DIVISION 16 - ELECTRICAL

SECTION 16301 - EXTERIOR ELECTRICAL WORK

PART 1 - GENERAL

GENERAL CONDITIONS:

The General Conditions and Special Provisions preceding this Specification shall govern this section.

Specification and Plans complement each other and what is specified, scheduled or mentioned by one shall be binding as if called for by both. Specification and Plans are intended to specify nature, quantity and quality of electrical work.

Before bidding, visit project site, carefully review each section of the Specification and all Drawings of this Contract, and obtain from utility companies their standards, drawings and specifications for the work to be provided. Verify details, report any error, conflicts or omissions to the Owner's representative (hereafter referred to as Engineer) at least 10 calendar days before submission of bids for interpretation or clarification. If errors or omissions are not reported, Contractor shall provide necessary work at no cost to the Department to properly complete intent of Specification and Drawings.

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.

WORK INCLUDED:

In general, provide complete underground electric, telephone, CATV, communications, street lighting, and power systems within project boundaries. 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, and as required for its correct and proper operation. 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:

Complete underground raceway system including trenches, ducts, manholes, and boxes, to be used by the Hawaiian Electric Company (HECO) for their cables and equipment.

Complete underground raceway system including trenches, ducts, manholes, and boxes, to be used by Sandwich Isles Communications, Inc. for their cables and equipment.

Complete underground raceway system including trenches, ducts, and boxes, to be used for communication system cables and equipment.

Complete street lighting system.

Complete secondary power systems.

Coordinate work and arrange for periodic inspections by Hawaiian Electric Co., Sandwich Isles Communications, Inc., State Inspectors, City & County Inspectors, and Engineer.

Pass test mandrel through all ducts and conduits, and make corrections as directed by inspectors or Engineer.

Provide pulling wire, No. 12 AWG galvanized steel or polypropylene cord, in all empty ducts and conduits, unless indicated otherwise. Provide duct measuring/cable pulling tape in all Hawaiian Electric Company and Sandwich Isles Communications, Inc. ducts and conduits.

Immediately report and pay for damages to existing equipment.

Obtain and pay for electrical permits, arrange for periodic inspection by local authorities and deliver certificate of final inspection to Engineer.

Contractor shall check and test the installation for completeness and functional operation as described by the Drawings and specified herein. Final test shall be in the presence of Engineer and representatives of the utility companies, Sandwich Isles Communications, Inc., and the City. Contractor shall arrange and pay for all testing costs. Should intermediate or final inspections of the duct system reveal crushed, damaged or impassable ducts, the Contractor shall repair those sections of duct system, including repairs to paved surfaces and concrete structures, at no additional cost to the Department.

SPECIAL CONDITIONS:

Contractor shall install duct systems and schedule the electric, telephone, CATV, communications, and street lighting work within the timetable set by the General Contractor.

Contractor shall verify ductline requirements, duct entry configurations and their locations, for each utility company and Sandwich Isles Communications manhole and handhole, with the respective utility company and Sandwich Isles Communications.

Contractor shall make detailed arrangements for work by utility companies and Sandwich Isles Communications, Inc. pertaining to this Contract. Payment to utility companies for their work shall be by the Department.

Contractor shall closely coordinate all work with Sandwich Isles Communications, Inc. (SIC). All trenches must be inspected prior to backfilling material. The Contractor shall notify the SIC Inspector (Customer Service Toll Free No. 1-888- 995-7274) at least 72 hours prior to pouring of concrete or backfilling trenches.

Arrange for the General Contractor to identify the locations of all civil site utilities (i.e. drain, water and sewer lines, etc.) and driveways prior to layout of electric, telephone, street light and CATV systems.

Contractor and General Contractor shall closely supervise and coordinate all electrical work with the utility companies and Sandwich Isles Communications, Inc. to ensure that proper roadway drainage is maintained during construction. Should damage and erosion occur during construction, the Contractor or General Contractor shall repair all damage and restore existing grade at no additional cost to the Department.

RELATED WORK BY OTHERS:

Service cables and transformer(s), final connection thereto, and metering equipment by Hawaiian Electric Company. Obtain service raceway, grounding, transformer, and metering requirements before bidding, fabricating, constructing and installing. Make detailed arrangements for all work by utility company pertaining to Contract.

Connection of street light circuits to utility company power source shall be by Hawaiian Electric Company.

Telecommunications utility cables and equipment shall be by Sandwich Isles Communications, Inc. and/or respective communications provider for this operator area.

Equipment utilizing electricity shall be provided by respective sections of Specification. Furnishing of equipment controllers (motor starters), unless otherwise specified, and providing complete control and interlock is provided by respective section supplying equipment. Installation of complete feeder or branch circuit system, and power wiring to equipment and controllers shall be part of electrical work.

SUBMITTALS:

Shop Drawings: Within four weeks of award of Contract and prior to installation, submit complete shop drawings and manufacturer's literature for Engineer's review before any work is fabricated. Submit six sets of manufacturer's literature and/or fabrication drawings for the following:

Complete street light standards and accessories, including computerized footcandle arrays showing illumination levels for all project roadways.

Complete secondary power system, including cabinets, meter sockets, circuit breakers, and accessories.

Complete electric and utility system pullboxes, handholes, manholes, conduit and accessories. For utility system pullboxes, handholes, and manholes, obtain approvals from respective utility company prior to submission for Engineer’s review.

Utility companies' drawings.

Prequalification: Brand names, manufacturer's names and catalog numbers indicate standard of design and quality required. 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 the Engineer. Burden of proof of equality of proposed substitutions will be the responsibility of the Contractor. List of substitute material together with qualifying data shall be submitted for approval at least ten days before bid opening.

Submission shall be as follows:

EXAMPLE:

Manufacturer and Catalog Substitute Manufacturer

Item Number Specified and Catalog Number

Cable John Doe - No. 3200 King - No. 2200

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.

Intent of Shop Drawing and Catalog Cut Review:

1. Shop drawing and catalog cut submittals processed by the Engineer are not Change Orders. The purpose of the submittals by the Contractor is to demonstrate to the Engineer 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 the Engineer, the design drawings and specifications shall control and shall be followed;

3. The fact that a manufacturer does not offer a specific option or meet a minimum guaranteed performance specification, called for herein or in a formal bid specification, is not deemed proprietary when such is available from one or more manufacturers.

Approvals rendered on shop drawings shall not be considered as a guarantee of measurements or site conditions. Where drawings are approved, said approval does not relieve the Contractor from his responsibility for furnishing material or performing work as required by the Contract Drawings and Specifications.

GUARANTEE AND CERTIFICATE:

Defective materials and workmanship shall be removed and replaced at no cost to the Department. For period of one year after acceptance of work by the Department, materials and workmanship developing defects and malfunctions shall be repaired and/or replaced, to conform to intent of the Specification and Drawings at no additional cost to the Department.

PART 2 - PRODUCTS

GENERAL:

All materials shall be new, except as specifically noted, and shall bear the label of Underwriters' Laboratories whenever standards have been established and label service is normally and regularly furnished by the agency.

All materials used for Sandwich Isles Communications, Inc. work shall be on the Rural Utilities Service (RUS), United States Department of Agriculture list of approved materials.

MATERIALS:

Direct Buried Conduits (for below grade use):

Under Sidewalk or Protective Concrete Topping: Conduits for electric systems shall be round bore, PVC (polyvinyl chloride) Schedule 40 plastic or approved equal. Conduits for telephone, CATV, and communication systems shall be round bore, PVC (polyvinyl chloride) Schedule 40 plastic, or approved equal. Conduits for street lighting and secondary power systems shall be PVC (polyvinyl chloride) Schedule 40.

Under Road Pavement or Grassed Areas: Conduits for electric systems shall be round bore, PVC (polyvinyl chloride) Schedule 80 plastic or approved equal. Conduits for telephone, CATV, and communication systems shall be round bore, PVC (polyvinyl chloride) Schedule 40 plastic, or approved equal. Conduits for street lighting and secondary power systems shall be PVC (polyvinyl chloride) Schedule 80.

Concrete Encased Conduits (for below grade use): Conduits for electric systems shall be round bore, PVC Schedule 40 plastic or approved equal. Conduits for telephone, CATV and communications systems shall be round bore, PVC Schedule 40 plastic or approved equal. Conduits for street lighting and secondary power systems shall be PVC Schedule 40.

Metal Raceways: (for above grade use)

Conduits: EMT (where indicated) and galvanized rigid steel.

Flexible conduit: Zinc-coated inside and outside; for wet or moist areas--liquid-tight with factory fittings.

Conduit and Duct Accessories: Couplings, spacers, plugs, and accessories shall be as recommended by the manufacturer of conduits and ducts and shall be of the same schedule as the ducts which are connected to it, unless indicated otherwise.

Ground Rods: Diameter shall be adequate to permit driving to full length of the rod, but not less than 5/8" in diameter unless otherwise indicated. Ground rods for street light standards shall be 5/8" x 10'-0" copper-cladded steel core. All others shall be 5/8" x 8'-0" copper-cladded steel core, unless indicated otherwise.

Wire Mesh: Welded steel wire fabric for reinforcing concrete, galvanized, conforming to ASTM Specification A185.

Concrete: Ready mixed type with compressive strengths as shown on Drawings. Concrete material and aggregates shall conform to latest ASTM Specifications. Concrete aggregates for ductlines shall be 3/4" maximum in size.

Backfill Material Type A: Black or beach sand, earth or earth and gravel mixture. Material used shall be non-expansive. If earth and gravel mixture, rock size shall be 1‑inch or smaller and shall not contain more than 20% rock particles by volume. This fill shall be used over concrete encased ducts and over direct buried ducts after backfill Type B has been placed.

Backfill Material Type B: Black or beach sand, earth or earth and gravel mixture. Material used shall be non-expansive. If earth and gravel, mixture must pass a 1/2‑inch screen and contain not more than 20% rock particles by volume. This fill shall be used all around direct buried conduits.

Manholes, Handholes and Pullboxes: Shall be the type noted on the drawings and shall be constructed in accordance with the applicable details as indicated. Manholes, handholes and pullboxes may be precast or cast-in-place

Precast Manholes, Handholes and Pullboxes: Provide precast manholes, handholes and pullboxes complete with all hardware and accessories (i.e., cable racks, steps, pegs, etc.) and strengths as required for cast‑in‑place manholes, handholes and pullboxes. Identify each casting by having the manufacturers name and address cast into an interior face or permanently attached thereto.

Precast manholes, handholes and pullboxes shall have a smooth trowel finish for horizontal surfaces.

Precast units shall be the product of a manufacturer regularly engaged in the manufacture of precast concrete manholes, handholes and pullboxes.

Precast manholes assembly, including frame and cover shall be rated for AASHTO Class H20 wheel loading, unless otherwise indicated.

Sandwich Isles Communications UH-35 assembly units shall be by Hawaii Precast, per master purchase agreement.

Sandwich Isles Communications Handholes: Shall include 20K traffic load rated cover(s). Covers shall have the “SIC” logo. Handhole cover bolts shall be stainless steel 3/4" Pentahead, unless otherwise noted.

Cast-in-Place Manholes and Handholes: Concrete used shall provide 4000 pounds compressive breaking strength at 28 days maturity. Floor surface shall have a steel trowel finish. Walls shall be of monolithic concrete construction. The complete manhole assembly, including cover, shall be rated for AASHTO Class H20 wheel loading. Submit manufacturer's certificate of compliance with requirements.

Pulling-in Irons: Shall be steel bars bent in the form indicated and cast in the manhole or handhole walls. In the wall they shall be not less than 6 inches above or below, and opposite the conduits entering the manhole or handhole. Pulling-in irons shall be projected into the handhole and manhole approximately 6 inches. Irons shall be zinc coated after fabrication.

Cable Racks: Including hooks and insulators, shall be sufficient to accommodate the cables and shall be spaced not more than 18 inches horizontally. The wall bracket shall be channel or T‑section steel. The hooks shall be of steel or malleable iron and shall be of the removable type. Insulators shall be dry‑process glazed porcelain. The metal portion of racks shall be zinc‑coated after fabrication. Cable racks for use in existing manholes shall be compatible with existing rack supports.

Cast end bells shall be provided; "knock outs" shall not be allowed.

Concrete bricks shall be concrete masonry units conforming to ASTM C 139.

Wires and Cables: Conductors shall be copper, No. 12 AWG minimum; No. 10 AWG and smaller, solid and round; No. 8 AWG and larger, 7 or 19 strands concentric.

Conductors No. 10 and smaller shall be type THWN/THHN, except that ground wire may be type TW. Conductors No. 8 AWG and larger shall be type RHW-USE, XHHW-USE or THW with neoprene jacket. For street light circuits, exterior and below‑grade locations, conductors shall be type RHW‑USE.

Grounding conductors shall be 1/c ‑ #4 bare copper unless indicated otherwise.

Wires and cables for locations and uses not specified above shall be suitable for the purpose and in accordance with the NEC.

Sandwich Isles Communications BM 2(5/8)(8) Housing Ground Assembly Unit: Consists of providing a copper clad ground rod, ground rod clamp and the required length of bare #6 AWG tinned copper ground wire connected to an auxiliary grounding connector (included in the housing assembly unit) within the housing. The first set of parentheses indicates the required diameter of the ground rod, and the second set of parentheses indicates the length of the ground rod.

Connectors and Terminals: Connectors and terminals shall be designed and approved for use with the associated conductor material, and shall provide a uniform compression over the entire contact surface. Solderless terminal lugs shall be used on all stranded conductors. Crimp type connectors will be acceptable; however, the type which makes only one indentation will not be acceptable. The crimping tool shall make a minimum of four indentations around the circumference of the cable. In addition, crimp type connectors to be used on 250 MCM and larger conductors shall have adequate length for two sets of indentations on each half of the connector.

Gaskets shall be of neoprene or Buna N rubber, and shall be a resilient, heat‑resistant and oil‑resistant grade having low compression set and high tear strength.

Cap screws shall be of a cadmium or zinc‑coated steel or of copper‑silicon alloy, and shall be of extra‑large size and closely spaced so as to maintain a tight joint.

Waterproof Connection Kits: Shall be quick disconnect in-line fuse holder (6 ampere fuse link unless indicated otherwise) fused for hot leg. The fuse holder body shall be molded plastic made in two sections where lead side section shall have a captive nut and waterproofing ring. Fuse holder shall be TRON and manufactured by BUSSMANN, or approved equal.

Boxes and Cabinets:

Outlet and Small Junction Boxes: Exposed boxes and weather exposed boxes shall be cast iron, or ferrous alloy, prime painted and enamel finished, with threaded hubs for conduit connection. Steel City 600 series or approved equal.

Large Junction Boxes and Gutters: For dry interior location, the box shall be fabricated from NEC gauge galvanized steel with matching screw‑on type cover, field punched knockouts. For exterior and wet locations, the box shall be galvanized cast iron with matching gasketed cover and threaded hubs for conduit connection. All screws shall be stainless steel. All boxes and gutters shall have minimum dimensions to accommodate pulling per NEC Article 370 requirements

Enclosures and Cabinets: Enclosures and cabinets for panelboards, breakers, and switches shall be NEMA type, fabricated from stainless steel, or as indicated, prime painted and enamel finished according to NEMA specifications. Field painting shall be as specified hereinafter.

Enclosures for individually mounted circuit breakers shall include provisions for locking the enclosure closed and locking the breaker open. The cover of the enclosure shall be interlocked with the circuit breaker operating handle so that the cover cannot be opened unless the circuit breaker handle is in the "OFF" position.

Device and Cover Plates: Plates for exposed and weather exposed boxes (indicated WP on drawings) shall be cast metal with neoprene gasket for sealing against entry of water and moisture into box.

Weatherproof Ground-Fault Circuit Interrupter (GFCI) Duplex Receptacle: Duplex receptacle, for mounting in a standard outlet box, 20 ampere, 125-volt, 3 wires, grounding type with test and reset buttons mounted on the device face. Device shall be capable of detecting a current leakage of 6 milliamperes or greater and tripping per requirements of UL-943 for Class A GFCI devices. Receptacles shall be UL rated for 20 amperes feed through, suitable for use as GFCI protection on a 20 ampere circuit. Pass & Seymour 2091-HG series or pre-approved equal. Includes cast metal outlet box, cast metal device plate with hinged self-closing lid. UL approved for "wet locations". Bryant Electric Co., Hubbell, Arrow Hart, General Electric, and Pass & Seymour equals.

Loadcenters: UL listed, surface‑mounted 120/240V, 1‑phase, 3WSN, copper bussing, with breaker complement as shown, complete with door, trim, 2-ply plastic nameplate, and typed directory. Locks to be keyed alike. Cutler-Hammer, or Square D, General Electric, Siemens equal.

Single pole breakers shall be full module size; two poles shall not be installed in a single module.

Multi-Pole Breakers: Provide common-trip type with single operating handle. Breaker design shall be such that overload in one pole automatically causes all poles to open. Multi-pole breakers of frame sizes 100 amperes or less may consist of single-pole breakers permanently factory assembled into a multi-pole unit having an internal mechanical nontamperable common-trip mechanism and external handle ties.

Individual Circuit Breaker: Shall consist of molded plastic case circuit breaker with toggle operated mechanism and thermal‑magnetic overload trips, in enclosure, type as indicated. Enclosures shall include provisions for locking the enclosure closed and locking the breaker “open”. Interchangeable trip shall be provided when available. Toggle positions "On" and "Off", engraved or embossed on body.

Meter Sockets: Surface-mounted weatherproof type with ratings and provisions as indicated on the drawings. Meter sockets shall be submitted to and approved by Hawaiian Electric Company.

Equipment Disconnect and Fused Switch: Heavy‑duty, horse‑power rated when used as motor disconnect, lever‑operated contacts, spring‑loaded, NEC standard fuse rejection type holders when used with current limiting fuses. Include provisions for locking the switch enclosure "closed" and for locking the switch "open". The cover of the enclosure shall be interlocked with the switch operating handle so that the cover cannot be opened unless the switch handle is in the "Off" position. General Electric Co. type TH, or Westinghouse, Cutler‑Hammer, Square D, Siemens equal.

Nameplates: Laminated plastic nameplates shall be provided for each cabinet. Nameplates shall be 1/8‑inch thick Melamine plastic, black with white center core, 1‑inch high by 2½ inches wide, minimum. Lettering shall be minimum 1/4‑inch high normal block lettering. Equipment designations shall be as indicated on Drawings.

Luminaires: Provided complete with all necessary mounting hardware and accessories, lamps, ballasts, etc., as specified herein and on the Drawings. Ballasts for high-intensity discharge lamps shall be integrally mounted in luminaire housing and be regulated, constant wattage, high power factor type, designed to operate the respective type of lamp indicated. Lamps shall be low mercury content type, and TCLP-compliant, passing the EPA's Toxic Characteristic Leaching Procedure test for non-hazardous waste. Where indicated, luminaire housing shall be provided with 3 wire twist lock receptacle mounted in the housing for individual photo electrical control.

Poles: Shall be vandal resistant, with access handhole, for anchor base mounting, complete with fixture luminaire aperture, hot-dipped galvanized anchor bolts, etc. as indicated on the Drawings. Pole strength design shall be for minimum of 105 MPH winds.

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

GENERAL:

Rules and Permit: The entire installation shall conform to ordinances of the City and County of Honolulu; General Order No. 10, Public Utilities Commission, State of Hawaii; and 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), National Electrical Safety Code (NESC) 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 Engineer before final payment will be made. Costs of permits and inspection fees shall be included in the Contractor's bid price.

Materials and Workmanship: All labor and materials of every kind shall be subject to the approval of the Engineer who shall be afforded every facility for ascertaining the competence of such labor and examining such materials as he may deem necessary. Concealed work shall be reopened at random as directed during formal inspection by Engineer or Electrical or Utility Inspector.

Qualification of Installers: 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.

Construction Methods: Construction shall conform to construction practices as recommended by the American Electricians Handbook by Croft (latest edition), American National Standards Institute (ANSI), Edison Electric Institute, National Board of Fire Underwriters (NBFU), National Electrical Code (NEC), National Electrical Manufacturer's Association (NEMA), National Electrical Safety Code (NESC), National Fire Protection Association (NFPA), Underwriters' Laboratories, Inc. (UL) and applicable instructions of manufacturers of equipment and material supplied for this project.

Inspection: Skill and competency of workmanship shall be subject to the approval of the Engineer, inspectors of the utility companies, Sandwich Isles Communications, Inc., the State of Hawaii and the City and County of Honolulu. Notification for inspection shall be given to the respective companies or agencies three working days in advance of work.

Record Drawings: The Contractor shall maintain an accurate and adequate record of each change as it occurs, regardless of how ordered. As‑built drawings shall be prepared in accordance with project requirements.

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 has been mentioned in both. The Contractor shall not make alterations in the drawings and specification.

Discrepancies and Interpretations:

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 Engineer who will issue any necessary clarification within a time period which does not disrupt the progress of the work.

All interpretation and supplemental instructions will be in the form of a written addendum to the Contract Documents.

Should any discrepancy arise from the failure of the Contractor to notify the Engineer, the higher quality or larger quantity of item shall prevail. Engineer shall make the final interpretation and judgment.

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 the Engineer 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.

Symbols: The standard electrical symbols together with the special symbols, notes and instructions shown on the drawings indicate the work and outlets required and are all to be included as a part of this specification.

Coordination: This specification is accompanied by plans, sections and elevations, and site plans indicating locations of all outlets, controls, service runs, and other electrical apparatus. These locations are approximate and, before installing, the Contractor shall study the adjacent civil utility and landscaping details and actually make the installation in the most logical manner. Any outlet may be relocated within ten feet before installation at the direction of the Engineer. The circuit routing is typical only and may be varied in any logical manner.

Before installation, verify all dimensions, conditions and sizes of equipment at job site. Installation shall be complete in every detail as specified and ready for use.

Work shall conform to ordinances of City and County of Honolulu; latest edition of National Electrical Code (NEC); National Electrical Safety Code (NESC), and Regulations and Standard Practices of Hawaiian Electric Company, Inc., and Sandwich Isles Communications, Inc.

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

American National Standards Institute (ANSI)

Illumination Engineer Society (IES)

National Board of Fire Underwriters (NBFU)

National Electrical Manufacturer's Association (NEMA)

National Fire Protection Association (NFPA)

Underwriters' Laboratories, Inc. (UL)

Applicable instructions of manufacturers of equipment and material supplied for this project.

All metallic materials shall be protected against corrosion. Exposed metallic parts of outdoor apparatus shall be given a rust-inhibiting treatment and standard finish by the manufacturer. All such parts as boxes, bodies, fittings, guards and miscellaneous parts made of ferrous metals but not of corrosion-resistant steel, shall be zinc-coated in accordance with ASTM A153. The Contractor shall not join dissimilar metals that will result in deterioration due to galvanic corrosion.

CONSTRUCTION REQUIREMENTS:

Trench Excavation:

Dimensions and locations of trenches for boxes, transformer and equipment pads, direct buried conduits and ductlines shall be as indicated on Drawings. Trench width and depths shall be sufficient to accommodate proper installation of conduit banks and cables.

Should material at bottom of trench for direct buried conduits not be equal to backfill material Type B, the trench shall be excavated an additional 3" to permit backfilling with Type B backfill.

Where a trench is excavated on slope, sides are to be vertical, and depth measured at lowest side. All measurements are to be based on final grades.

Bottom of trenches to be flat and smooth.

Trenches shall be widened at equipment pads, manhole, handhole and pullbox sites to permit proper entry of conduits.

Trenches shall be approved by respective utility inspectors prior to any ducts being installed.

All excavations for manholes, pullboxes and handholes in excess of the required depths shall be filled with concrete or crushed lava rock.

Excavate 30'-0" on both sides of manhole and handhole locations prior to installation of manhole and handhole. If water, drainage or sewer lines are encountered, provide smooth transitions in conduits and route below the respective utility line.

Sheathing and bracing as required shall be provided to support sides of excavations from cave-ins.

Provide drainage and pumps to keep trenches dry.

Saw cut all edges of existing sidewalks and pavement before trenching.

Excavated material may be placed alongside trench; however, it shall not interfere with utility company work.

Utility companies and Sandwich Isles Communications, Inc. shall be notified a minimum of seventy-two hours before commencing excavations.

Backfill:

Ducts, boxes, and conduit installations shall be approved by the respective inspector from utility company and Sandwich Isles Communications prior to backfilling. All excavations for boxes in excess of the required depths shall be filled with concrete or crushed lava rock.

Should material below utility company and Sandwich Isle Communications’ direct buried conduits not be equal to 3" (thickness) of backfill material Type B, trench shall be deepened by 3", and backfilled with Type B backfill.

Backfilling shall be to finished grades indicated on accompanying Drawings, and matching existing conditions.

Backfill material shall be completely free of wood or other debris. Excavated material may be reused as backfill, providing that it conforms to the requirements of Type A and Type B backfill. For excavated material used to backfill Sandwich Isles Communications ducts, a written soils report of conformance by a licensed third party Geotechnical Engineer is required prior to backfilling using the excavated material.

Type B backfill over conduits shall be installed under the supervision of the respective utility companies' and Sandwich Isles Communications’ inspector.

Backfill material shall be placed in maximum of 8" layers in loose thickness before compacting. Backfill shall be thoroughly compacted with hand or mechanical tampers to 95% of ASTM D1557 maximum dry density. In no case shall tamping be accomplished by using the wheels or tracks of a vehicle.

Backfill over conduit bends at transformer and switchgear pads shall be Type A or better.

Installation of Conduit and Duct Bank:

Bottom of trench shall be clean, smooth, and well‑graded and approved by utility company inspectors.

Saw cut, ream and taper ducts and conduits with manufacturers' approved tool.

Couplings and bells shall be tight to prevent entry of dirt or concrete into ducts and conduits. Stagger the joints of the ducts by rows and layers so as to provide a ductline having the maximum strength.

Provide spacers to maintain proper separation between ducts.

Changes of direction shall not exceed 4 degrees per length of conduit or duct. Radii and turns shall be made with appropriate duct bends and sweeps.

Horizontal bends for Sandwich Isles Communications and communications conduits/ducts shall be constructed with 25-foot minimum radius curves unless indicated otherwise or approved by the respective inspector or Engineer. Angled couplings are not permitted. If factory made bends are to be provided, the contractor shall demonstrate their suitability to the Engineer and inspectors by pulling the respective mandrel completely through the bend prior to installation. Vertical bends for Sandwich Isles Communications and communication conduits/ducts shall be constructed with 20-foot minimum radius curves unless indicated otherwise or approved by the respective inspector or Engineer.

Ducts shall be clean and free from debris, rubbish and water.

After each day's work, provide temporary watertight conduit plugs or seals at the end of conduit banks to prevent entry of moisture, dirt, rubbish, debris, or concrete. Ducts for Sandwich Isles Communications use shall be provided with Tyco, Quadplex Jackmoon Duct Seals and Hole Plugs, Series 136. Duct tape is not acceptable.

Pass a test mandrel conforming to the respective utility company, City & County of Honolulu or the Engineer's requirements, through the entire length of each duct or conduit to test for burrs and obstructions. Unless indicated otherwise, mandrel shall be 14" long and shall have diameter of 1/2" less than inside diameter of duct. Mandrel for Sandwich Isles Communications ducts shall be 12" long and shall have diameter of 1/4" less than inside diameter of duct. Mandrel shall be pulled through each Sandwich Isle Communications duct, after which a brush with stiff bristles shall be pulled through to make certain that no particles of earth, sand, or gravel have been left in the duct. The Sandwich Isles Communications Inspector shall be present during the mandrel testing. If burrs or obstructions are encountered, that section shall be replaced at no additional cost to the Department.

Unless indicated otherwise, install #12 AWG galvanized iron pulling wire or polypropylene cord, having a breaking strength of at least 200 pounds, in each conduit after testing.

For electric utility company ducts, provide cable pulling tape (NEPTCO WP1800P Muletape or approved equal) in each new duct.

For Sandwich Isles Communications ducts, provide duct measuring/cable pulling tape (NEPTCO WP1800P Muletape or approved equal) in each new duct.

Using the duct measuring/cable pulling tape, the Contractor shall measure at least one duct of a common duct run. The distance shall be marked on a copy of the record prints and submitted to the respective Sandwich Isles Communications and/or communication company inspector for record keeping.

Terminate ducts in end-bells where ductlines enter manholes and handholes. Ducts shall enter handholes at 90 degree angle. Ducts entering handholes at angles other than 90 degrees may be permitted, but only when specified by the Engineer.

Apply thin coat of sealing compound on ducts and conduits at couplings and bells.

Conduits stubbed for future connections shall be plugged and marked.

Securely anchor duct banks prior to pouring concrete encasement to prevent ducts from floating. Utility Company and Sandwich Isles Communications duct banks shall be inspected and approved by the respective inspector prior to placing concrete and backfilling.

When pouring concrete, prevent heavy masses of concrete from falling directly on ducts. If unavoidable, protect ducts with plank.

Direct flow of concrete down sides of duct bank to bottom, allowing concrete to rise between ducts, filling all open spaces uniformly.

To ensure against voids in concrete, work a long, flat splicing bar or spatula liberally and carefully up and down the vertical rows of ducts. Mechanical vibrators shall be used for stacked duct banks of three ducts or higher.

Cure concrete for a minimum of 72 hours before permitting traffic and/or backfilling.

Warning Tapes:

6" wide warning tape, red in color with a black imprinted message “CAUTION ELECTRIC LINE BURIED BELOW” shall be placed 12" below finish grade over electric ducts or the concrete jacket for electric ducts for the entire length of ductline installations.

A 3" wide warning tape, orange in color with black imprinted message "CAUTION BURIED FIBER OPTIC CABLE BELOW" shall be placed 12" above all Sandwich Isles Communications ducts or the concrete jacket for said ducts for the entire length of ductline installations.

Concrete and Brick Work:

Concrete, ready mixed according to ASTM C94-98.

Convey concrete from mixer to forms rapidly to prevent segregation. Free drop shall be limited to five feet, unless authorized by inspector.

Placing:

Clean and remove all debris from inside forms and trenches before placing concrete.

Place concrete only on clean damp surfaces, free from water.

Place concrete in forms, in horizontal layers not exceeding 18" thickness.

Place concrete to avoid segregation of materials and displacement of ducts, inserts and reinforcing.

Vibrate structural concrete thoroughly during and immediately after placing to ensure dense watertight concrete.

Prior to placing concrete for utility company ductlines, the Contractor shall obtain the approval of the respective inspector.

Forming:

Forms shall be of good sound lumber with sufficient strength and conforming to shapes and dimensions indicated on Drawings.

Forms shall be treated with non-staining form oil immediately before each use.

Patching: Patch all voids, pour joints and holes before concrete is thoroughly dry. Use mortar of same proportions as original concrete.

Curing: Curing of concrete shall be accomplished by impervious membrane method with liquid membrane compound. Apply two or more coats to obtain a total of one gallon for each 150 square feet of concrete surface.

Reinforcing Steel:

Clean reinforcing of mill or rust scale and form to dimensions indicated.

Install reinforcing in proper locations and secure in place to prevent movement during concrete placing or vibrating.

Concrete Brick and Hollow Concrete Block Work:

Concrete brick and hollow block shall be laid in full bed of mortar, both horizontally and vertically.

Mortar shall be one part (by volume) cement and three parts (by volume) fine aggregate, thoroughly mixed and used when fresh. Retampering will not be allowed. Mortar shall have a minimum 28 days strength of 2,500 psi.

Setting bed shall be of depth required to bring top of blocks flush with finish line.

Manholes, Handholes and Pullboxes:

Boxes shall be installed approximately where shown. The exact location of each box shall be determined after careful consideration has been given to the location of the driveway apron, other utilities, grades, and pavement. Boxes shall be of the type noted on the Drawings and shall be constructed in accordance with the applicable details as indicated. Provide number of cable racks and pulling-in irons as required by the respective utility company. A machine-finished seat shall be provided to insure a perfect joint between frame and cover. Covers shall be machined to prevent rocking within frames. In paved areas, the tops of pullbox, handhole and manhole covers shall be flush to grade with the sidewalk or with the finished surface of the paving, unless otherwise noted. In unpaved areas, the top of handhole covers shall be approximately 1/2 inch above the finished grade; Sandwich Isles Communications’ handholes shall be set approximately 1" above the finished grade.

Precast Handhole and Pullbox Installation: Commercial precast assembly shall be set on 6 inches of level, 90 percent compacted crushed rock fill, 3/4 inch to 1 inch size, extending 12 inches beyond the handhole/pullbox on each side. Granular fill shall be compacted by a minimum of four passes with a plate type vibrator. Provide number of cable racks and pulling-in irons as required by the respective utility company, complete with all hardware including steps and pegs.

Pits for Sandwich Isles Communications precast handholes and manholes are to be flat and smooth, free of rocks, rock chips, hardened lumps of dirt, debris and all deleterious material. A six-inch layer of compacted sand shall be placed as a base for the precast manholes and handholes. Set handhole or manhole on a level area, in the bottom of the excavation, on a 4" layer of crushed rock, for drainage purposes.

Sandwich Isles Communications Manholes, Handholes and Pullboxes:

Provide a 5/8" diameter x 8-foot copper clad ground rod in all handholes and manholes, unless indicated otherwise.

Damp-proofing shall be provided on all exterior precast manhole and handhole walls. All dust, dirt and other deleterious substances shall be removed from the concrete surface. The concrete surface shall be thoroughly dry before the damp-proofing is applied. The concrete surface shall be primed in accordance with the manufacturer’s instructions and two coats of damp-proofing compound shall be applied. Allow the compound to dry thoroughly after priming and in between coats. Do not backfill until the final coat has dried hard.

Before backfilling and compacting, make sure covers are in place and secured. Layer 6" to 8" of backfill material around the manhole or handhole. Tamp each individual layer of backfill material. Continue the layering and “tamping” until final grade is achieved.

Caulk manhole and handhole seams after the unit is assembled using a good quality silicone compound material.

The base of the manhole or handhole shall be placed level, and form work is constructed between the underside of the frame and topside of the manhole or handhole using duct tape, wood strips, cardboard, etc. Some manholes have adjustable frames that are raised to finish grade and secured in position. All voids created during the installation shall be filled with mortar mix, concrete or slurry and allowed to set. Strip forms after sufficient strength has developed. This is especially important where manholes or handholes may be subject to any vehicular traffic.

UH-35 handholes are equipped with jack moon duct plugs to accommodate the UD (1x 3) configurations. All 4-inch duct plugs, however, are to be provided by the Contractor. This unit will accommodate six SDR-11 conduits; therefore, the Contractor is required to provide plugs for the vacant conduit holes in the jack moon.

Ducts ending in manholes or handholes shall be terminated with junior end bells. End bells, terminators or ducts shall be flush to inside wall surfaces; duct extension into boxes is not acceptable. All ducts entering manholes or handholes shall be grouted between conduits and sidewall, inside and out. Verify requirements, complement and arrangement of ducts entering each manhole or handhole and location of duct entrance with the respective utility company and Sandwich Isles Communications, Inc. prior to fabrication and installation of the respective manhole or handhole.

All Sandwich Isles Communications conduits shall enter the handholes on the property side at all times unless otherwise specified by the Engineer. Conduits shall enter handholes at 90 degree angle.

Any exceptions shall only be permitted when specified by the Engineer.

Stub-out conduits from Sandwich Isles Communications handholes to individual residential lots shall be Schedule 40 PVC, 1" diameter and shall be extend 5' beyond property line. Cap and seal end and mark locations with above ground marker.

Electrical Equipment Pads:

Slope of lots/area for concrete equipment pads shall not exceed one‑inch rise in one foot run.

Grade sufficiently around equipment pad area to prevent future filling of lot/area.

Transformer pads may be precast or cast‑in‑place reinforced concrete as indicated on Drawings.

Concrete equipment pads shall be installed level. Pad elevation shall be 2" above the highest grade fronting the pad.

Street Lighting Systems:

Street lighting materials and installation shall be in accordance with the Standard Specifications of the City & County of Honolulu, and as specified herein and on the Drawings.

Street lighting system shall provide illumination along length of project roadways. System shall be provided complete, and be completely tested and ready for use. Furnish computerized footcandle arrays to show illumination levels and distribution along all project roadways.

Street light fixtures shall be mounted with bracket arms oriented 90 degrees to center line of road. Shaft shall be field adjusted for vertical alignment.

Prior to trenching or excavating, structural outlines and center lines of ductlines and street light foundation shall be clearly staked, and approval received from Engineer, City inspectors and utility companies. Staking shall be with steel or wood pegs or paint.

Base foundation for street light standards shall consist of cast-in-place reinforced concrete complete with anchor bolts, sized and placed in accordance with pole manufacturer's requirements and installation template. Length of base shown on Drawings shall be considered as minimum and shall be lengthened to suit the soil conditions and to adequately support the pole and lighting fixture assembly.

After pole is set, grease (or bituminous coat) ends of all anchor bolts, bottom of the anchor plate and all screws and bolts.

Provide duct seal in duct entries into handholes and pullboxes to prevent moisture from entering light fixtures.

Structural Steel and Miscellaneous Metal Work: Structural steel work including bolts, nuts, anchors, pulling-in irons, etc. shall be galvanized by hot‑dipped process after fabrication into largest practical sections.

Installation of Wiring System:

Secondary electrical system materials and installation shall be in accordance with Standard Specifications, and as specified herein and on the Drawings.

Unless otherwise indicated or specified herein, wiring shall consist of single conductor cables installed in conduit/duct in areas where permitted by the NEC and NESC.

Below or in slab, use Schedule 80 PVC, unless indicated otherwise. For distribution feeder banks, provide Schedule 40 PVC with 3" concrete encasement.

Above grade where exposed to damage, use galvanized rigid steel conduit.

Above grade where not exposed to damage, use EMT with UL approved grounding connectors.

Conduit system shall be continuous from outlet to outlet or fitting to fitting so that electrical continuity is obtained between all conduits of the system.

Conduits cut square and inner edges reamed. Butt together evenly in couplings.

Changes in direction shall be made with symmetrical bends or cast metal fittings. Make bends and offsets with hickey or conduit‑bending machine. Do not use vise or pipe tee. Flattened, crushed or deformed conduit not acceptable. Trapped raceways shall be avoided.

Use of running threads not permitted. Where conduits cannot be joined by standard threaded couplings, approved water‑tight conduit unions shall be used. Threadless fittings for electrical metallic tubing shall be of a type approved for the conditions encountered.

Cap conduits during construction with plastic or metal‑ capped bushings to prevent entrance of dirt or moisture. Swab all conduits and dry before installing wires.

Pull wires shall be placed in all empty conduits for ten feet in length and as indicated.

Install insulating bushings and two locknuts on each end of every conduit run at enclosures and boxes. Provide grounding bushings as required.

Conductors:

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 may be used as a lubricant for drawing wires through conduit. No other means of lubricating will be allowed.

Form neatly in enclosures and boxes for minimum of crossovers. Tag all feeders.

Thoroughly swab out existing ducts to remove foreign material before the pulling of cable.

Splicing of Wire and Cable:

Splices made according to NEC Article 110.

Splices for 600 Volt Class Cables: The conductors shall be joined securely both mechanically and electrically by the use of solderless or crimp type connectors with properly sized tools.

Splices for cables No. 10 AWG and smaller in underground systems shall be made only in accessible locations using a compression connector on the conductor, taped watertight.

Splices for cables No. 8 AWG and larger in underground systems shall be made only in accessible locations using a compression connector on the conductor and by insulating and waterproofing suitable for continuous submersion in water.

Cable Terminations: Protect terminations of insulated power and lighting cables from accidental contact, deterioration of coverings and moisture by the use of terminating devices and materials.

Install all terminations of insulated power and lighting cables in accordance with the manufacturer's requirements.

Make terminations using materials and methods as indicated or specified herein or as designated by the written instruction of the cable manufacturer and termination kit manufacturer.

Protection of Wire and Cable Ends: The ends of wire and cables in handholes, pullboxes, and in other wet locations, as defined by the NEC, that are not to be spliced or connected to equipment shall be protected from moisture and other damage.

The ends of wires and cables shall be protected by applying not less than six half‑lapped wraps of electrical insulating tape beginning three inches from the end of the wire or cable and continuing over the exposed conductor to form a watertight seal.

The ends of wires and cables that are to be left unspliced or unconnected temporarily during construction shall be protected to prevent moisture from getting into the cable.

Finishing:

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.

Wipe clean all exposed raceways and enclosures with rag and solvent. Unfinished raceways and enclosures shall be prime-painted and finished to blend into background. (Do not cover nameplates). Factory finished enclosures shall not be painted.

Miscellaneous Details:

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 the Engineer. Need for remedial work determined by Engineer as attributable to poor coordination and workmanship shall be cause for reconstruction to the satisfaction of the Engineer.

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.

Furnish necessary test equipment and make all test necessary to check for unspecified grounding, shorts and wrong connections. Correct faulty conditions, if any.

Provide nameplate for service equipment, loadcenters, enclosed circuit breakers, etc.

Tag all empty conduit in cabinets and boxes giving destination. Use fiber disc tags in bushing.

EXISTING UNDERGROUND UTILITIES:

Underground utilities indicated on plans are approximate in location. It is not the intention of plans to imply that all existing utilities are drawn and located. It shall be the responsibility of Contractor to coordinate locations of existing utilities prior to doing any excavation work. Any damage to existing utilities shall be repaired by Contractor at no cost to the Department.

CLEANING AND REPAIRING:

During the progress of work, all rubbish, waste lumber, displaced materials, etc. shall be removed as soon as possible and upon completion of the work, Contractor shall remove from Owner's property and from all public and private property, at his own expense, all temporary structures, rubbish and waste material resulting from his operations.

The Contractor shall restore all removed or damaged pavement, gutters, curbs, sidewalks, sign posts, trees and landscape damaged by his operations to as near their original condition or better. Materials used for restoration work shall be equal to or better in quality than the materials the Contractor will replace, and matching in thickness, texture, and color whenever applicable. The grades of the restored surfaces shall conform to the existing grades.

TESTS:

Test complete installation and correct all defects of material and workmanship as well as all malfunctions of equipment and systems prior to final inspection at no increase in contract amount. All wiring shall be tested to ensure proper operation according to functions specified herein; and in other sections of these specifications, on drawings and conform to standard industry practices.

Ground Resistance: Ground resistance measurements of each ground rod shall be taken and certified by the Contractor. 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. Upon completion of the project, the Contractor shall submit in writing to the Engineer, 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.

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 from phase to phase and phase to neutral. All test results shall be recorded and submitted.

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.

END OF SECTION