

SECTION 16050 – BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION OF WORK

The Contractor shall furnish all labor, materials, tools, equipment and appliances required to provide and install all Electrical Work, complete and operational. The drawings note various sizes of equipment as determined for basis of design; the electrical work, however, shall be installed to comply with the equipment furnished by the successful bidder/supplier. The work shall include but not necessarily be limited to, the following:

- A. Remove 3rd Level Ewa and Diamond Head (DH) Concourse concrete column mounted light fixtures adjacent to roadway. Salvage, store and protect light fixtures to be reused. Intercept and protect existing conductors powering existing light fixtures mounted on top of the concrete columns.
- B. Install new light poles over existing conduit penetrations as much as possible. Where not possible, intercept existing conduit and conductors with new junction box and extend to new light pole location. Reinstall existing light fixtures salvaged from demolition work. Provide new light fixtures where existing fixtures cannot be reused. Utilize existing lighting circuits, intercept and extend to new pole/fixture location as necessary.
- C. Provide temporary lighting to allow for normal airport operations, which includes but is not limited to the safe operation of the Wikiwiki Shuttle. Additional temporary lighting to be added at discretion of the State.

1.03 RELATED WORK SPECIFIED IN OTHER SECTIONS

<u>Section</u>	<u>Title</u>
16000	GENERAL ELECTRICAL REQUIREMENTS
16500	LIGHTING

1.04 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS. Each submittal shall be prepared with a summary sheet attached to each copy identifying all items included in the submittal. Incomplete submittals and those without summary sheets will be returned without review.

- B. Shop Drawings: Submit complete shop drawings and manufacturer's literature for DOT-A's review before any work is fabricated. Submit manufacturer's literature for the following:
1. Conductors.
 2. Conduit.
 3. Junction boxes.
 4. Mounting hardware (i.e. bolts, screws, fasteners, support brackets, etc.).
- C. Intent of Shop Drawing and Catalog Cut Review:
1. Shop drawing and catalog cut submittals processed by DOT-A are not Change Orders. The purpose of the submittals by the Contractor is to demonstrate to the DOT-A that he understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use.
 2. If deviations, discrepancies or conflicts between shop drawings and specifications are discovered either prior to or after shop drawing submittals are processed by DOT-A, the design drawings and specifications shall control and shall be followed.
 3. Prequalification: Where materials or products specified herein are designated by manufacturer's name, any request to substitute materials or products other than those specified shall be approved by DOT-A during the bidding period, as specified in the GENERAL PROVISIONS, Paragraphs 2.7 and 6.13, and as amended by the Special Provisions. Burden of proof of equality of proposed substitutions will be the responsibility of the Contractor.
 4. Shop drawings and catalogue cuts for substitute materials shall clearly specify compliance with and/or deviation from specified material. Certification shall not contain statements to imply that the item does not meet requirements specified, such as "as good as"; and "achieve the same end use and results as materials formulated in accordance with the referenced publications". Certifications shall simply state that the item conforms to the requirements specified. Certificates shall be printed on the manufacturer's letterhead and shall be signed by the manufacturer's official authorized to sign certificates of compliance. Review of shop drawings and catalogue cuts shall not release Contractor from complying with intent of drawings and specifications.

1.02 GUARANTEE AND CERTIFICATE

- A. Any item of material, apparatus, equipment furnished and installed, or construction by the Contractor showing defects in design, construction, quality or workmanship within one year from the date of final acceptance by the State shall be replaced by such new material, apparatus or parts as may be found necessary to make such defective portion of the complete system conform to the true intent and meaning of the specification and/or the drawings. Exceptions shall be LED light fixtures which shall be guaranteed for one half the manufacturer's listed life time. Such repairs or replacement shall be made by the Contractor or his surety, free of all expense to the State.

1.03 GENERAL REQUIREMENTS

- A. The Contractor shall furnish all labor, materials (except as hereinafter noted), tools, equipment and appliances required to provide and install all electrical work, complete, as indicated on the drawings and/or as herein specified. The drawings note various sizes of equipment as determined for basis of design; the electrical work, however, shall be installed to comply with the equipment furnished by the successful supplier. The work shall include but not necessarily be limited to, the following:
1. Remove 3rd Level Ewa and Diamond Head (DH) Concourse concrete column mounted light fixtures adjacent to roadway. Salvage and store light fixtures to be reinstalled as part of this project. Protect existing conduit penetrations and conductors for reuse.
 2. Install new light poles over existing conduit penetrations as much as possible. Where not possible, intercept existing conduit and conductors with new junction box and extend to new light pole location. Reinstall existing light fixtures salvaged from demolition work. Provide new light fixtures where existing fixtures cannot be reused. Utilize existing lighting circuits, intercept and extend to new pole/fixture location as necessary.
 3. Provide temporary lighting to allow for normal airport operations, which includes but is not limited to the safe operation of the Wikiwiki Shuttle. Additional temporary lighting to be added at discretion of the State Project Manager.
 4. Before bidding on this work, carefully examine each of the drawings and the site. By submitting a proposal of the work included in this Contract, the Contractor shall be deemed to have made such examination and to be familiar with and accept all conditions of the job site.
 5. Prior to ordering equipment, the Contractor shall examine the plans to verify the amount of space allocated for the electrical equipment and to

determine if the material proposed will fit within the allotted space. It shall be the Contractor's responsibility to provide equipment that will fit within the allotted space.

6. Rules and Permit: The entire installation shall be made in strict accordance with the latest rules and regulations of the National Board of Fire Underwriters, the currently adopted edition of the National Electrical Code (NEC). The State Electrical Code. and the local Electrical Bureau. The Contractor shall obtain and pay for the electrical permit as required by local laws and rules. All work shall be inspected by the proper local authorities as it progresses. The Contractor shall pay all inspection fees and shall deliver certificates of completion and inspection to the State before final payment will be made. Costs of permits and inspection fees shall be included in the Contractor's bid price.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. All materials shall be new, except as specifically noted, and shall bear the label of Underwriters Laboratories (UL) whenever standards have been established and label service is normally and regularly furnished by the agency.
- B. Raceways:
 1. Galvanized rigid steel (GRS), electrical metallic tubing (EMT), 3/4" minimum diameter. Metallic tubing and conduits shall be zinc-coated and conduits shall be hot-dip galvanized.
 2. Non-Metallic Conduit shall be high impact polyvinyl chloride (PVC), Schedule 40 and Schedule 80. Tensile strength 6000 psi minimum and compressing strength shall be 9000 psi minimum
 3. Flexible Conduit: Zinc-coated inside and outside, fully interlocked; for wet or moist areas - liquid-tight with factory fittings, UL 360.
- C. Conductors and Cables: Conductors shall be copper, No. 12 AWG minimum; No. 10 AWG and smaller, solid; No. 8 AWG and larger, stranded. Conductors shall be type THHN/THWN for interior use and RHW-USE for exterior use. All high voltage work shall be performed by qualified electricians certified to work on high voltage systems.

Conductors for use in exposed installation on cables trays or at equipment connections shall be flexible stranded copper, PVC insulation with nylon jacket, oil and gasoline resistant, sunlight resistant, UL VW-1 and CSA FT-1 & FT-4 flame resistant for outdoor installations.

- D. Outlet and Small Junction Boxes: In all conditions and for all cases, outlet and junction boxes shall be increased in size to conform with NEC Article 314 fill requirements. Boxes shall be cast iron or ferrous alloy, prime painted and enamel finished, with threaded hubs for conduit connection. For exterior, wet and basement locations, the box shall be NEMA 4X type 316L stainless steel. All screws shall be stainless steel type 316L. In all conditions and for all cases, outlet and junction boxes shall be increased in size to conform with NEC Article 314 fill requirements.
- E. Large Junction Boxes: For dry interior locations, the box shall be fabricated from NEC gauge galvanized steel with matching screw-on type cover, field punched knockouts. For exterior, wet and basement locations, the box shall be NEMA 4X type 316L stainless steel. All screws shall be stainless steel type 316L. In all conditions and for all cases, outlet and junction boxes shall be increased in size to conform with NEC Article 314 fill requirements.
- F. Device and Cover Plates:
1. Plates for enclosed interior flush construction shall be type 302 stainless steel, dull finish with suitable hole for device unless otherwise indicated.
 2. Plates for exposed, damp, or wet installations shall be weatherproof while-in-use type, with lockable U.V. stabilized covers. Covers shall permit plugs to be connected without compromising the integrity of the protective nature of the cover.
- G. Individual Circuit Breaker: Molded plastic case circuit breaker with toggle operated mechanism and thermal-magnetic overload trips. Interchangeable trip shall be provided when available. Toggle positions "ON" and "OFF" engraved or embossed on body. Trip plug rating as indicated on the Drawings. Eaton or preapproved equivalent.
- H. Nameplates: Laminated nameplates shall be provided for panelboards and circuit breaker enclosures. Nameplate shall be 1/8-inch thick melamine plastic, black and white center core. Size of nameplate shall be 1-inch by 2-1/2-inches minimum. Lettering shall be 1/4-inch high block lettering. Equipment designations shall be as indicated on the drawings.
- I. Hardware, Supports, Backing, Etc.: All hardware, supports, backing and other accessories necessary to install electrical equipment shall be provided. Wood materials shall be "wolmanized" treated against termites, iron or steel materials shall be galvanized for corrosion protection, and non-ferrous materials shall be brass or bronze.

PART 3 - EXECUTION

3.01 GENERAL

- A. Rules and Permit: The entire installation shall be made in strict accordance with the latest rules and regulations of the National Board of Fire Underwriters, the currently adopted edition of the National Electrical Code (NEC) and the local Electrical Bureau. All work shall be inspected by the proper local authorities as it progresses.

The Contractor shall pay all inspection fees and shall deliver certificates of completion and inspection to DOT-A before final payment will be made. Costs of permits and inspection fees shall be included in the Contractor's bid price.

B. Qualification of Installers:

1. For actual fabrication, installation and testing of the work of this section, use only thoroughly trained and experienced workmen completely familiar with items required and with manufacturers' recommended methods of installation. In acceptance or rejection of installed work, no allowance will be made for lack of skill on part of workmen.
2. Workmanship shall meet the approval of DOT-A who shall be afforded every opportunity to determine skill and competency. Concealed work shall be reopened at random during formal inspection by DOT-A at their request.

C. Construction Methods: Construction shall conform to construction practices as recommended by the American Electricians Handbook by Croft (latest edition), Edison Electric Institute, National Electrical Code, National Electrical Safety Code and applicable instructions of manufacturers of equipment and material supplied for this project.

D. Provide structural bracing for equipment permanently attached to the building. Structural bracing shall resist the effects of earthquake motions in accordance with ASCE 7 per 2018 IBC, Section 1613.

E. Field-Posted As-Built Drawings: The Contractor shall maintain an accurate and adequate record of each change as it occurs, regardless of how ordered and submit as-built drawings after project completion.

F. Plans and Specification: This specification is intended to cover all labor, materials and standards of workmanship to be employed in the work indicated on the plans and called for in the specification or reasonably implied therein. The plans and specification supplement one another. Any part of the work mentioned in one and not represented in the other, shall be done the same as if it had been mentioned in both. The Contractor shall not make alterations to the drawings and specification.

G. Discrepancies and Interpretations:

1. Should the Contractor find any discrepancies in or omissions from any of the documents or be in doubt as to their meaning, he shall advise DOT-A who will issue any necessary clarification within a time period which does not disrupt the progress of the work.
2. All interpretation and supplemental instructions will be in the form of a written addenda to the Contract Documents.
3. Should any discrepancy arise from the failure of the Contractor to notify DOT-A, the higher quality or larger quantity of item shall prevail. DOT-A shall make the final interpretation and judgment.

4. In the event of a discrepancy between small scale drawings and large-scale details, or between drawings and specification, on which is in violation of any regulations, ordinances, laws or codes, the discrepancy, if known by the Contractor, shall be immediately brought to the attention of DOT-A for a decision before proceeding with the particular work involved. Work carried out disregarding these instructions will be subject to removal and replacement at the Contractor's expense.
- H. Symbols: The standard electrical symbols together with the special symbols, notes and instructions shown on the drawings indicate the work required and are all to be included as a part of this specification.
- I. Coordination: This specification is accompanied by floor plans of the affected buildings, elevations, and site plans indicating locations of boxes, electrical connections, service runs, and other electrical apparatus. These locations are approximate and, before installing, the Contractor shall study the adjacent architectural details and actually make the installation in the most logical manner. The circuit routing is typical only and may be varied in any logical manner.

3.02 INSTALLATION

A. Grounding:

1. All metallic enclosures, raceways, and electrical equipment shall be grounded according to requirements of NEC Article 250. Final connection to equipment, raceways and other metallic parts directly exposed to ungrounded electric conductors shall be No. 12 AWG minimum, copper, NEC type TW, green insulation. Use approved bonding terminal at panels.
2. All grounding wire runs within building shall be routed together with circuit conductors.
3. Bond and ground all feeder conduit to panelboard enclosures.

B. Wiring System:

1. Below grade or in slab, use Schedule 40 PVC. Provide separate ground wire and rise out of ground with PVC. Transition GRS, or EMT conduit as required within 6" of finished grade or floor.
2. GRS shall be used where run is exposed in exterior locations and interior locations within six feet of the floor level.
3. EMT may be used in concrete walls, above suspended ceilings and where run is exposed in interior locations higher than six feet above the floor level.
4. Flexible conduit shall be used for connecting dry-type transformers, motors and other equipment subject to vibration or movement.
5. Conduit shall be cut square and inner edges reamed. Butt together evenly in couplings.

6. Bends and offsets shall be made with hickey or conduit bending machine. Do not use vise or pipe tee. Bends shall be made so that interior cross-sectional areas will not be reduced. Radius of curve of inner edge of field bend shall not be less than ten times internal diameter of conduit.
7. Use of running threads and set screw couplings will not be permitted. Where conduit cannot be joined by standard threaded couplings, approved watertight conduit union or compression couplings shall be used.
8. Cap conduit, during construction, with plastic or galvanized pipe caps to prevent entrance of dirt or moisture. All conduits shall be swabbed out and dried before wires or cables are pulled in.
9. Conduit shall be mounted clear of other piping, valves or mechanical equipment.
10. Fish wires, cords strings, chains or the like shall not be placed or inserted into the conduit system during installation. Insulating bushings and two locknuts shall be installed on the end of every run of conduit at sheet metal enclosures and boxes.
11. Securely fasten conduit to junction boxes and to structure support. Project adequate number of conduit threads through box for bushings. Anchorage for 1-1/2" and smaller conduit shall be made with two-hole galvanized conduit straps or clamps. Two-inch and larger conduits shall be anchored with galvanized wrought iron one-hole clamps or equal fittings.
12. Exposed conduit shall be parallel with, or at right angles to, structural or architectural elements, and securely fastened in place with two-hole galvanized pipe straps with screws, or with approved beam clamps, or approved single or gang pipe hangers spaced not more than five feet apart, as conditions required. Vertical runs shall be supported at intervals not exceeding five feet approved clamp hangers.
13. Muletape shall be installed in empty conduit. Muletape shall have a minimum tensile strength of 2000lbs. Muletapes shall be tagged at conduit terminations to identify conduit use (i.e. power, telephone, data, etc.) and location of other conduit termination on other end.

B. Conductors:

1. Mechanical means for pulling shall be torque-limiting type and not used for #2 AWG and smaller wires.
2. Pulling tension shall not exceed wire manufacturer's recommendations.
3. Where necessary, powdered soapstone may be used as a lubricant for drawing wires through conduit. No other means of lubricating will be allowed.
4. Form neatly in enclosures for minimum of crossovers. Tag all feeders.

C. Splicing of Wire and Cable:

1. Wires shall be formed neatly in enclosures and boxes.
2. Splices made according to NEC Article 110.
3. Splices shall be reinsulated. Remove all sharp points that can pierce tape. Use Minnesota Mining and Manufacturing Co. "Scotch" #33 tape, or equal. Splices in boxes for exterior locations shall be water-tight.

D. Finishing:

1. All cutting that may be required for complete installation of the electrical work shall be carefully performed, and all patching shall be finished in first-class condition by the Contractor.
2. Close unused knockouts in boxes or enclosures with metal cap.
3. Wipe clean all exposed raceways and boxes with rag and solvent. Unfinished raceways and boxes shall be prime-painted and finished to blend into background.

E. Miscellaneous Details:

1. Cut, drill and patch as required to install electrical system. Repair any surface damaged or marred by notching, drilling or any other process necessary for installation of electrical work. Cutting, repairs and refinishing subject to the approval of DOT-A. Need for remedial work determined by DOT-A as attributable to poor coordination and workmanship shall be cause for reconstruction to the satisfaction of the State of Hawaii.
2. Attachment of electrical equipment to wood by non-ferrous wood screws. Attachment to concrete by expansion anchors. Powder-charge-driven studs and anchors permitted only with prior approval.
3. Complete all panel circuit directories, using typewriter. Verify "room" and "use" designations before typing.
4. Prime and paint all exposed conduits, hangers, and fasteners.
5. All grounding wire within building run in rigid steel conduit, and where practicable, routed together with circuit conductors.
6. Furnish necessary test equipment and make all tests necessary to check for unspecified grounding, shorts and wrong connections. Correct faulty conditions, if any.
7. Tag all empty conduits in switchboard, panelboards, cabinets, at backboards, etc and identify destination.

8. Provide arc flash warning labels on all electrical equipment as required by 2014 NEC Article 110.16 and 2015 NFPA-70E 130.5. The contractor shall attain all information required for the calculations, perform the calculations, and provide the labels at no additional cost.
 9. Anchor all free-standing floor mounted electrical equipment, apparatus, and transformers. Provide additional bracing per the seismic conditions at the site.
- F. Firestopping: Provide UL listed firestopping for all holes at conduit penetrations through floor slabs, fire rated walls, partitions with fire rated doors, corridor walls, and vertical service shafts.

3.02 TESTING AND INSPECTION

- A. If DOT-A (or its representative) discovers any errors, the Contractor, at his own expense, shall go over all similar portions of the entire job, taking the necessary or directed remedial action.
- B. Interior installations 600 volts and less shall be tested for insulation resistance after all wiring is completed and ready for connection to fixtures and equipment. Including existing branch circuit conductors providing power to light fixtures, receptacles or other equipment affected by this project. Using a 500V megger tester, measure and record the insulation resistance from phase to neutral, phase to ground and neutral to ground. The records shall be submitted to the State for review and approval. The Contractor shall notify DOT-A when this test is to be performed. For any conductors with readings less than those in NETA-MTS 2015 Table 100.1, replace conductors and readminister test to satisfaction of the State.
- C. The Contractor shall re-tape splices which have been bared for inspection. The Contractor shall test all portions of the electrical system furnished by him for proper operation and freedom from accidental grounds. All tests shall be subject to the approval of DOT-A.
- D. Wherever test or inspection reveals faulty equipment or installation, the Contractor shall take corrective action, at his own expense, repairing or replacing equipment or installation as directed.

PART 4 - MEASUREMENT AND PAYMENT

4.01 BASIS OF MEASUREMENT AND PAYMENT

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

END OF SECTION