DIVISION 16 - ELECTRICAL

SECTION 16000 - GENERAL ELECTRICAL REQUIREMENTS

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

A. This Section includes specifications for interior and exterior electrical work.

1.03 GENERAL REQUIREMENTS

A. Electrical Work: Provide all articles, materials, workers, equipment operators, systems and services specified herein and, on the Drawings, and as normally required by accepted industry standard practices, including all labor taxes, fees, insurance, warranties and incidentals required to complete all electrical work.

B. In general, the following work is included:

1. 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.

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.

C. Furnish required submittals and samples, operations and maintenance manuals, and “As-built” Drawings.

D. Coordinate work with other trades to avoid omissions and overlapping of responsibilities.

E. Apply for, obtain and pay for all fees, permits, licenses, utility fees, assessments and inspections required for this work.

F. Pay for all temporary construction and testing power.

G. 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.

H. Conduct all tests to the approval of the State. Provide the necessary power, temporary power, man-power, equipment, and information as necessary to perform the tests and to provide the necessary submittals.

1.04 INTENT OF SPECIFICATIONS AND DRAWINGS

A. Specifications and Drawings are prepared in abbreviated form and include incomplete sentences. Omission of words or phrases such as "the Contractor shall", "as shown on the drawings", "a" and "the" are intentional. Omitted words and phrases shall be provided by inference to form complete sentences.

B. Specifications and Drawings complement each other and what is specified, scheduled or mentioned on one shall be binding as if called for by both.

C. 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 the State 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 addendum to the Contract Documents.

3. Should any discrepancies arise from the failure of the Contractor to notify the State, the higher quality or larger quantity of item shall prevail. State 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 Specifications, of 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 the State 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.

1.05 DEFINITIONS

A. Provide: "Furnish and install, test and deliver to the State in operating and ready to use condition."

B. Wiring: "Provide all raceways, junction boxes, conductors, devices, protection equipment, installation of motor controllers (furnished by others) when required, etc., including testing for a complete, operative and ready to use electrical system."

C. Equal: "Material, equipment or system, including all necessary labor, modifications and accessories satisfying the requirements of the contract documents, the design intent, and to provide features or have operating characteristics equal or better than that specified."

D. Complete: "Furnish installation that is operative, tested, and ready to use and which satisfies the intent of the contract documents, including all necessary accessories and modifications."

E. Contractor: "General Contractor responsible for all work shall assign work to Sub-Contractors. Except where noted, work of this section shall be assigned to the Electrical Sub-Contractor."

F. HECO: Hawaiian Electric Company

1.06 QUALITY ASSURANCE

A. Government and Utility Requirements: Comply with all requirements of the State of Hawaii, Disability and Communication Access Board (DCAB), and respective utility company rules and regulations.

B. Specifications are accompanied by architectural, structural, civil, mechanical, environmental, and landscape plans of the buildings, site, and diagrammatical electrical plans showing locations of luminaries, standards, outlets, feeder runs, devices and other electrical equipment. Locations are approximate and before installation, Contractor shall study adjacent construction details and make installation in the most logical manner. Prior to installation and at the direction of the State, relocate any device, equipment, feeder, or circuit within 10'-0" of the location presently shown without added cost to the State.

C. Prior to start of the rough-in work, verify all dimensions and equipment sizes with the approved shop drawings including equipment furnished by others. Circuits

and raceway routes are diagrammatic and may be altered in any logical manner. However, all changes from the contract documents shall be subject to review and acceptance of the State and indicated on the "As-built" Drawings.

D. Feeders and branch circuits for equipment furnished by others were sized for the anticipated equipment. Verify electrical requirements of all equipment furnished by others prior to rough in and prior to ordering of the electrical distribution equipment. Re-size affected feeders and branch circuits at no additional cost to the State.

E. Materials and Equipment: Materials and equipment shall conform to requirements of applicable technical specification sections, publications specified therein and shall be as shown on the drawings. Materials and equipment shall be new and shall be the product of manufacturers regularly engaged in the manufacture of such products.

All items shall essentially duplicate materials and equipment which have been in satisfactory use at least two years prior to bid opening and shall be supported by a service organization that is located reasonably close to the site of installation.

F. Substitutions:

1. Project substitutions shall comply with all requirements of the Hawaii Department of Transportation – Air and Water Transportation Facilities Division – General Provisions for Construction Projects – Latest Edition, paragraphs 2.7 and 6.13, and as amended by the Special Provisions.

G. Prevention of Corrosion: All metallic materials shall be protected against corrosion. Exposed metallic parts of equipment, apparatus, devices, mounting hardware, and fasteners that are provided in damp, wet, or corrosive areas shall be constructed from 316L stainless steel. All such parts as boxes, bodies, fittings, guards and miscellaneous parts shall be constructed of 316L stainless steel. The Contractor shall not join dissimilar metals that will result in deterioration due to galvanic corrosion.

1.07 DEPARTURES

A. Departures resulting from the substitution of materials or systems shall be accompanied by appropriate changes in all affected work of every trade and shall include stamped and signed drawings by a licensed engineer for any portion of the project requiring re-design. Such changes shall be done at no increase to the contract amount and shall be the responsibility of the Sub-Contractor or supplier responsible for the departures. Changes proposed by the Contractor shall be based on a system approach and may be allowed if implemented without decrease in quality, performance and operations, increase in utility costs or adverse effect

on the available physical space to install the equipment. Such departures shall be submitted and noted in shop drawings for review and acceptance by the State. Departures initiated by other trades, requiring changes in the electrical system as well as other systems, shall be accompanied by appropriate changes to all affected work of every trade, at no increase in contract amount. Submission for departure shall be as follows:

EXAMPLE:

Item	Manufacturer and Catalog Number Specified	Substitute Manufacturer and Catalog Number
Cable	John Doe - No. 3200	King - No. 2200

B. The General Contractor shall be responsible to coordinate, approve and select systems that do not impose unaccounted for impacts on the electrical work. It shall be understood that after the award of contract, all departures having electrical impact, unless otherwise noted, have been reviewed and approved by the General Contractor.

1.08 SUBMITTALS

A. Submit in accordance with Section 01300 - SUBMITTALS. All submittals shall be reviewed and approved by the General Contractor and the Electrical Contractor. Partial submittals or submittals lacking the General Contractor's and Electrical Contractor's approvals will not be acceptable. Annotate descriptive data to show the specific model, type, option, and size of each item the Contractor proposes to furnish. Do not commence work until each system, including all the various components, have been approved. The State will review and approve all submittals. Before the materials are ordered or the work is commenced the shop drawings must be approved.

B. List of Materials and Equipment: These lists shall include manufacturer's names and material or equipment identification such as styles, types, or catalog numbers to permit ready and complete identification. Original catalog cuts or brochures shall be provided. Scanned or photocopied submittals will be rejected without review.

C. Product Data: Shall be sufficiently comprehensive and detailed to permit evaluations, otherwise the item may be rejected, and shall include, as applicable, the following:

1. Original catalog cuts or brochures shall be provided. Scanned or photocopied submittals will be rejected without review.

2. Each submittal shall contain an itemized list of each item being submitted. Each item shall be identified with the complete manufacturer's ordering number including all options.

3. Dimension outlines of all enclosures.

4. Dimension drawings of components such as generators, switchgear, panelboards, transformers, enclosed circuit breakers, safety disconnect switches, and cabinets.

5. Scaled drawings showing the layouts and arrangement of equipment in all electrical rooms, switchgear rooms, and generator rooms.

6. Operating and electrical characteristics including interrupting ratings and impedances.

D. Certificate of Compliance: Where required by the section specifying the equipment, the Contractor shall submit six (6) copies of certificates of compliance in accordance with the requirements of the GENERAL REQUIREMENTS. The certificates shall include but not be limited to factory test reports.

E. Installation, Operation and Maintenance Data: Six (6) copies of installation, operation and maintenance data shall be submitted for equipment specified to require such data. The data shall be in the form of manuals and shall indicate instructions for operating, maintaining, repairing, recommended inspection points, periods for inspection, and all related spare parts in a practical, complete and comprehensive manner. The information shall be arranged in a logical, orderly sequence, including a general description of the equipment and significant technical characteristics.

Test, adjustment and calibration information shall be furnished and identified to specific equipment. The installation, operation and maintenance data shall be as required by the General Requirements.

F. Acceptance Requirements: Acceptance for material and equipment will be based on manufacturer's published data. Where materials or equipment are specified to be constructed and tested, or both, in accordance with the standards of the National Electrical Manufacturers Association (NEMA) or the American National Standards Institute (ANSI), the Contractor shall submit proof that the items furnished under this section of the specifications conform to such requirements. A certification or published catalog specification data statement to the effect that the item is in accordance with the referenced NEMA standard by a company listed as a member company of NEMA for the section whose standards cover the item under construction, will be acceptable as sufficient evidence that the item conforms to the requirements of the National Electrical Manufacturers

Association. A manufacturer's statement indicating complete compliance of each item with the applicable NEMA, ANSI or other commercial standard specified shall be submitted and will be acceptable proof of compliance. Conformance with the agency requirements does not relieve the item from complying with any other requirements of the specifications.

G. Nameplates:

1. General: In addition to standard manufacturer's nameplate, permanent corrosion resistant nameplates shall be provided for each enclosed circuit breaker, safety switch, panelboard, lighting contactor, inverter, telecom junction box, and other major pieces of equipment. Nameplates shall designate the function of the equipment for which they are used. The designation shall be submitted for review and acceptance with the shop drawings.

2. Material and Lettering: 1/16" thick, laminated plastic, black-white-black. Nameplate lettering shall be 1/4" high upper-case.

3. Fastening: Nameplates shall be fastened stainless steel (316L) screws.

4. Hand lettering or stick-on embossed marking tape is not acceptable.

5. Provide laminated tape labeling for all new receptacles on coverplates. Identify associated panel name and circuit number.

H. Labels:

1. Provide labels as required by the latest version of the National Electrical Code adopted by the State.
2. The labels shall be designed according to the following standards:

   a. UL969 – Standard for Marking and Labeling Systems.

   b. ANSI Z535.4 – Product Safety Signs and Labels.

   c. NFPA 70 (National Electric Code) – Article 110.16.

   d. NFPA 70E – Section 130.

3. Labels shall be provided for, but not limited to:

   a. Available fault currents at switchgear and panelboards per 2017 NEC 110.24(A).

b. Arc Flash warning labels shall be provided per 2017 NEC 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.

c. Source and location of feeder serving switchgear and panelboards per NEC 408.4(B).

d. Method utilized for conductor identification per 2017 NEC 210.5(C).

e. All SCADA and communication signal cables.

4. Label materials shall be provided similar to nameplates except those labels for wires, conductors, and cables shall be of the printed tape type.

I. Factory Tests and Inspection:

1. The equipment furnished shall be inspected mechanically and electrically, and all manufacturers' routine factory tests shall be performed to verify conformance with the specified requirements. The test equipment and test methods shall conform to the requirements of standards specified. The contract price shall include cost of performing all tests.

2. The Contractor shall furnish, at time of equipment delivery, six (6) certified copies of all test results.

J. Equipment Guarantees: Installation shall be complete in every detail and ready for use. Any item furnished or provided by the Contractor developing defects within two (2) years after final acceptance by the State shall be replaced by materials, apparatus and parts including installation labor costs to make such defective portion of the completed system conform to the true intent and meaning of the drawings and specifications, without additional cost to the State. The Contractor shall guarantee all equipment specified from the date such equipment is accepted by the State, against defects in materials, design, performance and workmanship. Guarantees shall be supported by manufacturer's written warranties and shall be signed by an official of the manufacturer's organization. Replacement parts shall be delivered and repairs shall be made promptly upon receipt of notice of failure under normal and proper use and maintenance. All costs of replacement and repair shall be borne by the Contractor provided that a report substantiating such defect or failure to conform to specifications is promptly given to the Contractor.

1.09 SHOP DRAWINGS

A. Layout shop drawings required. Prepare and submit the following coordinated layout shop drawings:

1. All new transfer switches and existing generator, switchgear, and electrical equipment.

2. Areas requiring deviation from design documents. Such deviations shall be clearly identified.

1.10 CODES, REGULATIONS AND STANDARD SPECIFICATIONS

A. Work shall conform to the Hawaii Revised Statutes, the Ordinances of the City & County of Honolulu; the International Conference of Building Officials (ICBO) International Building Code (IBC); requirements of the Daniel K. Inouye International Airport; and the latest edition of National Electrical Code (NEC).

B. Applicable rules, standards and specifications of following associations shall apply to materials, workmanship, and procedures:

American National Standards Institute (ANSI)
Illuminating Engineering Society of North America (IESNA)
National Electrical Manufacturer's Association (NEMA)
National Fire Protection Association (NFPA)
Underwriters' Laboratories, Inc. (UL)

1.11 WARRANTY

Defective materials and workmanship shall be removed and replaced at no cost to the State. For period of two years after date of final acceptance of work by State, materials and workmanship developing defects and malfunctions shall be repaired and/or replaced, to conform with intent of the specification and drawings, at no additional cost to the State.

PART 2 - PRODUCTS

2.01 MATERIALS

All materials shall be new, except as specifically noted, and shall bear the label of Underwriter’s Laboratories, Inc., wherever standards have been established and label service is normally and regularly furnished by the agency. See the respective technical sections for the electrical material specifications.

PART 3 - EXECUTION

3.01 MATERIALS AND EQUIPMENT PROVIDED BY THE CONTRACTOR

The electrical installation shall be complete and operable and shall conform to the requirements of the contract drawings. The Contractor shall provide all electrical equipment and materials, wiring, supports and such additional parts as are necessary to make the installation complete. All Contractor furnished materials and equipment are subject to review and acceptance by the State.

3.02 PROTECTION DURING STORAGE

Store all materials and equipment in a safe manner. Provide weather, dehumidification, and fire protection for all materials. Store all materials above grade to avoid damage by moisture. Cover all materials to avoid damage from sunlight.

3.03 PROTECTION OF WORK IN PROGRESS

All electrical materials and equipment shall be completely protected during installation. Equipment shall be securely protected against physical or chemical damage. In areas exposed to weather, materials unused at the end of each day's work shall be protected by weatherproofed installations. All unprotected conduits shall be sealed to prevent water and foreign debris from entering conduits. Damage to materials and equipment due to Contractor's neglect shall be repaired or replaced by and at the expense of the Contractor.

3.04 PROGRESS OF WORK AND COORDINATION

The Contractor shall prepare a schedule identifying the sequence of electrical work. The electrical work shall be coordinated with the work of other Contractors and other trades. The schedule shall be submitted prior to beginning installation and shall be subject to review and acceptance by the State.

3.05 RULES

The entire electrical installation shall conform to the applicable rules and regulations of the State Electrical Code, the State Fire Code and the standards and publications specified in the technical sections.

3.06 COORDINATION

The contract drawings indicate the extent and general location and arrangement of equipment, conduit and wiring. Lighting fixtures, outlets and electrical equipment shall be located so as to avoid interference with architectural, mechanical and structural features. The State may request any device, equipment, circuit, or feeder to be relocated

within 10'-0" of the location shown on the Drawings before installation is initiated and without increase in contract amount.

3.07 WORKMANSHIP

A. All materials and equipment shall be installed in accordance with printed recommendations of the manufacturer and shall conform to the requirements of the contract drawings. The installation shall be accomplished by workers skilled in this type of work. For actual fabrication, installation and testing of the Electrical work, use only thoroughly trained and experienced workmen completely familiar with items to be installed 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.

B. Inspection: Skill and competency of workmanship shall be subject to the approval of the State and the County. The contractor shall open all electrical equipment, cabinets, junction boxes, and devices as required by the State or inspector for inspection. All equipment shall be de-energized prior to inspection unless voltage and current measurements are required. The Contractor shall be responsible for all electrical and arc flash safety at the project site.

3.08 FIELD TESTS

A. After the installation is completed, and at such time the State may direct, the Contractor shall conduct field tests for acceptance by the State. When the tests are specified to be performed under the supervision of the equipment manufacturer, the Contractor shall cooperate with the State during tests and shall place at the manufacturer’s disposal, all assistance, materials and services required to perform such tests. The tests shall be performed in the presence and to the satisfaction of the State. The Contractor shall furnish all necessary electric power, fuel, instruments, equipment, and personnel required for the tests and shall pay for all power and fuel.

B. Insulation Tests: The insulation of all conductors shall be tested with a megger insulation tester. 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. Operating Tests: The equipment and systems shall be demonstrated to operate in accordance with the requirements of the technical sections in which the equipment or systems are specified.

D. Ground Resistance Test: Test ground resistance by three-point method. Results of test shall be submitted to the State. Ground Resistance: Ground resistance measurements of each ground rod shall be taken and certified by the Contractor. Upon completion of the project, the Contractor shall submit in writing to the State, the measured ground resistance of each ground rod and grounding system, as well as the resistance and soil conditions at the time the measurements were made. Ground resistance measurements shall be made in normally dry weather, not less than 48 hours after rainfall, and with the ground under test isolated from other grounds.

E. Test all 600 volt class conductors to verify that no short circuits or accidental grounds exist. Make tests using an instrument which applies a voltage of approximately 500 volts to provide a direct reading in resistance, and measure the insulation resistance using the testing method described above. All test results shall be recorded and submitted to the State.

F. Wherever test or inspection reveals faulty materials or installation, Contractor shall take corrective action, at his own expense, repairing or replacing materials or installation as directed. The materials or installation shall then be retested.

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