 1221-W, Arrow-Hart & Hegeman, General Electric or Bryant.

- B. Receptacles, in general, shall be 5362-W or equal manufacturer as indicated above.

- C. Switch and pilot units shall be Hubbell 1297-W or equal manufacturers as listed above.

- D. Plates, in general, shall be white bakelite finish.

- E. Ground fault receptacles shall be Hubbell #GFI-5362-W or equal.

- F. Mounting height from center to finish floor, unless otherwise noted, shall be as follows for wiring devices.

- Switches, in general .....4'4"
- Receptacles, in general .....18"
- Receptacles with X, see architectural details for mounting height above counter.

2.10 SAFETY DISCONNECT SWITCHES

- A. Safety disconnect switches shall be heavy duty type.

- B. Switches shall be of the quick-make, quick-break type. Current carrying parts shall be high conductivity copper, designed to carry the rated load without excessive heating.

- C. Switch contacts shall be silver tungsten type or plated to prevent corrosion, pitting and oxidation and to assure suitable conductivity. Disconnects shall be Challenger, IIE Corp. or General Electric.

2.11 MOTOR STARTERS

- A. Each motor shall be provided with a motor starter of the proper design to meet the requirements of the motor and drive. Starters shall be installed by the Electrical Contractor when they are not part of a self-contained system as specified in HVAC Specification.

2.12 CIRCUIT BREAKERS

- A. Circuit breakers for lighting and small power loads shall be thermal magnetic, quick-make, quick-break, trip-free and sized as designated on Panel Schedules.

- B. Circuit breakers for distribution panels and power panels shall be quick-make, quick-break, trip-free, molded case type and sized as shown on Panel Schedules.

- C. Circuit breakers shall be manufactured by Square D, General Electric, or Cutler Hammer.

2.13 PANELS

- A. Panels shall be circuit breaker type 120/208V, sized as indicated on drawings.

- B. Panels shall be mounted in code gauge steel cabinets having not less than 5" gutters, equipped with hinged doors, flush lock and keys and having surface or flush trims as designed on schedules or drawings.

- C. Panels shall have typewritten legends.

- D. Panels shall be Siemens Co., Square D, General Electric, or Cutler Hammer.

2.14 LIGHTING FIXTURES AND LAMPS

- A. The Electrical Contractor shall furnish fixtures and lamps in accordance with the lighting fixture schedule. The Electrical Contractor shall be responsible to install the fixtures and lamps.

- B. All necessary devices and auxiliary fittings required for a complete and workmanlike installation shall be furnished by this Contractor.

- C. Plaster frames shall be furnished for recessed fixtures where applicable. The Contractor shall check ceiling finishes, clearances, structures, suspension system, etc., before ordering fixtures to ensure correct application. Where fixtures occur on or in the ceilings, dimensions to produce symmetrical pattern where possible. In suspended ceiling areas, the Contractor shall coordinate the placement or cutting of ceiling members with the Ceiling Contractor.

- D. All fixtures shall be UL, Inc., approved and manufactured.

- E. Ballasts, starters and lampholders shall be UL, Inc., approved and C.B.M. certified by E.T.L. Fluorescent lamp ballasts shall be high power factor type. Ballasts shall be rapid start type where applicable to lamp type. Ballasts shall be electronic.

- F. Metal halide ballasts shall be constant wattage, high power factor, individually fused and where used outdoors, able to start lamps to -20°.

- G. Fluorescent lamps shall be designated on the FIXTURE SCHEDULE. Incandescent lamps shall be 130 volts, inside frosted, except where clear lamps are required for correct fixture characteristics or where otherwise specified. Lamps shall be General Electric, Westinghouse, Sylvania or equal.

2.15 HANGERS AND SUPPORTS

- A. Lighting fixtures and lamps shall be hung independent of the ceiling structure.

- B. Recessed fixtures shall be supported from 1/4" steel rod or chain supports.

- C. Surface mounted fixtures shall be supported from 1/4" steel rod supports.

- D. Metal halide fixtures shall be hung from 3/4" conduit and safety chain supports.

2.16 POWER WIRING AND CONTROLS

- A. Motors shall be supplied by HVAC Contractor.

- B. This Contractor shall furnish power wiring to all motors.

- C. This Contractor shall furnish safety disconnect and switches unless otherwise noted herein in HVAC Specification that disconnect switches are part of an HVAC unit.

- D. Temperature control wiring to motors shall be furnished by HVAC Contractor.

- E. Disconnect switches exposed to weather shall be of the weatherproof type, fused as noted.

2.17 FIRE ALARM SYSTEM

- A. The fire alarm is an existing addressable, closed circuit, electrically supervised, manual/automatic fire alarm system. System shall comply with the City of Portland's rules and regulations.

- B. The fire alarm system shall be wired in conduit and teflon cable, in accordance with Maine's rules and regulations.

- C. The equipment shall be UL approved in compliance with local and national codes and shall be approved by the local fire chief.

- D. The equipment is existing FCI.

- E. Reconnect the new and existing fire alarm devices to the existing initiating and signal circuits.



SHEPHERD ENGINEERING, INC.

ELECTRICAL CONSULTANTS

1308 GRAFTON STREET  
WORCESTER, MASSACHUSETTS 01604

PHONE: (508) 757-7793 \* FAX: (508) 753-2309  
REFERENCE NO.: 13061

DESCRIPTION	DATE	MARK

**B GOOD**  
**PORTLAND, ME**

15 Exchange Street  
Portland, ME

Drawing Title

**ELECTRICAL**  
**SPECIFICATIONS**

Commission Number:

Scale: AS NOTED

File Name:

Drawn By: GCR

Issue Date: April 12, 2013

**E2.2**