SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 THE GENERAL ELECTRICAL PROVISIONS

A. Section 16010 - General Electrical Provisions shall also apply. In general, this section describes quality assurance, submittals, testing and guarantees. Special conditions modifying these items, when required, shall be included hereinafter.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Galvanized Rigid Conduit (GRC): Hot dipped galvanized inside and out, rigid steel, 3/4" minimum, round bore electrical conduit and for use with threaded fittings.

B. Electrical Metallic Tubing (EMT): Hot dipped galvanized, 3/4" minimum trade size for use with crimp, compression or set screw connectors.

C. Flexible Conduit: Flexible steel, zinc-coated. For damp or wet locations, factory-covered with high density polyethylene for use with factory approved fittings.

D. Plastic Conduit: Polyvinyl chloride plastic, 3/4" minimum, schedule 40,. Use only buried below grade.

E. Gutters, Pullboxes, Enclosures and Cabinets: For panelboards, breakers and switches, unless otherwise specified, shall be NEMA 1 for interior locations and NEMA 3R for exterior locations exposed to the weather. Fabricate from code gauge galvanized steel, prime painted and enamel finished according to NEMA specifications.

F. Outlet Boxes:
   1. Concealed boxes shall be pressed down NEC gauge steel, galvanized 4-11/16" square x 1-1/2" deep minimum.

   2. Exposed boxes and weather exposed recessed boxes, including lighting outlets and exteriors, shall be galvanized cast iron or alloyed aluminum, prime painted, enamel finished with threaded hubs for conduit connections.

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

H. Devices and Cover Plates:
   1. Plates for interior flush construction shall be one piece, stainless steel, 18% chrome, 8% nickel with suitable hole for device.

   2. Plates for exposed exposed boxes shall be cast metal with neoprene gasket for sealing against entry of water or moisture into the box. Switch plates provided with neoprene cover over handle or raintight lever mechanism. Receptacle covers shall be "in use" type" with clear or translucent polycarbonate with stainless steel spring-loaded gasketed weatherproof cover.

I. Conductors:
   1. Conductors shall be copper, 600 volts, No. 12 AWG minimum. Conductors No. 10 and smaller shall be solid. Conductors No. 8 and larger shall be stranded. Unless specified or indicated otherwise, or required to be otherwise by NFPA 70, all power

and lighting wires shall be NEC Type THW, THWN or XHHW, except that grounding wire may be NEC Type TW.

2. Color code: Black - phase "A"; red - phase "B"; blue - phase "C"; white - neutral; green - ground. Except for ground conductor, use different colors for 480 volts system as required by the NEC. Color coding shall be maintained throughout entire wiring system. Use other colors when more wires than above listed are contained in one raceway. Project Manager shall determine whether deviation from color coding will be permitted.

J. Panelboards: Type and rating as noted with bolted, molded plastic case circuit breaker complement. Enclosures shall be galvanized steel with hinged door, latch, lock, rated for outdoor use (NEMA 3R). Provide 2 keys, typed circuit directory in metal frame with complete circuit assignments. 4" minimum side gutters and 5" minimum top and bottom gutters. All panels shall be keyed alike.

K. Circuit Breakers: Molded case circuit breaker with toggle operated mechanism and thermal-magnetic overload trips. Toggle positions "ON", "TRIPPED" and "OFF" engraved on body of toggle. Enclosed in NEMA steel box.

L. Wiring Devices:
1. Switches: Specification grade; single pole or double pole, 3 or 4 way as indicated, non-mercury quiet type, 20 amperes, 120/277 volts, UL labeled AC type, silvered contacts, tumbler switch with endurance of 10,000 make-breaks. Ivory.
IL type switches will not be permitted.

2. Duplex Convenience Receptacle: Specification grade; Tamper-Resistant type; NEMA 5-20R. Duplex, 20 ampere, 125 volts, side-wired, 3 wires, grounding type in plastic body. Ivory.

3. Ground Fault Receptacle: Specification grade; NEMA 5-20R. Duplex 20 ampere, 125 volts. Device shall be equipped with L.E.D. indicator lamp and TEST/RESET buttons. Ivory.

M. Disconnect Switches: Heavy duty fusible or non-fusible safety switch. Horsepower rated when used as motor disconnect. Contacts shall be lever operated, spring loaded and enclosed in NEMA 1 enclosure for interior locations and NEMA 3R enclosure for exterior locations. When for use with fuses, blades shall be rejection type. Enclosure shall have provisions for padlocking.

N. Ground Rods: Copper clad, 3/4" diameter X 10' long.

O. Hardware, Supports, Backing, etc.: Provide all hardware, supports backing and other accessories necessary to install electrical equipment. Wood material shall be termite treated. Iron and 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.

PART 3 - EXECUTION

3.01 CONSTRUCTION METHODS

A. Comply with local ordinances and regulations of County of Honolulu. Workmanship shall be subject to Project Manager's review. Project Manager shall be afford every opportunity to determine the skill and competency of the workmanship. Concealed work reopened at random during formal site visits by Project Manager without additional costs to the State.

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 instructions of manufacturers of equipment and material supplied for project.

C. Raceways:
   1. All raceways in damp locations and in hazardous locations shall be galvanized rigid steel conduit. All exposed raceways less than 7 feet above floor where subject to physical damage shall be galvanized rigid steel conduit. Electrical metallic tubing may be used in dry locations and where not subject to physical damage.

      PVC plastic conduits may be buried under floor or below garde only. Encase conduits below grade, where indicated, with minimum 3" thick concrete jacket.

      Paint metal conduits if used in or underground floor slabs with asphaltic corrosion resistance base paint or compound after installation in place.

   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 ten times the internal diameter of raceway. Use running threads not permitted. Where conduits cannot be joined by standard threaded couplings, use approved watertight conduit unions.

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

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

   6. Fish wires, cords, strings, conductors or the like shall not be placed or inserted in the raceway system during the installation of raceways.

   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 ground receptacles and connect raceways to service ground, per NEC Article 250.

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

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

   10. Securely fasten metal raceways with 1 or 2 hole galvanized pipe straps with screws or bolts and spaced not more than 7 feet apart or with approved beam clamps, or approved single or ganged pipe hangers spaced not more than 5 feet apart, as conditions require. Vertical runs supported at intervals not exceeding 5 feet by approved clamp hangers. Raceway runs with one 90-degree bend or equivalent, 150 feet maximum without pullbox. Raceway runs with two 90-degree bends or equivalent, 100 feet maximum without pullbox. Raceways shall be supported from building structure and shall not be supported from suspended ceiling system or mechanical systems.

   11. Provide pullstring in all empty raceways.

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. When two or more devices are installed at a single location, mount in gang box under single device plate. Boxes in hazardous locations shall be installed in accordance with Article 500 of the National Electrical Code.

E. Conductors:
   1. Conductor fill in raceways shall conform to NEC (based on Type RHW conductors).

   2. Conductor pulling: Mechanical means of pulling shall be torque-limiting type and shall not be used for #2 AWG and smaller conductors. Pulling tension shall not exceed wire manufacturer's recommendations.

      Where necessary, powdered soapstone may be used as a lubricant for drawing conductors through raceways. Other means of lubricating conductors shall be reviewed by Project Manager.

   3. Form wires neatly in enclosures and boxes.

   4. Splices: Splice in accordance with NEC Article 110. Splice conductors #10 AWG and smaller with wirenuts or Scotchlok connectors. Splice conductors #8 AWG and larger with high pressure compression (indent) copper sleeve connectors. Do not use bolt-on connectors. Reinsulate and weatherproof splices. Reinsulate splices according to manufacturer's instructions and recommendations. Splice insulation shall be 200% in thickness of original conductor insulation and of the same electrical and mechanical characteristics.

F. Equipment Connections: Make power connections to equipment with short section of flexible raceway. Provide liquid-tight flexible connections to motors at exterior locations.

G. Grounding:
   1. Equipment, motors, metallic enclosures, raceways and electrical equipment shall be grounded according to the requirements National Electrical Code, Article 250.

   2. Ground connection to equipment, raceways, motors, grounding type receptacles and other metallic parts directly exposed to underground electric conductors by continuous metal raceways or no. 14 AWG, minimum, copper, NEC type TW, green.

   3. All grounding conductors shall be run together with circuit conductors. Install ground wire in all nonmetallic conduits.

   4. Size all ground conductors per NEC Article 250.

   5. Install ground conductor in all non-metallic raceways.

3.02 FINISHING

A. Patch, repair and restore all structural and architectural elements cut, drilled or damaged for the installation of electrical system. Drilling, cutting, patching, repairing and restoring shall be subject to review and acceptance by Project Manager.

B. Attach electrical equipment to wood with wood screws and attach to concrete by embedded or expansion inserts and bolts. Use powder-driven charge with prior approval only. Powder-driven fasteners shall not be used on precast concrete structures.

C. Close unused knockouts on all enclosures with metal caps.

D. Wipe clean all exposed raceways and enclosures. Prime painting and finishing of unfinished raceways and enclosures shall conform to PAINTING Section.

E. Factory finished enclosures shall not be painted.

F. Panelboards, disconnect switches and enclosed circuit breakers shall be identified with plastic nameplate engraved with identification designation and ratings.

G. Connect circuits to circuit assignments shown on the drawings. Provide neatly type written circuit directory for all panelboards.

3.03 TESTING

A. All wiring and circuits shall be tested to insure proper operation according to the functions specified. All tests shall be made in the presence of the Project Manager.

B. Proper operation of all electrical devices shall be demonstrated at the request of the Project Manager.

C. Balance loading on each feeder.

END OF SECTION