

SECTION 16000 BASIC ELECTRICAL REQUIREMENTSPART 1: GENERAL1.01 WORK INCLUDED

- A. In general, the work consists of new constructions of electrical systems and connecting new equipment associated with the construction of two (2) rental buildings consisting of 6 units per building including; power, lighting, and HVAC system, all as indicated on the drawings and specifications, including the following:
1. Furnish and install wiring and connections for new lighting fixtures, electrical baseboards, electric unit heaters, receptacles, panelboards, signaling, etc.
 2. Provide for future sub-service panel to each unit, provide new house panel under Base Bid.
 3. Furnish all labor, materials, equipment, suppliers and perform all operations necessary to complete the secondary grounding work in accordance with drawings and these specifications.
 4. Furnish and install fire alarm addressable system for each building. Installation shall comply with NFPA. See section 16721.
 5. Furnish and install the core utilities for communication and signaling system for each unit as shown on the drawings.
- B. Unless specifically noted otherwise, all items noted to be furnished, provided, or installed shall be both provided and installed.

1.02 QUALITY ASSURANCE

- A. All wiring shall be in accordance with the latest issue of the National Electrical Code.
- B. The service equipment shall be the grounding point for the conduit, boxes, fittings and metal enclosed equipment used in the building wiring system. Any grounding methods allowed under Article 250 of the National Electrical Code may be used, provided the ground resistance is less than 25 ohms. This resistance shall be tested.
- C. The contractor shall show evidence of having successfully completed at least five similar projects. Installation of each system shall be under the supervision of a factory-authorized organization.
- D. The Contractor shall show evidence, upon request, that he maintains a fully equipped service organization capable of furnishing adequate inspection and

service to the system. The Contractor must have a service contract program for the maintenance of the system after the guarantee period.

- E. All electrical equipment shall be approved by the Underwriters' Laboratories, Inc. Each system shall be products of a single manufacturer of established reputation and experience. The Contractor shall be have supplied similar apparatus to comparable installations rendering satisfactory service for at least three years.
- F. The Contractor shall guarantee all equipment and wiring free from inherent mechanical or electrical defects for one year from date of acceptance.
- G. For each system the manufacturer shall furnish "gratis" to the Owner, a one year contract effective from the date of installation, for maintenance and inspection services of the manufacturer's equipment with a minimum of two inspections during the contract year.
- H. Furnish the services of a competent instructor for not less than one four hour period for instructing personnel in the operation and maintenance of the communication and signaling systems, on the dates requested by the Owner.

1.03 SYSTEM DESCRIPTION

- A. The utility providing service is 208volt, 3 phase, 4 wire.
- B. Provide a 120/208-volt, 3 phase, 4 wire sub-panel to each ubit.

1.04 PROJECT CONDITIONS

- A. Regulatory Requirements: Secure and pay for all permits and certificates as required by local and state laws.

1.05 WARRANTY

- A. The Contractor shall guarantee all equipment and wiring free from inherent mechanical or electrical defects for one year from date of acceptance.

1.06 RELATED WORK

- A. Division 15 – Mechanical

PART 2: PRODUCTS

2.01 MATERIALS

- A. Toggle Switches: 20A, 277V, 1 pole, brown specification grade, mount 4' 0" above finished floor at door entrance.
- B. Receptacles shall be 20 amp duplex units, ivory.
- C. Plates shall be same color as receptacles, nylon.

- D. Boxes shall be steel, minimum 2 ½ “ deep.
- E. Light Fixtures: The light fixtures shall be as described on the drawings or other approved equal are also acceptable.
- F. Disconnect Switches: Disconnect switches shall be horsepower rated, heavy duty type.
- G. Wiring Materials:
1. Flexible Metal Conduit shall be used for all connections to motors and vibrating equipment, and shall comply with Federal Spec. WW-C-566.
 2. All wiring shall be type THW, XHHW, or THWN, UL labeled, copper conductors with 600 volt insulation, except as otherwise noted. Minimum size wire shall be No. 12 AWG.
 3. Type MC Cable shall have minimum No. 12 AWG type THWN or XHHW insulated copper conductors with an internal bare or insulated copper ground wire.
 4. Panelboards
 - a. Provide standard manufacturer products. All components of panelboards shall be the product and assembly of the same manufacturer. All similar units of all panelboards shall be of the same manufacturer.
 - b. All panels shall be dead front safety type.
 - c. All panelboards shall be completely factory assembled with molded case circuit breakers.
 - d. Panels shall have main breaker or main lugs, bus size, voltage, phase, top or bottom feed, and flush or surface mounting all as scheduled on the drawings.
 - e. Panelboards shall have the following features:
 - 1) Nonreduced size copper or aluminum bus bars and connection straps bolted together and rigidly supported on molded insulators. Bus bar taps shall be arranged for sequence phasing of branch circuit devices.
 - 2) Full size neutral bar mounted on insulated supports.
 - 3) Ground bar with sufficient terminals for all grounding wires. The ground bar shall be insulated and isolated where called for on the drawings.

- 4) Buses braced for available short circuit current, but not less than 22,000 ampere symmetrical. If the panelboard is within 25 feet of the service entrance, and never less than 10,000 amperes symmetrical.
- 5) All breakers arranged so that it will be possible to substitute a two-pole breaker for two single pole breakers or a three-pole breaker for three single pole breakers when frame size is 100 amperes or less.
- 6) Design interior so that protective devices can be replaced without removing adjacent units, main bus connectors and without drilling or tapping.
- 7) Where designated on panel schedule as "space", include all necessary bussing, device supports and connections. Provide blank cover for each space.
- 8) Provide galvanized steel cabinets to house panelboards. Cabinets for panelboards may be factory primed and suitably treated with a corrosion-resisting paint finish meeting UL standard for outdoor applications.
- 9) Back and sides shall be of one piece formed steel. Cabinets for panelboards may be of formed sheet steel with end and side panels welded, riveted or bolted as required.
- 10) Provide minimum of four interior mounted studs and necessary hardware for in and out adjustment of panel interior.
- 11) Fabricate trim of sheet steel consisting of frame with door attached by concealed hinges. Provide flush or surface trim as shown on the drawings.
- 12) Surface trim shall have the same width and height as the box.
- 13) Provide doors with flush type latch and manufacturer's standard lock.
- 14) In making switching devices accessible, doors shall not uncover any live parts.
- 15) Provide concealed butt hinges welded to the doors and trims.
- 16) Provide keyed alike system for all panelboards.

- 17) Provide a directory card, metal holder, and transparent cover. Permanently mount holders on inside of doors.
- 18) Circuit breakers in panelboards shall be bolt on type on phase bus bar or branch circuit bar. Molded case circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips.

I. Grounding Conductors:

1. Grounding conductors shall be soft-drawn bare copper.
2. Insulated Grounding Wires shall be UL and NEC approved types, copper, with THWN or XHHW insulation color, identified green, except where otherwise shown on the drawings or specified.
3. Wire shall not be less than shown on the drawings and not less than required by the NEC.

J. Ground Clamps:

1. Ground clamps shall be cast bronze or cast copper and shall be UL listed for grounding connections.
2. Ground clamps shall be sized for the specific conductor and electrode to be clamped.

K. Grounding Connections: Connections shall be of the exothermic type welding process as manufactured by Cadweld or approved equal.

L. Equipment Grounding Connections: Connections shall be of the compression type solderless connectors.

PART 3: EXECUTION

3.01 INSTALLATION

A. General:

1. All work shall be in accordance with the National Electrical Code requirements as amended to date, with the local electrical utility company rules, the Fire Underwriter's requirements, and all local, State and Federal laws and regulations.
2. Conduits shall be of sizes required by the National Electrical Code. Exposed conduits shall be installed with parallel or perpendicular to walls and ceiling, with right angle turns consisting of bends, fittings, or outlet boxes. No wire shall be installed until work, which might cause damage to wires or conduits, has been completed. Conduits shall be

thoroughly cleaned of water or other foreign matter before wire is installed.

3. All splices shall be mechanically and electrically perfect, using crimp type wire connectors.
4. Provide all disconnect switches required by the N.E.C.
5. Mount disconnect switches and starters at a height of 48" above finished floor unless otherwise noted.
6. Provide all necessary hardware for mounting motor starters.
7. A typewritten schedule of circuits, approved by the Owner's Representative shall be on the panel directory cards. Three complete copies of all directories, neatly bound, shall be delivered to the Owner's Representative.
8. Mount the panelboard so that maximum height of circuit breakers above finished floor shall not exceed 78".
9. Circuit numbers indicated on the drawings are the actual numbers assigned to the circuit in the panelboard and shall not be varied without the consent of the Architect/Engineer.
10. Provide all necessary hardware for mounting panelboard.
11. Branch circuit wiring may be metal sheathed cable where concealed and allowed by Code, Type MC. **NOTE:** All shall be Properly Supported. (Provide continuous ground wire.)
12. Feeder circuit wiring shall be in conduit or EMT.
13. In general, conductors shall be in the same size from the last protective device to the load and shall have an ampacity the same as or greater than the ampacity of the protective device where the wire size is not shown on the drawings. Use the 60 degree C. ampacity rating for wire sizes # 14 through # 1. For 120v circuits, home runs longer than 50 feet shall be minimum #10 AWG, longer than 100 feet shall be minimum #8 AWG.

B. Grounding:

1. The entire electrical system shall be permanently and effectively grounded in accordance with Code requirements.
2. Connections to junction boxes, equipment frames, etc. shall be bolted.
3. Conduit Systems:
 - a. Ground all metallic conduit systems.

- b. Conduit systems shall contain a grounding conductor sized per NEC table 250-95 or as shown on the drawings. Increase conduit size where necessary to accommodate the grounding conductor.
4. Feeders and Branch Circuits: Install green grounding conductors with all feeders and branch circuits.
5. Lighting Fixtures: Conduits shall not be used for grounding fixtures. Green equipment grounding conductor must be bonded to all fixtures.
- C. Identification: Provide tags on each of all pulled wires giving location of the other end. Provide phenolic nameplates for all panelboards, motor starters, and disconnect switches (except switches located at motors).
- D. Record Drawings: The Contractor shall keep on the job a set of prints showing any changes to the installation. These shall be given to the Engineer at the completion of the work.
- E. Testing and Adjusting:
 1. The entire installation shall be free from short circuits and improper grounds. Tests shall be made in the presence of the Engineer's representative.
 2. Each individual lighting circuit shall be tested at the panel, and in testing for insulation resistance to ground, the lighting equipment shall be connected for proper operation. In no case shall the insulation resistance be less than that required by the National Electrical Code. Failures shall be corrected in a manner satisfactory to the Architects and Engineers.
 3. Each system shall be completely tested and shall be adjusted for proper operation as required by the Engineer.
- F. Instruction: Furnish the services of a competent instructor for not less than two four hour periods for instructing personnel in the operation and maintenance of the fire alarm system.

END OF SECTION