DIVISION 16 – ELECTRICAL

SECTION 16010 – ELECTRICAL WORK

PART 1 – GENERAL

1.01 RELATED SECTIONS

The General Provisions of the contract, including the General Provisions for Construction Projects (2016), Special Provisions, and General Requirements of the Specifications, apply to the work specified in this section.

1.02 SUMMARY

A. Furnish all labor and materials required to complete all electrical work as indicated on the drawings and/or specified herein. In general, the following work is included:

1. Power systems including panelboards, luminaires, branch circuits, outlets, wiring devices and wiring.

2. Electrical demolition work as indicated.

B. The term "wiring" shall include raceways, outlets, conductors, fixtures and devices.

C. Wiring and connecting of all electrical equipment supplied for installation and use in this contract and not specifically listed as work by others.

D. Obtain and pay for electric permit.

1.02 RULES AND PERMIT

A. The entire installation to be made in strict accordance with the applicable provisions of the latest edition of the National Electrical Code, Local Ordinances, and rules and regulations of the State of Hawaii.

B. The Contractor to obtain and pay for the electrical permit as required by local rules and regulations. He shall arrange for periodic inspection by the local authorities as work progresses so that certificates of completion and inspection may be turned over to the Engineer.

1.03 SUBMITTALS

A. Submit in accordance with SECTION 01300 - SUBMITTALS.

B. Shop Drawings and Catalog Cuts: Submit for approval one set of reproducible transparency and 3 sets of ozalid prints of shop drawings or 6 sets of catalog cuts of following equipment and resubmit until approval is received before placing order:

1. Light fixtures including data on lamps.

2. Wiring devices.

3. Panelboards.

4. Circuit breakers and disconnect switches.

C. Field Posted As-Built Drawings: Before installing, verify all dimensions and sizes of equipment at job site. Circuit and conduit routing is typical and may be altered in any logical manner; however, all changes shall be approved by the Engineer and shown on "field posted as-built" drawings.

D. Guarantee: Submit guarantee as noted under item entitled “GUARANTEE” hereinbelow.

1.04 QUALITY ASSURANCE

A. Drawings: Specifications are accompanied by architectural plans of building, site plans and diagrammatic electrical plans showing locations of outlets, fixtures, switches, devices, and other electrical equipment. Locations are approximate and before installing, Contractor shall study adjacent construction details and make installation in most logical manner. Any device may be relocated within 10-feet-0 inch before installation at direction of the Engineer, whose decision shall be final.

B. Shop drawings and catalog cuts for substitute materials shall clearly specify compliance with and/or deviation from specified material. Approval of shop drawings and catalog cuts shall not release Contractor from complying with intent of specifications and drawings. Any deviations from approved shop drawings shall have prior approval by the Engineer.

1.05 GUARANTEE

A. Contractor’s Guarantee: Installation shall be complete in every detail and ready for use. Any item supplied by the Contractor developing defects within one year of final acceptance by the Engineer, except lamps which shall be guaranteed for 50 percent of rated life as published by manufacturer, shall be replaced by such materials, apparatus or parts including installation labor to make such defective portion of complete system conform to true intent and meaning of drawings and specifications, at no additional charge to the State of Hawaii.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Materials and equipment shall be new and those listed by Underwriters' Laboratories shall bear "UL" label of approval. Brand names, manufacturer's names and catalog numbers indicate standards of design and quality required.

B. Raceways:

1. Electrical Metallic Tubing (EMT) - Thin walled steel tubing, zinc coated; 3/4-inch minimum diameter.

2. Rigid steel conduit, zinc coated, 3/4-inch minimum diameter.

C. Outlet Boxes:

1. Concealed boxes shall be pressed from NEC gauge steel, galvanized 4-inch square x 1-1/2 inches deep minimum.

2. Exposed boxes shall be galvanized cast iron or alloyed aluminum with threaded hubs for conduit connections. Boxes for surface metal raceway shall be by the same manufacturer of the raceway.

3. Extension or raised rings for pressed boxes pressed from NEC gauge steel and galvanized.

D. Device and Cover Plates: Plates for interior flush construction shall be satin finished 302 high nickel stainless steel, 18 percent chrome, 8 percent nickel with suitable hole for device.

E. Conductors:

1. Wires: Conductors shall be copper, 600 volts, No. 12 AWG minimum. Conductors No. 10 and smaller, solid and round. All conductors No. 6 and larger shall be NEC Type TW, XHHW and THW. Wiring in fixtures and fixture wiring channels shall be type RHH or THHN.

2. Color Code: Black-Phase "A", red--Phase "B", blue--Phase "C", White-neutral, green-ground. Color coding shall be maintained throughout entire system.

F. Wiring Devices:

1. Duplex Convenience Receptacles: Duplex, 20 ampere, 125 volts, side wired, 3 wires, grounding type in plastic body.

Hubbell	No. 5262
Bryant	No. 5262
Arrow Hart	No. 5262

2. Switches: Specification grade, non-mercury, "quiet", 120-277 volts, ivory or brown to match or coordinate with the wall.

1 Pole 20A	Arrow 1991
2 Pole 20A	Arrow 1992
3 Way, 20A	Arrow 1993

3. Equal devices by General Electric Company, Leviton and Sierra are approved or accepted equivalent.

G. Circuit breakers and safety switches shall be of the rating and type indicated. Circuit breakers shall be of the interchangeable trip type when available. Safety switches shall be heavy duty. For indoor locations, enclosures shall be NEMA 1 enclosure and for exterior locations enclosures shall be NEMA 4X 316 stainless steel.

H. Panelboards shall be 3-phase, 4WSN application, voltage and mounting as indicated, with doors and trims, copper bussed with bolted molded case thermal magnetic breakers, complement as shown on the drawings, circuit directory, lock and 2 keys. Breakers shall be interchangeable trip type when such is available. All panels shall be keyed alike.

I. Hardware, Support, Backing, Etc.: Provide all hardware, supports, backing and other accessories necessary to install electrical equipment. Wood materials shall be treated, iron or steel materials shall be galvanized for corrosion protection, and non-ferrous materials shall be brass or bronze. All wood screws shall be brass or galvanized steel.

J. Light Fixtures: Provide complete with necessary stems, drivers and accessories according to LUMINAIRE SCHEDULE. Manufacture and install according to NEC Article 410.

1. Fixtures manufactured from sheet metal, protected by bonderized "Bonderite" or "Cryscoat" process and baked white enamel finished, reflectance of 80 percent minimum. Finishing and process shall resist corrosion and 300 hours salt spray tests. Anodize all aluminum parts.

2. LED drivers shall be integral to luminaires.

3. LED color temperature shall be as noted on LUMINAIRE SCHEDULE.

PART 3 – EXECUTION

3.01 CONSTRUCTION METHODS

A. Comply with local ordinances and regulations of the State of Hawaii. Workmanship subject to approval of the Engineer who shall be afforded every opportunity to determine skill and competency. Concealed work re-opened at random during formal inspection by the Engineer without additional charge to the State of Hawaii.

B. Construction shall conform to construction practices as recommended by American Electricians Handbook by Croft (latest edition), National Electrical Code, National Electrical Safety Code and applicable instruction of manufacturers of equipment and materials supplied for project.

C. Raceways:

1. All conduits within building line shall be rigid steel conduits or electrical metallic tubing. Electrical metallic tubing may be used only in dry walls and in dry exposed locations 10-feet or higher above floor. Provide #14 gauge galvanized steel pull wire or nylon pull line in all empty conduits.

2. Cut raceways square, and ream inner edges. Butt together evenly in couplings.

3. Make bends and offsets with hickey or conduit bending machine. Do not use vise or pipe tee. Bends made so that interior cross-sectional area will not be reduced. Radius of curve of inner edge of field bend not less than 10 times internal diameter of raceway. Use of running threads not permitted. When raceways cannot be joined by standard threaded couplings, use approved water-tight raceway unions.

4. Cap raceways during construction with plastic or metal-capped bushings to prevent entrance of dirt or moisture. Swab all raceways out and dry before wires or cables are pulled in.

5. Mount raceway free from other piping, valves, or mechanical equipment.

6. Fish wires, cords, strings, chains or the like shall not be placed or inserted in the conduit system during installation.

7. Install insulating bushings and two locknuts on each end of every run of conduit at enclosures and boxes. Provide grounding bushings as required to grounding receptacles and connect conduits to service ground, per NEC Article 250.

8. Project adequate number of conduit threads through box for bushings.

9. Run exposed conduit or raceway parallel with, or at right angles to structural or architectural elements.

10. Securely fasten conduits with galvanized pipe straps with screws or bolts and spaced not more than 7-feet apart, or with approved beam clamps, or approved single or gang pipe hangers spaced not more than 7-feet apart, as conditions require. Vertical runs supported at intervals not exceeding 5-feet by approved clamp hangers. Conduit runs with one 90-degree bends or equivalent, 100-feet maximum without pullbox.

D. Outlet Boxes: Provide outlet boxes to suit conditions encountered. Provide outlet boxes in spaces with extension or raised rings of such depth that metal will be flush with surrounding surfaces of opening. Concealed boxes shall be pressed steel, galvanized, 4-inch square by 1-1/2 inches deep minimum.

E. Conductor Fill in a raceway shall conform to NEC Chapter 9, Table 3A (based on Type RHW wires) unless otherwise indicated on the drawings.

F. Wire Pulling: Mechanical means for pulling shall be torque-limiting type and not used for #2 AWG and smaller wires. Pulling tension shall not exceed wire manufacturer's recommendations. Where necessary, powdered soapstone shall be used as a lubricant for drawing wires through conduit. Other means of lubricating allowed with written approval of the Engineer.

G. Wire Splicing:

1. Form wires neatly in enclosures and boxes.

2. Splice in accordance with NEC Article 110. Crimp connect conductors #10 and smaller. Splice conductors #8 through #4/0 with high pressure compression (indent) copper sleeve connectors. Do not use bolt-on connectors. Re-insulate splices and waterproof splices. Re-insulate splices according to wire manufacturer's instructions. Splice insulation shall be 200 percent in thickness of original wire insulation and of same electrical and mechanical characteristics. Tape shall be vinyl plastic.

H. Equipment Connections: The Contractor shall connect all equipment and appliances for operation. Furnish all disconnects and starters if none are furnished by other trades. All starters shall be furnished with overload protection on each ungrounded phase. Verify equipment ratings, locations and wiring requirements prior to rough-in work.

I. Installation of Lighting Fixtures: Support fixtures securely and safely be means of fixture studs in the outlet boxes or other approved means. Provide accessories, such as straps, mounting plates, nipples or brackets for proper installation.

J. Finishing:

1. Patch, repair and restore all structural and architectural elements cut or drilled for installation of electrical system. Drilling, cutting, patching, repairing and restoring shall be subject to approval of the Engineer.

2. Attach electrical equipment to wood by wood screws, and attach to concrete by embedded or expansion inserts and bolts. Use powdered-driven charge with approval only. Close unused knock-outs on boxes or enclosures with metal cap. Powder actuated fasteners shall not be used on precast concrete. Do not use powder activated fasteners to attach enclosures and boxes to the building.

3. Wipe clean all exposed raceways and enclosures with rag and solvent. Prime painting and finishing of unfinished raceways and enclosures shall conform to SECTION 09901 - PAINTING. Factory finished enclosures shall not be painted.

4. Connect circuits to circuit assignments shown on drawings. Correct existing panel circuit directory as required.

K. Testing:

1. All wiring shall be tested to insure proper operation according to functions specified.

2. Balance loading on each feeder.

PART 4 – MEASUREMENT AND PAYMENT

4.01 BASIS OF MEASUREMENT AND PAYMENT

A. Work under this section will not be measured nor paid for separately, but shall be considered incidental to and included in the price bid for the various items of work in this project.

END OF SECTION