STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS

Land Development Division

OCTOBER 30, 2018
Date

ADDENDUM NO. 1
TO
INVITATION FOR BIDS

IFB-19-HHL-001
ANAHOLA FARM LOTS WATER PROJECT, PHASE II
WATER TANK REPLACEMENT AND FACILITY IMPROVEMENTS

Notice to All Prospective Offerors

This ADDENDUM is hereby made a part of the contract documents for **ANAHOLA FARM LOTS WATER PROJECT, PHASE II WATER TANK REPLACEMENT AND FACILITY IMPROVEMENTS, IFB-19-HHL-001**, and it shall amend the said contract documents as detailed within this ADDENDUM.

APPROVED:

Norman L. Sakamoto, Administrator
Land Development Division
Department of Hawaiian Home Lands

Please execute and immediately return the receipt below to the Department of Hawaiian Home Lands via facsimile to: **(808) 620-9299, Mr. Wayne Nakamura, Land Development Division.**

Receipt of Addendum No. 1 for the **ANAHOLA FARM LOTS WATER PROJECT, PHASE II WATER TANK REPLACEMENT AND FACILITY IMPROVEMENTS**, Invitation for Bids No.: **IFB-19-HHL-001**, is hereby acknowledged.

Signature: _____ _____
Print Name: Title

_____ _____
Name of Firm/Company Date

ADDENDUM NO. 1

October 30, 2018

IFB-19-HHL-001
ANAHOLA FARM LOTS WATER PROJECT, PHASE II
WATER TANK REPLACEMENT AND FACILITY IMPROVEMENTS

INCLUSIONS

This Addendum No. 1 shall incorporate the following amendments to IFB-19-HHL-001:

1. Addendum No. 1 Cover Page;

2. Addendum No. 1 Inclusions:

   Section 4. Technical Specifications

4. TECHNICAL SPECIFICATIONS

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SECTION 304 - MECHANICAL AND ELECTRICAL

The following shall modify and supplement Division 300, Section 304, "Mechanical and Electrical" of the Water System Standards, 2002.

304.01 MECHANICAL GENERAL CONDITIONS

A. INTENT OF SPECIFICATIONS AND DRAWINGS: Specifications and Drawings complement each other and what is specified, scheduled, or mentioned by one shall be binding as if called for by both. Specifications and Drawings are intended to specify minimum performance, nature, quantity and quality of the required work.

Before proposing, Contractor shall visit project site to verify existing conditions and dimensions and carefully review Specifications and Drawings. Any error or omissions shall be reported to the Officer-in-Charge at least five days before the proposal opening date for interpretation or clarification.

The provision of any item of work that is shown on the drawings or specified shall be the overall responsibility of the general contractor. In the event that any work under this contract is not clearly or specifically defined as belonging to, or being the responsibility of any particular trade or subcontractor, it shall be the responsibility of the general contractor to assign and coordinate the provision of such work to the appropriate subcontractor in accordance with generally accepted construction industry practice and/or applicable General Contractors Association of Hawaii policy and procedures. Specific electrical items of work normally provided by the mechanical contractor and installed by the electrical contractor shall be governed by the aforementioned industry practice or policy. The resolution of any disputes between subcontractors, vendors, etc. and the completion of any specified or indicated work shall be the responsibility of the General Contractor.

Where equipment is removed from existing piping and replaced with new, it shall be the Contractor's responsibility to ensure proper fit. The Contractor shall provide the necessary adapters, spacers, spool, piping adjustment, etc. to accomplish a complete and proper piping assembly in accordance with normally accepted industry standards.

Contractors should read the Specifications and Drawings carefully and note that written approval from the Officer-in-Charge must be obtained prior to performing the work. The Officer-in-Charge reserves the right to reject any work that is performed without approval and require the Contractor to redo those services to the satisfaction of the DHHL at no additional cost.

B. QUALITY OF MATERIALS. All materials and equipment installed as part of any permanent construction shall be new, unless otherwise specified. The Contract contemplates the use of first-class materials and equipment throughout the performance of the Contract, and it is agreed that any material for which no particular specification is given shall be of the highest quality of its class or kind. For the purpose of this subsection, "new" shall mean purchased specifically for the project for which award was made and does not include used or refurbished parts, materials and/or equipment. The Officer-in-Charge reserves the right to request any type of documentation and/or information from the Contractor demonstrating to the DHHL's

satisfaction that any material or equipment installed as part of any permanent construction is new. For motors only, the motor shall also be manufactured within the previous two years of the date of this contract and the manufacturer's certificate of compliance shall be provided for DOW approval. All materials specified herein and as specified in the Water System Standards that are in contact with potable water shall be "Lead Free" as required by the current Reduction of Lead in Drinking Water Act and shall be in compliance with NSF/ANSI 61, Annex G and NSF 372.

C. SUBSTITUTE MATERIALS AND EQUIPMENT: Brand names, manufacturer's names, and catalog numbers indicate standard of design and minimum quality required. Substitute material/equipment may be used if qualified by written permission from the Officer-in-Charge. List of substitute material together with qualifying data shall be submitted for approval at least ten days before proposal opening.

Submission shall be as follows:

EXAMPLE:

ITEM	MANUFACTURER AND CATALOG NUMBER SPECIFIED	SUBSTITUTE MANUFACTURER AND CATALOG NUMBER	VARIATION FROM THE SPECIFICATIONS
VALVE	Joe Doe - No. 3200	King – 2200	None

Qualifying data shall include four sets of catalog cuts, performance curves (for pumps), shop drawings and specifications to show equality with materials specified herewith. Data provided shall be complete and adequate for the Officer-in-Charge to evaluate the substitute material/equipment for comparable quality, performance, etc. Any variations shall be specifically identified and justified for substitution. Incomplete submittals will be rejected.

D. DEPARTURES FROM DRAWINGS AND SPECIFICATIONS: Departures resulting from substitution of materials or systems shall be accompanied by appropriate changes in all affected work of every trade. Such changes shall be at no increase in the contract amount and shall be the responsibility of the subcontractor or supplier responsible for the departures. C hanges proposed by the Contractor shall be based on a system approach and will be allowed if implemented without decrease in quality, performance, operations, or increase in utility space to install the equipment. Such departures shall be submitted and noted in shop drawings for approval by the Officer-in-Charge. The General Contractor shall be responsible to coordinate, approve, and select systems that do not impose unaccounted for impact on any work.

E. SUBMITTALS: Provide submittals when specified in the individual sections herein. Submittals shall identify the project name and number, contractor, consultant, and submittal date:

1. Data Sheets: The Contractor shall submit all data sufficient to demonstrate conformance to the requirements of the Mechanical Work. Submittals shall

include but not be limited to manufacturer's name, catalog number, materials of construction, dimensions, and electrical and physical characteristics of the equipment.

2. Shop Drawings: The Contractor shall submit 22"x36" detailed shop drawings of all equipment and all materials required to complete the project. Material or equipment shall not be delivered to the job site until the Contractor has the approved shop drawings.

3. MSDS Sheets: The Contractor shall submit MSDS sheets for all materials used in this project. Contractor shall perform all work in accordance with the recommendations of the MSDS, including all tests.

4. Test Reports: The Contractor shall submit test reports with all test data procedures and descriptions as specified herein.

5. As-Built Drawings: The Contractor, at no additional cost shall submit one (1) reproducible set of the contract drawings corrected to reflect the "as-built" conditions of the installation to the Department of Water. In addition, the Contractor shall submit AutoCAD files for the revised as-built drawings. Drawings shall be 22" x 36" and include floor plans, sectional views, wiring diagrams and dimensions and details of all construction. All clearances and required access shall be shown on the drawings. Materials, manufacturers, and model numbers shall be indicated for all components. All items shall be cross-referenced with the Operations and Maintenance Manual.

6. Certificates: The Contractor shall submit certificates indicating acceptance and compliance with regulations of agencies having jurisdiction or confirming recorded test data as specified herein.

7. Operations and Maintenance Manuals: The contractor shall submit hard bound operation and Maintenance Manuals and CD with adobe Acrobat searchable PDF files.

   The manual shall identify project name and number, Contractor, Consultant, date, and all equipment provided. Equipment manufacturer's name and contact information, model number and serial number, capacity, shall be provided.

   Provide edited manufacturer's literature, parts list and assembly diagrams, control and wiring diagrams, operating instructions, maintenance instructions, maintenance schedule, and installation instructions.

F. PAINTING: The Contractor shall be responsible for painting of all new unfinished surfaces and existing finished surfaces when directed in accordance with the Water System Standards.

G. MEASUREMENT AND PAYMENT:

1. Measurement: The mechanical work items in the proposal shall be considered sufficient to complete the work in accordance with the plans and specifications. Any portion of the work not listed in the bid form shall be deemed to be a part of the item for which it is associated and shall be included in the cost for that item. Payment for that item shall be considered to cover the cost of all labor, material, equipment, and the performance of all operations necessary to complete the work in its entirety, ready for use. Where work is to be performed at a lump sum price, the lump sum shall include all operations and elements necessary to complete the work. No payment shall be made for any material wasted, unused, rejected, or used for the convenience of the Contractor, including the labor and equipment cost associated thereof.

2. Payment: Payment for the furnishing and installing of mechanical equipment, incidentals, and all work included in the mechanical plans and specifications shall be made at the lump sum bid price indicated in the Bid Proposal, and shall be full compensation for all work in connection therewith, complete and finished, fully tested and operational, in accordance with the plans and specifications.

304.01.A MECHANICAL WORK DESCRIPTION

A. DESCRIPTION: The Contractor shall furnish and install a new vertical turbine pump, packaged line booster pump system, hydropneumatic booster pump system, and sodium hypochlorite system, including necessary demolition work, instrumentation and controls, piping, valves, gauges, testing and start up services to ensure all mechanical equipment is operating satisfactorily, including any related work necessary to close out the mechanical portion of the project.

The provision of any item of work that is shown on the drawings or specified shall be the overall responsibility of the general contractor. In the event that any work under this contract is not clearly or specifically defined as belonging to, or being the responsibility of any particular trade or subcontractor, it shall be the responsibility of the general contractor to assign and coordinate the provision of such work to the appropriate subcontractor in accordance with generally accepted construction industry practice and/or applicable General Contractors Association of Hawaii policy and procedures. Specific electrical items of work normally provided by the mechanical contractor and installed by the electrical contractor shall be governed by the aforementioned industry practice or policy.

B. SEQUENCE OF WORK: The following is a description of the sequence of work to be followed.

1. Notify the Officer-in-Charge at least one (1) week prior to start of work to allow DHHL to make necessary preparations for contractor's work.

2. Install Package Line Booster Pump System

   a. Coordinate with other trades before installing unit. The reinforced concrete pad, connecting underground suction and discharge piping, and underground electrical wiring should be in place prior to installing this pump unit.
   b. Install package line booster pump system, in place complete.
   c. Coordinate with the Officer-in-Charge prior to system start up and testing. Provide system start up and testing services. After system is approved and fully operational, provide necessary training for DHHL and Aqua Engineers personnel.

3. Install Hydropneumatic Booster Pump System

   a. Coordinate with other trades to ensure space is prepared to receive the system. All connecting pipes and wiring shall be installed and available for necessary connections and hook ups.
   b. Install hydropneumatic tank, pumps, piping, valves, gauges, and appurtenances, in place complete.

c. Coordinate with the Officer-in-Charge prior to system start up and testing. Provide system start up and testing services. After system is approved and fully operational, provide necessary training for DHHL and Aqua Engineers personnel.

4. Install Sodium Hypochlorite System

a. Coordinate with other trades to ensure space is prepared to receive the system. All connecting pipes and wiring shall be installed and available for necessary connections and hook ups.
b. Install chlorine solution tank, metering pump, piping, valves, instruments, and appurtenances, in place complete.
c. Install chlorine residual analyzer, including connecting piping, valves, fittings, tubing, and appurtenances, in place complete.
d. Coordinate with the Officer-in-Charge prior to system start up and testing. Provide system start up and testing services. After system is approved and fully operational, provide necessary training for DHHL and Aqua Engineers personnel.
e. Install emergency eye wash and shower, including connecting piping, valves, and appurtenances, in place complete.

5. Install Vertical Turbine Deep Well Pump

a. Remove and salvage existing deep well pump and motor unit.
b. Remove existing deep well pump discharge piping, valves, and appurtenances as shown in the plans. Salvage any items as directed by the Officer-in-Charge. The existing concrete pump and discharge pipe foundation and pedestals will be protected and reused. The Contractor shall repair any damaged surfaces that were the result of the Contractor's operations.
c. Install new vertical turbine pump and motor unit, in place complete.
d. Install new well pump discharge piping, valves, fittings, gauges, instrumentation, and appurtenances, in place complete.
e. Coordinate with the Officer-in-Charge prior to pump start up and testing. Provide pump start up and testing services. After pump is approved and fully operational, provide necessary training for DHHL and Aqua Engineers personnel.

C. WARRANTY: The Contractor shall provide a one (1) year warranty against all defects for the following:

1. All equipment and materials supplied and installed in accordance with this section.

2. Workmanship used to perform the work covered by this section.

The warranty period shall commence from the date of final acceptance of the project by the DHHL. Should any trouble develop within the warranty period

specified above, due to defective workmanship, equipment or materials, the trouble shall be corrected as approved by and at no cost to the DHHL.
If the DHHL elects to operate the equipment prior to final acceptance of the project, the warranty shall commence on the date the equipment is operated and used by the DHHL.

304.01.B VERTICAL TURBINE PUMP

A. DESCRIPTION: This section of the specification covers the furnishing, installing and testing of one new vertical, motor-driven, product-lubricated line shaft deep well turbine pumping unit. The pump shall conform to AWWA E102-06 specifications.

B. PUMPING UNIT CHARACTERISTICS:

1. Pump Characteristics:

a. Number Required: One (1)

b. Pump Rated Capacity and Head at 1750 rpm:

1) 700 gpm at 420 ft. head (Pump efficiency not less than 85.0%)

c. Pump Performance Characteristics:

1) 0 gpm at 550 ft. head maximum (shutoff head)

2) 500 gpm at 473 ft. head (Pump efficiency not less than 78%)

3) 600 gpm at 451 ft. head (Pump efficiency not less than 83%)

4) 700 gpm at 420 ft. head (Pump efficiency not less than 85.0%)

5) 800 gpm at 371 ft. head (Pump efficiency not less than 83.0%)

6) 900 gpm at 325 ft. head (Pump efficiency not less than 81.0%)

d. Pump used to dimension plans and specify pump performance characteristics:

National, Model J11LC (1770 rpm, 7-Stages, 8.813" diameter impeller)

C. MOTOR CHARACTERISTICS:

1. Number Required: One (1)
2. Electrical Motor Rating: 125 HP
3. Power: 3-Phase, 60 Hertz, 480 Volts
4. Minimum Full Load Motor Efficiency: 90%

D. WELL DATA:

1. All elevations refer to mean sea level.
2. Casing Inside Diameter: 14 inches
3. Length of Solid Steel Casing: 328 feet
4. Length of Screen Casing: 123 feet
5. Elevation of Bottom of Solid Steel Casing: 18.0 feet, MSL
6. Elevation of Bottom of Screen Casing: (-)105.0 feet, MSL
7. Elevation of Bottom of Pump Bowl Assembly: (-) 39.5 feet, MSL
8. Elevation of Bottom of Pump Column Assembly: (-) 33.6 feet, MSL
9. Elevation of Centerline of Discharge Flange: 345.9 feet, MSL
10. Length of Pump Column and Pump Bowl Assembly Measured from Centerline of Discharge to Bottom of Pump Bowl Assembly: 385.4 feet
11. Elevation of Static Water Level in well: 11.5 feet, MSL
12. Drawdown: 11± feet at 700 gpm (Note: drawdown did not stabilize)

E. DEEP WELL PUMP DESCRIPTION: The pump shall be as manufactured by National Pump Company, or approved equal and meet "Quality Management Standards", ISO 9001:2015 and NSF 61, Annex G and NSF 372 Certified. All materials in contact with potable water shall be “Lead Free” as required by the current Reduction of Lead in Drinking Water Act. Discharge head assembly shall be designed to support the weight of the motor, column, pump, and all hydraulic forces.

1. Bowls: The pump bowls shall be close-grained cast or ductile iron having a minimum tensile strength of 30,000 pounds per square inch, free from blow holes, sand holes and all other faults; accurately machined and fitted to close dimensions. Bowls shall be porcelain enamel lined. Porcelain enameled finish shall be smooth, nominal 8 mils thick, and shall be free of defects such as thin spots, blister, chipping, spray sagging, air bubbles, fish scaling and pinholes. The manufacturer shall provide the Officer-in-Charge with pressure ratings of bowls at shut-off conditions as well as full load.

2. Pump Shaft: The pump shaft shall be of polished ASTM A 582, Grade 416 stainless steel minimum, and shall be supported by suitable non-corrosive bearings on both sides of each impeller and positive means must be provided for water lubricating each bearing. The shaft shall be provided with a means to accurately locate the shaft with respect to the bowls during

assembly of the bowl unit. The case bearings shall be bronze or other approved material.

3. Impellers: Impellers shall be the fully enclosed type of bronze cast from new ingot material of heavy construction, finished all over, accurately fitted and perfectly balanced both statically and dynamically. (Hydraulic "balanced thrust" impellers shall not be permitted.) They shall be locked securely to the impeller shaft with a tapered collet lock bushing or other means. The bowls and impellers shall be designed with open and smooth passages to secure efficient operation and to prevent air locking or sand locking. The impellers shall be so designed as to permit axial adjustment to compensate for wear. The clearance calculations shall be submitted to the Officer-in-Charge before the pump is installed.

   Sand collars, locked securely to the shaft, shall be bronze, ASTM B505 alloy C83600 to prevent dirt, sand or other foreign particles from entering the shaft bearings.

4. Suction Case: The suction case shall connect the strainer to the pump bowls and house the bearing which supports the bottom portion of the impeller shaft. The suction case shall be of cast iron conforming to ASTM A 48, Class 30, properly designed to guide water from the well to the first impeller with minimum friction loss.

5. Strainer: The strainer shall be of the cone type. The strainer shall be directly attached to the lower end of the suction case or attached to the suction case by means of a short length of suction piping with suitable couplings. The suction piping shall not exceed one foot in length and shall be of identical size and construction as the discharge column piping.

   The strainer shall be of stainless steel, Type 316. The net inlet area of the strainer shall not be less than 200 square inches. The length of the strainer shall be 22-1/4 inches. Strainer shall be constructed of No. 7 round wire forming a screen with 1/4 inch slot width. A half-inch neoprene washer shall be inserted for vibration control.

6. Discharge Column Assembly:

   The discharge column assembly shall consist of the discharge column pipe, combination column couplings, line shaft, and line shaft couplings.

   a. Discharge Column Pipe. The column pipe shall be 8-inch minimum inside diameter, 24.70 pounds per foot steel pipe conforming to ASTM A 53, Grade B, coated with zinc inside and outside by the hot-dip process with no less than 1.8 ounces per square foot. Each section of column shall have 8 threads per inch, 3/16 inch taper with ends accurately machined to form a butt joint to insure an accurately assembled column length and perfect alignment. The pipe shall be furnished in 5 feet top and bottom column assemblies and the remainder in interchangeable sections of not more than 10 feet in length. The column size shall be such that friction loss will not exceed 1.5 ft. per 100 ft. at the rated capacity of the pump.

b. Combination Column Couplings. Each discharge column pipe section shall be equipped with a cast iron combination column coupling with an alignment spider cast integrally of the same material. Each spider shall have its own water lubricated rubber bearing properly fitted to maintain the alignment of the shafting and to prevent vibration.

c. Line Shaft. The line shaft shall connect the head shaft to the impeller shaft. The line shaft shall be ground and polished ASTM A276, Type 416 stainless steel with Type 304 stainless steel, hard chrome or Monel metal sleeves at the location of each bearing. The size of the shaft shall be no less than that determined by ANSI B58.1 and shall be such that elongation due to hydraulic thrust will not exceed the axial clearance of the impellers in the pump bowl.

The line shaft shall be furnished in interchangeable sections of not more than 10 feet in length. To insure accurate alignment of the shafts, they shall be straight within 0.005 inch total indicator reading for a 10 foot section; the butting faces shall be machined square to the axis of the shaft.

d. Line Shaft Coupling. The individual sections of the line shaft shall be connected with ASTM A582, Type 416, stainless steel couplings. The coupling shall be designed with a safety factor of 1-1/2 times the shaft safety factor and shall be threaded to tighten during pump operation without distortion or vibration.

7. Discharge Head Assembly:

The discharge head assembly shall consist of a head base plate, surface discharge head and head shaft.

a. Head Base Plate. A base plate shall be of sufficient area and thickness to support the weight of the entire pumping unit and motor, shall be furnished for mounting the surface discharge head. The base plate shall be of steel plate accurately machined, drilled and rabbetted on one side to fit the surface discharge head and shall be properly fitted as a permanent part of the concrete pump foundation to prevent the entrance of surface water into the well. The opening of the base plate shall be of sufficient size to allow the installation of the pump bowl assembly, the discharge column assembly, and the well level recorder pressure sensor assembly.

b. Surface Discharge Head. The surface discharge head shall support the driver, the discharge column assembly and the pump bowl assembly and shall discharge water from the discharge column assembly. The discharge head shall be accurately machined, of cast iron ASTM A48, Class 30, free from blow holes, sand holes and all other detrimental defects. The discharge head shall incorporate a discharge elbow having an above ground, ANSI B16.1, Class 125, flanged outlet.

The discharge head shall have one (1) 1-1/4" N.P.T. tap in the space between the well casing and the pump discharge column to allow passage of the well level recorder pressure sensor assembly. One (1) 1-1/2" pre-lubrication connection shall also be provided.

The discharge head shall be provided with the manufacturer's mechanical seal assembly. Stainless steel removable screens shall be provided at the coupling guard openings.

c. Head Shaft. The head shaft shall connect the line shaft to the driver. The head shaft shall be of ASTM A276, Type 416 stainless steel which shall not exceed 10 feet in length. A suitable method shall be provided, on the top of the head shaft, to allow impeller adjustment by means of an adjusting nut. The nut shall be provided with a positive locking device. Straightness tolerance shall be given under the "Line Shaft" section of these specifications.

d. Mechanical Seal. Provide Chesterton 155, or approved equal.

8. Sounding Tube for Deep Well Pump:

Sounding tubes for measuring water levels in the well shall be furnished and installed by the pump contractor together with sufficient stainless steel straps (minimum width 3/4-inch) and rubber cushions to fasten the tubes to the discharge pipe column at intervals not exceeding 10 feet. Tubes shall be suitable diameter to enclose the well level transducer and cable. Tubes shall be polyvinyl chloride pipe, schedule 80 with standard threaded connections (solvent welding male/female adapters will not be acceptable). The tube shall be accurately measured as to depth of setting when installed. The lower end of the tube is to be set at the top of the bowl assembly. All joints shall be sealed with teflon tape or an approved equal. Submerged length plus 20 feet above static water level shall be Type 304 stainless steel ASTM A312 or ASTM A269 with flush joint ends.

F. PUMPING UNIT EFFICIENCY TEST REQUIREMENT:

1. Minimum guaranteed overall efficiency of pumping unit at rated capacity and head: 7 0 %

G. MOTOR:

The motor shall be a vertical hollow shaft, 1800 rpm, 3 phase, 60 hertz, 460 volt, cast iron, normal torque, premium efficiency, low starting current, squirrel cage induction motor with TEFC enclosure and shall conform to the standards of the National Electrical Manufactures Association and the American Institute of Electrical Engineers. Motor shall be General Electric, US Motors, or approved equal.

The motor shall be designed to operate at an ambient temperature of 40 degrees C with a temperature rise of not more than 90 degrees C at the rated horsepower of the motor.

Insulation shall be inverter-duty rated, NEMA class B with an added process for improved weather protection. Motor windings shall be encapsulated or sealed with epoxy according to NEMA standards by an insulation system such as General Electric "Custom Polyseal" or approved equal. Trade name for added process shall be stamped on the motor nameplate. The motor shall be "high efficiency" rated.

All openings shall be furnished with corrosion-resistant, stainless steel screens. Each motor shall be furnished with 120-volt space heaters which shall operate only when the motor is not running.

Motor shall have a 1.15 service factor. The motor rating shall be such that the nameplate horsepower will not be exceeded for any pump load for the entire pump head range from atmospheric pressure at the discharge head to shut-off head and at no place on the pump curve shall the loading exceed the service factor.

Motor shall be provided with an extra heavy thrust bearing. Bearing shall be sized to support a thrust load equal to calculated thrust at shut-off head or 1.5 times calculated thrust at design head, whichever is larger, with a minimum life of one (1) year (8,760 hours). The Contractor shall submit thrust load calculations for approval by the Officer-in-Charge prior to ordering the motor.

Motor shall be supplied with non-reverse coupling designed to prevent reverse rotation when the unit is shut down. Motor shall be provided with hose bibb installed on motor oil drain port.

H. SPARE PARTS:

1. The pumping unit shall be supplied with the following:

   a. One (1) Spare Chesterton 155 Mechanical Seal.
   b. One (1) Spare 125 hp Motor for deep well pump.
      Provide storage container for the spare motor that will facilitate periodic maintenance of the motor.

I. PRELIMINARY SUBMITTALS:

The Contractor shall submit six (6) copies of the following to the Officer-in-Charge for review and recommendation. The DHHL shall also review and approve the pump unit prior to its ordering:

1. Preliminary Pump Characteristic Curve. (Overall Characteristics)

   The preliminary pump characteristic curves shall show the head, efficiency and brake horsepower vs. capacity of the pump to be furnished.

2. Pumping Unit Specifications.

   The Contractor shall submit complete specifications for the pump and motor he proposes to furnish. All pumping unit materials shall be specified.

3. Thrust Load Curves.

The contractor shall supply a curve showing the thrust load from the shut-off head to the lowest head specified. The rating of the thrust bearing being furnished with the motor shall be shown as part of the data on the curve.

4. Bowl Assembly Data.

Bowl Assembly data shall contain thrust factor, available lateral end clearances, all required clearances and computations of relative shaft stretch at shut off head and at other point specified.

5. Data Sheets.

The Contractor shall complete a copy of the attached pump and motor data sheets.

PUMP DATA SHEET

MANUFACTURER:_____
PUMP NO.: _____
OPERATING PUMP SPEED: _____RPM
NUMBER OF STAGES: _____
DIAMETER: _____INCHES
THRUST CONSTANT (K): _____
SHAFT DIAMETER: _____INCHES
SHAFT ENCLOSING TUBE: _____INCHES
DISCHARGE COLUMN: _____INCHES
SUCTION SIZE: _____INCHES
DISCHARGE HEAD MODEL NO: _____
IMPELLER WEIGHT (EACH): _____LBS.

TOTAL LENGTH OF PUMP: _____FEET_____INCHES
(Top of Pump Bowl to Bottom of Suction Strainer)

TOTAL WEIGHT OF PUMP: _____LBS.
(Including column, shaft, & tubing; excluding discharge head)

PUMP LABORATORY EFFICIENCIES:
AT DESIGN CONDITIONS:
FIELD HEAD RANGE _____TO_____FEET
MINIMUM CAPACITY: _____GPM
MINIMUM BOWL EFFICIENCY: _____%
MINIMUM OVERALL EFFICIENCY: _____%
AT MAXIMUM OVERALL EFFICIENCY:
EFFICIENCY: _____%
CAPACITY: _____GPM
TOTAL DYNAMIC HEAD: _____FEET
OPERATING HORSEPOWER: (SUBMIT CALCULATIONS)
AT DESIGN HEAD RANGE: _____H.P.
AT SHUT-OFF HEAD: _____Ft. _____H.P.
AT ZERO HEAD AT DISCHARGE HEAD: _____H.P.

TOTAL DOWNTHRUST: (SUBMIT CALCULATIONS)
AT DESIGN HEAD RANGE: _____LBS.
AT SHUT-OFF HEAD: _____LBS.

SHAFT STRETCH: (SUBMIT CALCULATIONS)
AT DESIGN HEAD RANGE: _____INCH
AT SHUT-OFF HEAD: _____INCH
MAXIMUM LATERAL ALLOWED: _____INCH

MOTOR DATA SHEET

MANUFACTURER:_____
VERTICAL OR HORIZONTAL, SOLID OR HOLLOW SHAFT: _____
COUPLING: _____
TYPE: _____
TYPE OF ENCLOSURE: _____
NAMEPLATE HORSEPOWER: _____H.P.
RPM AT FULL LOAD: _____RPM
PHASE: _____PHASE
FREQUENCY: _____HERTZ
VOLTAGE: _____VOLTS
FULL LOAD AMPERES: _____AMPS
LOCKED ROTOR CURRENT: _____AMPS

POWER FACTOR:
-100% LOAD: _____
- 75% LOAD: _____
- 50% LOAD: _____

EFFICIENCY:
-100% LOAD: _____PERCENT
- 75% LOAD: _____PERCENT
- 50% LOAD: _____PERCENT

NEMA CODE LETTER: _____
FRAME DESIGNATION: _____
WEIGHT: _____LBS
LENGTH: _____INCHES
SERVICE FACTOR: _____

NAMEPLATE TEMPERATURE RISE DEGREE C/AMBIENT TEMPERATURE
DEGREE C: _____
INSULATION CLASS AND ADDED PROCESS: _____

THRUST BEARING:
SLEEVE OR BALL: _____
TYPE OF LUBRICATION: _____
CAPACITY
- UP: _____LBS
- DOWN: _____LBS

SPACE HEATERS:
NO: _____
VOLTS: _____
WATTS: _____

GUARDS - MATERIALS: _____

J. FACTORY LABORATORY PUMP TEST:

The Contractor shall submit to the Officer-in-Charge six (6) factory certified copies of the performance curves and test data sheets of a factory laboratory running test conducted for each bowl assembly furnished and witnessed by an independent engineering firm. The curves and data sheets must be approved by the DHHL before the pump is shipped. The running test shall be conducted in accordance with the latest edition of ANSI/HI 14.6 to show that the specified conditions can be met by the bowl assemblies furnished in accordance with 1U acceptance grade. The performance curve shall show the head-capacity, efficiency-capacity and required brake horsepower capacity curves for each bowl assembly.

The Contractor shall make the necessary changes and replacements to obtain the required performance characteristics before the pumping unit including pump motor, leaves the factory. All costs for such changes and replacements will be paid for by the Contractor. The cost for all laboratory tests shall be paid for by the Contractor.

K. CERTIFICATION OF MATERIALS:

1. Before the pumping unit is installed, the Contractor shall submit to the Officer-in-Charge six (6) copies of the certificates verifying that the materials used in the manufacture of the pump assembly, including all pump components, conform to these specifications.

L. LAYOUT DRAWINGS:

Six (6) sets of pump and piping layout drawings shall be submitted for approval to the Officer-in-Charge, prior to construction. All dimensions of pump, valves, piping fittings and appurtenances shall be shown.

M. CHECKING OF EXISTING WELL:

Checking of the existing well shall be done by a well driller holding a current C-57 Well Drilling Specialty License from the State of Hawaii. The well driller shall check the existing well for silting, caving-in, foreign materials, and damage to the well casing before installing the pumping unit. The well driller shall video log the entire depth of the well and shall perform a dummy test to ensure the pump equipment can be successfully installed within the well. These tests shall be conducted prior to ordering the pump unit. The testing procedure must be approved by and scheduled with the DHHL prior to starting. A written report stating the results of the tests shall be submitted to the Officer-in-Charge after completion of testing.

In the event deficiencies are observed, the Contractor shall take corrective measures as directed by the DHHL. Corrective measures authorized by the DHHL shall be considered extra work. The Contractor shall be responsible for maintaining the integrity of the well throughout the contract period.

N. INSTALLATION OF VERTICAL TURBINE PUMP:

Installation of the vertical turbine pump shall be by a pump installer holding a current C-68 Pump Specialty License from the State of Hawaii, under the direction of the supplier of the equipment. The equipment shall be installed in the presence of the DHHL.

The pump installer shall have a minimum of 5 years experience in the installation, testing, maintenance and repair of vertical turbine deep well pumping units of similar capacity, head, setting and horsepower as the pumping units specified. The pump installer shall also have access to plant facilities and equipment to expedite repair of the pumping units, should an emergency arise.

O. INSPECTION OF PUMPING UNIT:

Immediately upon the arrival of the pumping unit at the job site, the Contractor shall make a careful inspection of the pumping unit and all incidental items including motor and discharge head that go with the unit and shall submit to the Officer-in-Charge a certified check list describing all items checked. All defects and or parts not conforming to these specifications shall be replaced without delay.

P. TEST OF PUMPING UNIT:

The overall efficiency after installation and adjustment shall be not less than the specified in "Performance Characteristics" of the pump subsection above. There shall be no exceptions.

1. Factory Tests: Before delivery of the pumping unit for the project, the Contractor shall submit to the Officer-in-Charge a certificate from an approved independent qualified testing firm or from an independent qualified professional engineer, stating that materials used in the manufacture of the pump assembly, including motor and all pump components, conform to these specifications and that the efficiency so determined was not less than the efficiency specified. The Contractor shall submit at least six (6) copies of the above test data (including performance curves and test data sheets) to the Officer-in-Charge along with information showing the overall efficiency resulting from the efficiency of each bowl assembly unit so determined, taking into consideration the motor efficiency, column losses, and all other minor losses.

   The running test shall be conducted in accordance with the latest edition of the "American National Standard for Deepwell Vertical Turbine Pumps Line Shaft and Submersible Types," to show that the specified conditions can be met by the bowl assembly furnished.

   Upon receipt of a satisfactory certification showing that the pumping unit and motor will meet the minimum requirements stated above, the Contractor will be permitted to deliver the pump. Should the test for efficiency result in an overall efficiency less than that specified in for the pumping unit, the Contractor shall make the necessary changes and replacements to obtain the required minimum efficiency before the pumping unit leaves the factory. All costs for such changes and replacements will be paid for by the Contractor.

2. Field Tests: After installation of all equipment and before any field tests are conducted, the pump shall be operated continuously for a period of forty-eight (48) hours or as directed by the DHHL. A complete operating test of all the equipment for the pumping unit and controls shall be made over a period of not less than six (6) hours. Two field tests shall be conducted: One with incoming power furnished by the local utility and the second test with power furnished by the new onsite emergency generator.

Throughout the operation tests, the pumping unit shall run smoothly, within the vibration limits specified. If any structural or mechanical defect or weakness develops during the test, or as a result of the test, or if the pump fails to deliver its required discharge under required conditions, the Officer-in-Charge reserves the right to reject any part or all of the equipment and demand reconstruction or replacement to meet the reconstruction or replacement including removal, reinstallation, freight, and handling. All reconstruction or replacement costs shall be paid for by the Contractor.

After the operating test has been completed to the satisfaction of the Officer-in-Charge and DHHL, a check efficiency test shall be made. This efficiency test shall be conducted by the DHHL, with the necessary assistance from the Contractor, in accordance with ANSI B58.1 (AWWA E101) Appendix-Field Testing of Vertical Turbine Pumps and as modified by the DHHL.

Overall pumping unit efficiency is defined as and will be determined by dividing the water horsepower at the measuring devices near the discharge head by electrical input horsepower at the outlet of the motor control center.

Water horsepower shall be computed by the following formula:

$$whp = \frac{H \times Q}{3960}$$

Where

H = Distance in feet from the well water level to the center of the discharge flange of the pump plus the discharge pressure in feet plus velocity head in feet ($V^2/2g$). It does not include discharge column loss and head loss.

Q = Discharge in gallons per minute.

Test shall be made with the electric voltage and current normally furnished by the utility company. No adjustment of the electrical power will be allowed.

Should the test for efficiency result in an overall efficiency for the pumping unit of less than that specified, the Contractor shall make the changes and replacements required to obtain the required minimum over-all efficiency. All costs for such changes and replacements including the removal of the deficient pump, the installation of the repaired or replaced pump, and the additional testing shall be paid for by the Contractor. No reduction of the minimum overall efficiency specified in these specifications shall be allowed for any reason.

a. Vibration: Under normal operating conditions, the pumping unit shall run smoothly, within the vibration limits stated below. The limiting peak-to-peak amplitude, as recognized by the Vertical Turbine Pump Association shall be as follows:

Pump Speed (RPM)	Limiting Peak-to-Peak Amplitude (Inches)

3600	0.002
1800	0.004
1200	0.006
900	0.008
720	0.008
600	0.008

The amplitude shall be measured with a vibration meter at three points, 120 degrees apart, at the top of the motor frame.

3. Material and Equipment for Field Test:
The Contractor shall furnish all material, instruments, and equipment required by the Officer-in-Charge to properly perform the operating test and the efficiency test of the pumping unit after installation. The items to be furnished shall include a megger, meters, pipe, hose, gages, electrical analyzer and other items that are necessary for this test as requested and approved by the Officer-in-Charge and DHHL. A calibrated differential pressure gage will be supplied by the Contractor to measure flow thru the new venturi tube located on the discharge line. A calibrated test pressure gage will be used to measure discharge pressure. All instruments furnished under this paragraph shall be properly calibrated and checked to the satisfaction by the Officer-in-Charge. All items in this paragraph shall be furnished at no cost to the DHHL and shall remain the property of the Contractor.

Q. CHLORINATION:

After the pump has been acceptably installed and tested the Contractor shall chlorinate and flush the well, pump, and piping by injecting a chlorine solution in accordance with AWWA A100. The chlorination, testing and flushing procedure shall be repeated as required by the Officer-in-Charge and the DHHL. The chlorination, testing and flushing procedures shall be submitted to and approved by the Officer-in-Charge prior to action. A copy of all disinfection test results shall be submitted to the Officer-in-Charge for approval.

The Contractor shall be responsible for proper disposal of chlorinated water to safeguard public health and the environment in accordance with Department of Health regulations.

R. PUMP AND MOTOR SUBMITTALS:

The Contractor shall submit, for the Officer-in-Charge review and approval, the Preliminary pump submittals within 20 calendar days after Notice to Proceed or sooner.

The Contractor shall submit well video log and dummy test results within 20 calendar days after the preliminary pump submittals are approved.

The Contractor shall submit certified pump performance curves within 30 calendar days after the preliminary pump submittals are approved.

The Contractor shall submit, within 30 calendar days after the certified curves are approved, the proper invoices to show that the pump has been ordered.

The Contractor may request partial payment after the pump has been received. By failing to adhere to the above schedule, any extensions of time shall be denied, and the Contractor shall be liable for the appropriate liquidated damages.

S. AS-BUILT DRAWINGS:

The Contractor, at no additional cost shall provide as-built drawings to the DHHL.

T. PACKING AND SHIPMENT:

Pump equipment shall be packed in substantial containers to protect them adequately from damages during normal handling in transit.

U. STORAGE:

The Contractor shall, as a minimum, comply with the following requirements for protection of all equipment during storage.

Equipment shall be stored off the ground, properly supported on skids, blocking, cribbing or other suitable support. Equipment having saddle or dollies shall be supported mainly from these supports. Equipment supports shall be leveled and aligned on wedges or shims as necessary to prevent any twisting or bending stresses on the supported equipment.

At the time of delivery, the factory-installed closures on nozzles and equipment openings shall be inspected for weather-tightness. Any closures, which are punctured, or missing shall be replaced with temporary closures and made weather-tight. All closures shall be maintained weather-tight and left in place until the DHHL or Officer-in-Charge authorizes removal.

Motor and controls shall be stored only in an enclosed cover, except that if outdoor storage of a short duration is necessary, these items may, for that period, be stored off the ground and fully covered with a suitable waterproof covering free from punctures or tears and secured against displacement. The protective measure for all such outdoor storage will be provisional upon approval by the Officer-in-Charge.

V. COORDINATION OF WORK:

The Contractor's work and installation of equipment and materials shall be closely coordinated with the Officer-in-Charge and other contractors working on the project to avoid all possible interferences, delays, omissions, and overlapping of responsibilities.

W. WARRANTY:

The Contractor shall guarantee the equipment covered by these specifications against any defective material and workmanship for one year after the date of acceptance of the installed pump unit. The Contractor shall replace and correct all defective parts within this period and pay for all costs thereof including shipping, removal and reinstallation of the necessary parts. It shall be understood that any shipping damages shall be corrected and paid for by the Contractor, and final acceptance and payment will be subject to satisfactory delivery of the equipment.

304.04 PUMP STATION MECHANICAL EQUIPMENT

A. GENERAL REQUIREMENTS

1. The following construction standards, with certain modifications as hereinafter specified, are hereby incorporated into and made a part of these specifications by reference and shall be applicable to all work performed by the Contractor under this section.

   a. "Water System Standards", dated 2002 of the Department of Water, County of Kauai, as amended. Paragraphs relating to Measurement and Payment in the Sections are not applicable to the project.

2. This section covers the equipment, piping, valves, controls, testing and balancing as indicated on the plans and specified herein. Provide all labor, material, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this section, complete, and specified herein.

   Examine all other sections for work related to those specifications as required to be included as work under this section.

3. Quality Assurance: All material and workmanship shall be suitable for the perspective positions in the work and the type of service encountered. All equipment shall be constructed to operate safely without water hammer or undue wear.

   The drawings show the general arrangement, direction and sizes of pipes. It is not intended to show every offset, valve and fitting, or every structural difficulty that may be encountered, but the piping and appurtenances shall be installed to suit and to avoid interference with the installation, operation and maintenance of fixtures, equipment or other piping. All measurements shall be verified at the job site.

   The Contractor shall comply with the requirements of the State and local plumbing codes, and shall obtain all permits, inspections and tests required by those codes for the project.

   Use sufficient journeyman workers and competent supervisors in execution of this portion of the work to ensure proper and adequate installation throughout. In the acceptance or rejection of installed work, no allowances will be made for lack of skill on the part of workmen.

4. References: The work under this section shall conform to all applicable provisions of the latest editions of the following, as well as to specific standards listed elsewhere in these Specifications:

   a. Uniform Plumbing Code, with County of Kauai Amendments.

   b. State of Hawaii, Title 11 Administrative Rules, Department of Health.

c. American Society for Testing and Materials (ASTM):

B88-03	Seamless Copper Water Tube.
D 1784	Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride (CPVC) Compounds.
D 1785	Poly Vinyl Chloride (PVC) Plastic Pipe, Schedule 40, 80 and 120.
F 37	Sealability of Gasket Materials.
F 402	Safe Handling of Solvent Cements, Primers and Cleaners Used for Joining Thermoplastic Pipe and Fittings.
F 441	Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedule 40 and 80.

d. American National Standards Institute (ANSI):

A 13.1	Scheme for the Identification of Piping Systems
B 16.18-78	Cast Bronze Solder Joint Pressure Fittings
B 16.22-73	Wrought Copper and Bronze Solder Joint Pressure Fittings

e. American Water Works Association (AWWA):

C 651	Disinfecting Water Mains
M 11	Manual: A Guide for Design and Installation

5. Submittals: Submit six (6) copies of the each submittal required hereinafter. All equipment and shop drawings submittals must be reviewed and approved before beginning work.

6. Shop Drawings: Within thirty (30) days after award of Contract, and before any of the materials of this section are delivered to the job site submit six (6) sets of complete shop drawings to the Officer-in-Charge in accordance with the General Requirements of these Specifications. The shop drawings shall indicate construction size, arrangement, operating clearances, performance characteristics and capacity of each item of equipment installed. All floor plans shall indicate dimensions and piping inverts. Diagrams shall be neat and legible. Copies or reproductions of contract drawings are not acceptable.

   Failure to comply with the above requirements may be grounds for rejection and delay shop drawing approval.

   Plumbing layout, drawn to scale, shall also clearly indicate where it deviates from the Contract Drawings.

   Approval rendered on Shop Drawings shall not be considered as a guarantee of measurements or building conditions. Where Drawings are approved, said approval does not in any way relieve the Contractor from his responsibility of furnishing materials or performing work as required by the Contract Drawings and Specifications. Any deviation from Shop

Drawings shall require prior approval by the Officer-in-Charge, and shall be clearly outlined on the Shop Drawings.

7. Materials List: Accompanying the Shop Drawings, submit for six (6) copies of a complete list of materials and equipment proposed to be furnished and installed under this portion of the work, giving manufacturer's name, catalog number, and catalog cut for each item where applicable. Submit manufacturer's catalog literature completely describing the physical characteristics, operating capacities, and dimensions of each piece of equipment to be installed.

8. "Record" Drawings: After completion, but before final acceptance of the work, furnish to the Officer-in-Charge a complete set of record drawings of work installed under this section of the Specifications. Record drawings shall be of the same size sheets as the Contract Drawings, of reproducible vellum. Drawings shall be signed by a representative of the Contractor certifying the representative accuracy of the drawings.

9. Properly label each item indicating the specific service for which material or equipment is to be used, section, article number of specifications governing, Contractor's name, and name of Project. Catalogs, pamphlets, or other documents submitted to describe items on which approval is being requested shall be specific and identification in catalog, pamphlet, etc., of item submitted shall be clearly made in ink. Data of a general nature will not be accepted.

10. Operating and Maintenance Manual: Furnish Operating and Maintenance manuals of all equipment. As a minimum, the manual shall outline the operation of each component and major items of equipment. The specific model number of all items shall be properly marked on the catalog page. Instruction on starting, stopping and emergency operation of system and sub-system shall be addressed. Space parts, operating set points and recommended frequency of maintenance shall be clearly outlined as a separate division in the manual. Submit one copy of the complete manual for review prior to final inspection. After approval, submit eight (8) sets of complete Operating and Maintenance manuals.

11. Additional Work: The design is based on equipment as described on the Drawings and these Specifications. Any changes in electrical wiring, conduit, connections and openings, required by alternate equipment specified, submitted and approved shall be paid for by the Contractor.

12. Guarantee and Certificate: Guarantee and certify in writing all new work in this Section for a period of one year from date of acceptance of the work as a whole by the office in charge. Should any equipment of materials fail within this period, replace or repair that item at no additional cost to the DHHL (labor and material) if such is due to faulty workmanship of materials. Contractor shall be responsible for all damages to any part of the premises caused by equipment furnished under this Section.

13. Product Delivery, Storage and Handling: Furnish new equipment, materials and accessories bearing the Manufacturer's identification. Coordinate deliveries to avoid interferences of construction delays.

Protect product during delivery, storage, installation and the remainder of the construction period after installation.

14. Instruction to Personnel: The Contractor shall furnish the services of competent instructors who will give full instruction to designated personnel in the adjustment, operation and maintenance, including pertinent safety requirements, of the equipment and/or systems specified. Each instructor shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work.

B. PIPING:

1. Potable Water Lines Above Grade: Copper Type L, hard temper, with wrought copper or cast bronze fittings made up with 95-5 solder.

2. Potable Water Lines Below Grade: Copper Type K, soft temper, with silver-solder brazed joints.

3. Marking tape: Provide detectable underground marking system for all below grade PVC piping. Pro-Line Safety Products or approved equal.

4. Piping Accessories:

a. Pressure gauge shall be a 3-1/2 inch diameter dial, Ashcroft Type 1009, or approved equal, with a scale range approximately two times the operating pressure.

b. Ball Valves: Bronze or PVC Ball valves shall be rated for the pressure and temperature of the service fluid. Materials of construction for valves shall be compatible with service fluid.

c. Gate Valves: Gate valves shall be rated for the pressure and temperature of the service fluid. Materials of construction for valves shall be compatible with service fluid.

d. Check Valves: Non-slamming check valves shall be rated for the pressure and temperature of the service fluid. Materials of construction for valves shall be compatible with service fluid.

e. Strainers: Strainer shall be of Y-pattern, bronze body, with 80 mesh screen.

f. Dielectric Unions shall separate all ferrous and nonferrous metals in all piping systems. Unions shall be copper with bronze body, 200 psig, except that of metal-to-metal contact shall be avoided. For pipes 2-inch and smaller use ground joint, for pipes 2-1/2-inch and larger use flanged face. Where flanges are used, the bolts shall be electrically insulated from the body of the flange.

g. Escutcheons: Brass body, chrome-plated finish of sizes sufficient to cover pipe openings through the floor, wall, or

ceiling. Escutcheons shall be secured in place by either spring clips or setscrews.

h. Pipe Sleeve: Schedule 40 Type 316 stainless steel pipe sleeves in concrete, 18 gauge Type 316 stainless steel sheet metal sleeves in other construction. Sleeves shall be sized to provide a minimum of ¼-inch clearance around bare or insulated piping or as otherwise required by Code.

i. Hose Bibb: Watts No. 11-4 with vacuum breaker, ¾-inch hose thread outlet, removable key handle.

C. PUMP DISCHARGE CONTROL:

1. General Description: The pump discharge control, consists of a pump control valve, pump main line check valve, and an air release/vacuum relief valve, and all necessary piping shall be furnished for the pumping unit as shown on the plans.

a. Pump Control Valve (Valve #1):

1) Size of valve: 6 inches

2) Minimum pressure rating of valve: 150 psi

3) Water pressure available for operation of valve: 45 psi

4) Class of valve flange: 125 lb. USAS B16.1

5) Cla-Val Pump Control Valve, Model 61-02 KC, with opening and closing speed controls, and X105 L2W limit switch assembly.

b. Pump Discharge Check Valve:

1) Size of valve: 8 inches

2) Minimum pressure rating of valve: 125 psi

3) Class of valve flange: 125 lb USAS B16.1

4) APCO Model No. 608 Silent Check Valve

c. Air/Vacuum Valve for Deep Well Pump

1) Size of valve: 3 inches

2) Minimum pressure rating of valve: 125 psi

3) Class of inlet valve flange: 125 lb USAS B16.1

4) APCO Model No. 146 Air/Vacuum Valve with 3” mushroom cap

2. Plan of Operation of Pump Discharge Valve Unit:

The pump discharge valve unit shall be designed to

a. Release air in the pump discharge column on starting up

b. Break the vacuum in the pump discharge column as the water drops back into the well when shutting down, and

c. Eliminate objectionable pipeline water pressure surges.

The pump control valve is normally open with pumping unit stopped. When the pump is started, the solenoid valve (a part of the pump control valve) shall be energized by the sequence timer which will slowly close the control valve. The air and initial inrush of water from the pump column shall be expelled through the pump control valve. As the pump control valve moves from its open position the pump discharge check valve slowly open to permit the flow of water into the main line. Time delay relays shall be provided to shut down the pumping unit should the pump control valve fail to complete its sequence within the time sequence as shown on the electrical plans.

When the pump is to be shut off, the pump control valve solenoid valve is de-energized causing the pump control valve to slowly start opening. As the control valve nears the open position, the pump discharge check valve will close and a limit switch on the pump control valve shall shut down the pumping unit. Should the water, on falling back into the well, create a vacuum in the pump discharge column, the air and vacuum valve opens and breaks the vacuum. Time delay relays shall be provided to shut down the pumping unit should the shutting down sequence take longer than the time sequence as shown on the electrical plans..

3. Pump Control Valve And Appurtenances: This valve shall be a modified globe-type, hydraulically operated by a double-acting diaphragm. An externally-mounted, four-way rotating disc type, solenoid-operated pilot valve shall control the main valve operation. When the solenoid valve is energized, the pilot valve shall close the main valve. When it is de-energized, the pilot valve shall open the main valve. Two flow control valves shall permit separate regulation of both valve opening and closing rate. The control valve body shall be ductile iron; stem shall be stainless steel; seat shall be bronze and removable; disc shall be synthetic rubber. The micro-switch installed on the valve stem shall be adjustable over the entire valve travel. The valve interior shall be factory epoxy coated. The valve unit shall be Clayton Valve No. 61-02 Pump Control Valve, or approved equal.

D. FLOW METER AND APPURTENANCES

1. DESCRIPTION: This section of the specifications includes the furnishing and installation of deep well pump flow tube, transmitter, flow indicator, and appurtenant equipment.

a. FLOW TUBE

1) Description: Flow tube supplier shall be responsible for furnishing and calibrating the flow transmitter.

2) Number required: One (1)

3) Size of flow tube: 8 inches

4) Throat size: 4.2 inches

5) Flow Range: 0 - 1.5 million gallons per day.

6) Class of flow tube flange: USAS B16.1 125 lb.

b. FLOW TRANSMITTER

1) Number required: One (1)

2) Pressure Differential: 100 inches of water at 1.48 mgd. (The transmitter shall have a differential pressure range suitable for the flow range specified above.)

3) Location: At flow tube.

c. FLOW INDICATOR:

1) No. Required: One (1)

2) Capacity range: 0 - 2.0 mgd = 4 to 20 mA

3) Location: Control Building (Wall-Mounted)

2. FLOW TUBE: The flow tube shall be a Primary Flow Signal Model HVT-CI, BIF UVT, Wyatt-Badger BVT, or approved equal, suitable for installation between two ANSI pipe flanges. The flow tube shall be constructed of cast iron and furnished with a bronze or type 304 stainless steel liner. The Officer-in-Charge must approve all flow tube details.

3. DIFFERENTIAL PRESSURE FLOW TRANSMITTER

a. Microprocessor based electronics type flow transmitter equipment shall be ABB 266DSH, SMAR LD301, Rosemount 3051C Intelligent pressure transmitters, Yokogawa EJA 110A, or approved equal with four digit LCD indicator display.

b. DESCRIPTION: Using capacitance sensing measuring principle, the two wire 4 to 20 ma transmitter, with signal proportional to the square root of characterized to the applied differential pressure, and transmitted over a pair of twisted wires shall be limited only by the wire and load resistance and will operate

with digital signal communication superimposed for remote calibration and monitoring with a hand held configuration terminal that shall be supplied with the equipment. One technical maintenance and operating manual for the flow transmitter is required.

The hand held terminal will be supplied with all technical, maintenance, and operating manuals and a carrying case.

c. PERFORMANCE SPECIFICATION:

1) Accuracy: ± 0.1% of span ≥ 10% of URL.

± 0.05[1+(0.1URL/SPAN)]% of span for span ′ 10% of URL.

Includes the effect of linearity, hysteresis and repeatability.

2) Stability: ± 0.2% of URL for 6 months.

3) Temperature: ± (9.075% x URL + 0.20% x span per 20°C.

4) Static Pressure Effect:

a) Zero error: ± 0.1% URL per 1,000 PSI.

b) Span error: ± 0.2% of reading per 1,000.

5) Power Supply: ± 0.005% of calibrated span per volt

d. FUNCTIONAL SPECIFICATIONS:

1) Output signal: Two-wire, 4-20 ma with superimposed digital communication.

2) Range: 30” to 900” H2O

3) Turndown: 30:1 minimum.

4) Power Supply: 10.5 - 42 VAC

e. Manifold valves (to include by-pass and shut off for high and low pressure) and mounting brackets, flanges, adapters, and drain plugs shall be of stainless steel construction and shall be supplied for the transmitter.

f. GENERAL REQUIREMENTS:

1) Flow transmitter housing shall be weather proof for outdoor installation.

2) Minimum warranty period of all equipment supplied under this contract shall be one (1) year.

3) No hazardous material to be component of any of the equipment supplied under this contract.

4. FLOW INDICATOR/TOTALIZER: Flow indicator shall be a Precision Digital Model PD2-6200, or approved equal, designed for wall mounting. The indicator shall accept a 4-20 mA input signal from the flow transmitter. The indicator shall provide a continuous 6-digit display of the flow in GPM. The display shall be at least 1/2-inch-high, red, and sunlight readable. Indicator accuracy shall be +0.5% span. One 4-20 mA auxiliary output shall be provided.

5. FLOW VERSUS PRESSURE DIFFERENTIAL CURVE: A graph showing the flow versus pressure differential calibrated for the flow tube furnished shall be provided with the flow tube. The minimum range of the curve shall be the capacity range of the flow recorder.

6. SUBMITTALS: The Contractor shall submit six (6) copies of the equipment submittals for approval by the Officer-in-Charge prior to ordering. Submittals shall indicate size, style, construction and component materials.

E. WELL LEVEL MEASURING:

1. WELL LEVEL PRESSURE TRANSDUCER

a. Pressure transducer shall be KPSI 335 with KPSI 815 aneroid bellows, or approved equal. Pressure range shall be 10 psi with 4-20 mA output. Transducer shall be of Type 316 stainless steel housing with a ported nose cap, suitable for the intended use. The transducer shall be equipped with a Super Dry Vent Filter that prevents moisture from entering the vent tube. Provide KPSI Part Number 335S14B0B010.000000.000B11550B. Static accuracy shall be ±0.05% FSO.

b. Cable shall be electrical cable vented for fast response and shall have a polyurethane sheath including para-aramid synthetic fiber members to prevent errors due to cable elongation. The cable shall be provided with protective connector cap and service grip with a breakaway strength of 200 pounds minimum. The service grip shall be attached to a stainless steel bracket or plate fastened to the deep well pump base plate, foundation, or discharge head. The cable shall be constructed with a water block feature that self-seals in the event of accidental cuts to the cable. A quick disconnect for the pressure transducer shall be provided for easy replacement of the transducer.

c. One pressure transducer, including vented cable, shall be provided as spare. Cable length shall be equal to the length provided for this project.

d. An Extended warranty for a period of three years shall be provided. In the event of corrosion or defects the unit(s) shall be replaced at no additional cost.

2. WELL LEVEL INDICATOR:

a. Well level indicator shall be a Precision Digital Model PD2-6001, or approved equal, designed for wall mounting. The indicator shall accept a 4-20 mA input signal from the well level transducer. The indicator shall provide a continuous 6-digit display of the well level in feet and inches to the nearest 1/16 of an inch. The display shall be at least 1/2-inch-high, red, and sunlight readable.

b. Indicator accuracy shall be +0.5% span.

c. One 4-20 mA auxiliary output shall be provided.

F. SODIUM HYPOCHLORITE CHLORINATION SYSTEM:

1. GENERAL DESCRIPTION:

This section of the specification covers the furnishing of a complete potable water chlorination system. The chlorination system shall be suitable for metering sodium hypochlorite having a concentration of up to 12.5 percent.

2. GENERAL OPERATING AND PERFORMANCE REQUIREMENTS

a. The chlorination system shall be capable of metering up to 3.0 pounds of chlorine per 24-hour day, at a system flow rate of 1.0 MGD water flow. Sodium hypochlorite solution strength shall range between 9 and 12.5 percent and diluted 2:1. The chlorination system shall be capable of delivering to the discharge main a chlorine dose ranging from 0.1 to 0.5 mg/l, with a main pressure of 25 psi. The above capacity requirements shall be met without the use of redundant components.

b. The chlorine solution metering pump shall vary dosage automatically based on the 4-20 mA output flow signal from the chlorine residual analyzer.

c. The chlorination system components shall be capable of operating continuously 24 hours per day and be suitable for potable water service.

d. The chlorination system shall automatically reset after power failure.

f. Equipment malfunctions and loss of flow associated with the chlorine solution metering pump shall activate separate SCADA system alarm relays.

g. Provide six (6) copies of operation and maintenance manual for system components.

3. CHLORINE SOLUTION FEED SYSTEM

The chlorination system shall consist of the required chlorine solution feed equipment, including chlorine solution metering pump, metering pump control panel, tubing, fittings, valves, hydropneumatic booster pump system, chlorine solution injection assembly, chlorine residual analyzer and one 65 gallon (nominal) double wall polyethylene tank with connection fittings and threaded access cover.

a. Chlorine Solution Metering Pump: Provide one (1) chlorine solution metering pumps. Pumps shall be positive displacement, mechanical diaphragm type pumps. The use of a hydraulically backed diaphragm shall not be permitted. The pump shall be capable of metering sodium hypochlorite solution at between 0.15 to 8.4 gallons per hour at a total head of 70 psi. To eliminate the need for a pressure relief valve, the pump shall automatically stop pulsing when discharge pressure exceeds the pump pressure rating by 35 percent. Output volume per pump stroke shall be adjustable from zero to 100 percent capacity. Pump stroking frequency shall be proportional to a 4-20 mA input signal, or shall be manually set as selected by controls integral with the pump. Pump features include anti-siphon, automatic degassing, backpressure, pressure relief, and line pressure release functions.

Pump drive shall be totally enclosed solid state electronic pulsar, 120 V, 60 Hz. Pump drive shall be isolated from the chemical being pumped. Pump housing and all wetted pump components shall be of highly corrosion resistant material capable of resisting continuous exposure to a 12.5 percent hypochlorite solution, Pump check valves shall be ball type with ceramic balls seating on combination valve seat and seal ring. Pump shall be Prominent Model Gamma/X or approved equal.

The following additional chlorine solution pump components shall be provided.

1) Pump Wall Mounting Brackets: Provide each pump with a polypropylene mounting bracket. Bracket shall allow pump to be mounted in any direction.

2) Flow Monitor: A flow monitor shall be provided on the discharge of each pump to monitor flow pulsing and detect a “no flow” condition during operation of the pump. A “no flow” condition signal generated by a cycle timing device connected to the flow monitor shall be transmitted to the pump control panel to activate the SCADA system alarm relay.

3) Spare Parts Kit: Provide four (4) each, consisting of seal rings, valve balls, and anti-siphon spring if required.

b. Chlorine Solution Tubing: Tubing shall be Nalgene 980 reinforced PVC vinyl tubing, or approved equal. The braided vinyl tubing shall consist of an internal layer of plasticized PVC, an intermediate extra strong layer of graded synthetic fiber braid, and an outer layer of plasticized PVC. The tubing shall be installed in a protective conduit.

c. Chlorine Solution Fittings and Valves: Valves and fittings for the chlorination system shall be of corrosion resistant materials suitable for continuous exposure to 12.5 percent sodium hypochlorite solution and a working pressure of 150 psi at 90 degrees F. Connections shall be water tight and compatible with the chlorine solution tubing.

d. Chlorine Solution Injection Assembly: Provide a chlorine solution injection assembly at the injection point as shown on the drawings. Wetted components of the assembly shall be suitable for continuous exposure to 12.5 percent sodium hypochlorite solution and a working pressure of 200 psi at 90 degrees F. Severn Trent Corporation Cock Model BMS 111-1 or approved equal.

e. PVC Pipe and Fittings: PVC pipe and fittings shall be Schedule 80. PVC material shall conform to ASTM D1784. Schedule 80 PVC socket fittings shall conform to ASTM D2467. PVC solvent weld cement for socket connections shall meet the requirements of ASTM D2564. Schedule 80 PVC threaded fittings shall conform to ASTM D2464. PVC pipe and fittings shall be coated for UV protection with coating system recommended by the pipe manufacturer.

f. Solenoid Valve: Cla-Val Model 136-01BCS, 3/4-inch, normally closed, with opening and closing speed controls, or approved equal.

g. Flow Meter Tube: Blue-White Model No. F-40750LN-12, 3/4-inch, flow range: 1-10 gpm, or approved equal.

4. MISCELLANEOUS CHLORINE SYSTEM APPURTENANCES:

a. Placard: One weather proof corrosion resistant placards complying with NFPA Designation 704 for 12.5 percent sodium hypochlorite (per Material Safety Data Sheet) shall be mounted on the chlorination room door. The placard shall be securely mounted with stainless steel hardware.

b. Chlorine Solution: The Contractor shall provide the initial supply of 12.5 percent sodium hypochlorite solution in one 53-gallon drum containers for startup and testing.

c. Polyethylene Tank: The Contractor shall furnish all labor, equipment, materials, tools, supplies, fittings, and appurtenances required for the fabrication, support, installation, anchorage, hook-up and testing of a high density linear polyethylene (HDLPE) tank. Tank shall be suitable for storing 12.5 percent sodium hypochlorite solution.

1) Tank Design: Tank shall be of the double wall vertical type, with flat bottom. Provide tank with 7-inch diameter threaded access, 1-1/2 inch vent, and 1-1/2 inch fill assembly with antifoam elbow at top of tank, interstitial leak detection, and ultrasonic tank level indicator. Tank penetrations for piping connections and fittings shall be titanium and provided as shown on the plans. Tank shall be black in color. Tank shall have a nominal capacity of 65 gallons. Tank shall be Assmann Model No. IMT 65, or approved equal.

2) Testing: Hydrostatically test the tank prior to shipment. Manufacturer shall submit a letter verifying that the tank is suitable for storing 60 gallons of 12.5% sodium hypochlorite.

d. Drum Hand truck: A hand truck designed to transport plastic chlorine solution drums up to 55 gallon in size shall be provided. The hand truck shall be four- wheeled, and shall have a 1,000 pound capacity. The hand truck shall allow operator to tilt and lower a full drum to its horizontal position for dispensing or storage. Kickstand provided for upright storage. The hand truck shall have an easy to use cinch buckle with safety belt to secure the drum to the truck. The hand truck shall have extra-large nose pads to pickup drums without danger or puncture. The hand truck frame shall be of heavy-duty steel construction and the wheels shall have heavy-duty roller bearings.

e. Drum Pump: A drum pump designed to transfer sodium hypochlorite solution from delivery drums to the storage tank shall be provided. The drum pump shall be electrically powered, and shall have a minimum flow of 15 gpm. The pump shall have a 6 foot long, 1 inch PVC discharge hose. The pump shall be complete with a wall mounted storage bracket, barrel adapter, polypropylene hand nozzle, and 16 foot power cord and plug.

5. OPERATION:

The Contractor shall adjust and verify proper operation of the sodium hypochlorite system and adjust dosage per DHHL and Aqua Engineers input.

6. WARRANTY:

The warranty shall be full parts and labor for 12 months commencing following acceptance of the system by the DHHL.

7. SHOP DRAWINGS:

Drawings shall be a minimum of 22 inches by 36 inches in size, except as specified otherwise. Drawings shall include floor plans, sectional views, wiring diagrams and installation details of equipment. Drawings shall also identify equipment spaces indicating proposed location, layout and arrangement of items of equipment, control panels, accessories, piping and other items that must be shown to assure a coordinated installation. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. If equipment is disapproved, drawings shall be revised to show acceptable equipment and be resubmitted.

Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and interconnection of each item of equipment.

The Contractor shall review, stamp with his approval and submit, all Shop Drawings required by the contract documents or subsequently by the DHHL as covered by modifications. At the time of submission, the Contractor shall inform the DHHL in writing of any deviation in the Shop Drawings from the requirements of the Contract Documents. By approving and submitting Shop Drawings, the Contractor certifies that he has determined and verified all field measurements and obstructions, field construction criteria, materials, catalog numbers and similar data, checked and coordinated each Shop Drawing with the requirements of the work and of the Contract Documents, and that all equipment fits within the designated spaces.

8. AS-BUILT DRAWINGS

The Contractor, at no additional cost shall return one set of red marked as-built drawings to the DHHL. In addition, the Contractor shall submit Autocad files for the revised as-built drawings. Drawings shall be 22" by 36" and include floor plans, sectional views, wiring diagrams and dimensions and details of all construction. All clearances and required access shall be shown on the drawings. Materials, manufacturers, and model numbers shall be indicated for all components. All items shall be cross-referenced with the Operations and Maintenance Manual.

9. SPARE PARTS:

a. One (1) Spare Chlorine Solution Metering Pump.

G. CHLORINE RESIDUAL ANALYZER

1. DESCRIPTION:

This Section of the specification covers the furnishing of one potable water chlorine residual analyzer unit. The chlorine residual analyzer unit shall be supplied with the necessary piping to connect to the product feed line and drain line.

2. CHLORINE RESIDUAL ANALYZER:

One Chlorine Residual Analyzers shall continuously measure free chlorine residual from the Anahola Well pump discharge line. The unit shall consist of a direct measuring chlorine flow cell, sensor interconnect cable with quick disconnect plug, and an electronic controller housed in a NEMA 4 enclosure suitable for wall mounting. The chlorine flow cell shall be a amperometric membrane capable of direct measurement of free chlorine residual in clean water without the use of liquid reagents. The sensor cell assembly shall be constructed of clear material allowing the condition of the sensor to be inspected without removal of the sensor casing. The controller shall provide a display of residual chlorine concentration directly in PPM on a backlit LCD display. The overall display range shall be 0.00-10.00 PPM. An isolated 4-20 mA output shall be provided, capable of driving loop loads up to 1000 ohms. Accuracy shall be 0.5% of the range. Power input shall be 115 Vac, single phase. The unit shall be provided with a user accessible power switch. The unit shall provide two isolated 4-20 mA outputs configurable for chlorine, pH temperature, or PID control. Analog outputs shall be both ground isolated and isolated from each other. Unit shall also contain two SPDT alarm relays. Provide unit with flow rotameter, sample taps, and adjustable pressure regulator. The complete chlorine monitor shall be supplied with spare parts and accessories for up to 2 years of operation. The Chlorine Residual Analyzer shall be Dulcometer as manufactured by Prominent, or an approved equal.

3. WARRANTY:

The warranty shall be full parts and labor for 12 months commencing following acceptance of the project by DHHL.

H. HYDROPNEUMATIC SYSTEM:

1. HYDROPNEUMATIC TANK: WellXTrol Model WX-302 pressure storage tank, or approved equal. The tank shall be ANSI certified, NSF approved, rated for 150 psi working pressure, and a volume of 86.0 gallons. Provide with DuraBase composite tank stand and Pro-Access connection. The tank manufacturer shall provide a pressure switch for controlling the booster pump start and stop operation. The desired cut-in pressure is 45 psi and the cut-out pressure is 65 psi.

2. BOOSTER PUMPS: The booster pump shall be a Grundfos vertical, multi-stage, stainless steel pump, Model CRI(E)5-6, or approved equal. Each pump shall be equipped with 3500 rpm, 2 horsepower, 3-phase, 208 volts, 1.15 service factor, TEFC motor. Pump shall be outfitted

for operation with potable water having a temperature range of 50˚F to 80˚F.

3. PIPING: Piping shall be installed as indicated. Pipe shall be cut accurately to measurements established at the building by the Contractor and shall be worked into place without springing or forcing. Aboveground piping shall run parallel with the lines of the building unless otherwise indicated. Provide service markings for all piping systems.

I. FLOW SWITCH:

1. GENERAL DESCRIPTION: The discharge line flow switch shuts the pump off if the switch fails to actuate or actuates and releases during the monitoring period when the pump is discharging into the line. It activates the chlorination system when it actuates and deactivates the chlorination system when it releases. The prelube line flow switch shall prevent the well pump from starting if it fails to actuate or shuts down the well pump when there is insufficient flow in the lubrication line.

   The flow switch shall be weather-resistant Noryl cover, 316 stainless steel body, leak proof flow switch.

   a. Pump discharge and prelube lines flow switches:

      1) Number required:

         Discharge Line: One (1)
         Prelube Line: One (1)

      2) Drag Disk:

         LL (discharge line)
         L (prelube line)

      3) Adjustable Flow Range:

         Discharge line: 121-378 gpm
         Prelube line: 10-30 gpm

      4) Pipeline sizes:

         Pump discharge line: 12 inches
         Prelube line: 1-1/2 inches

      5) Location: As shown on plans. Install in accordance with manufacturer's written instructions.

2. The flow switch shall be an Omega Model FSW-4 Series drag disk-operated, non-magnetic flow switch as manufactured by Omega Engineering, Inc., Stamford, CT, or approved equal.

J. EMERGENCY SHOWER/EYEWASH: Shall be combination shower/eyewash with stainless steel shower head, stainless steel eyewash spray heads, stainless steel eyewash receptor and dust cover, 304 stainless steel pipe, fittings, and stay open stainless steel ball valves.

Item	Manufacturer	Model
Fixture	Haws	8330

K. PACKAGED LINE BOOSTER PUMP SYSTEM

1. GENERAL DESCRIPTION:

a. This section includes variable speed, packaged pump system for domestic water applications.

b. Sequence of operation.

2. REFERENCES:

ETL	Intertek Laboratory
ASTM	American Standards for Testing Materials
ASME	American Society of Mechanical Engineers
NSF	National Sanitary Foundation
NEC	National Electrical Code (NFPA 70)
NFPA	National Fire Protection Association
HI	Hydraulic Institute
NEMA	National Electrical Manufacturers Association
ANSI	American National Standards Institute
UL	Underwriting Laboratory

3. SUBMITTALS:

a. Pumps curves with condition point and pump operating capacities shall be supplied.

b. Shop Drawings:

1) System outline drawing(s) including elevation, plan and detail views shall be provided.

2) Drawings shall include system connection and bolt-down sizes and locations as well as recommended NEC clearances.

3) System drawings/models CAD files in AutoCAD (.dwg) format shall be supplied.

4) Wiring diagrams in .pdf format shall be provided.

c. Six bound copies and an electronic copy of Installation, Operation and Maintenance manuals (IO&M's) shall be provided for the pump system.

4. QUALITY ASSURANCE:

a. Manufacturers seeking authorization to furnish their product shall submit to the Officer-in-Charge an in-house quality assurance program.

b. The pump system shall be listed ETL/c-ETL for Packaged Pump systems.

c. The manufacturer shall be listed under UL508 for the manufacturer of control panels.

d. The manufacturer's personnel shall have a minimum of 30 years' experience in the fabrication of packaged pump system.

e. The system shall be certified under NSF 61, Annex G and NSF 372, Drinking Water System and Lead Content Compliance.

f. The pump system shall be hydrostatically tested to maximum working pressure (MWP) the system is rated at for a minimum of 1 hour.

g. The pump system shall be factory run tested to insure condition point is maintained at the expected power draw.

h. The pump system test facility instrumentation shall be NIST traceable and have current calibration certificates.

i. Piping shall be built in compliance with ASME B31.1. Piping shall be fabricated by ASME Section IX certified welders.

j. Structural steel weldments shall we fabricated by AWS D1.1 certified welders.

k. Welder's certifications shall be submitted for approval.

5. PRODUCT:

a. Acceptable Manufacturers:

1) PREMIERflow, LLC ("PREMIERflow"), or approved equal.

b. Pump System Description:

1) The system shall provide varying water flow rate at a constant pressure through the use of a PID PLC controller and variable speed drives. System Condition Point: 276 gpm at 50 psi. System Model: PFV-7.5-6 (Triplex).

2) The packaged pump system shall consist of:

a) Three vertical, multi-stage, in-line, centrifugal pumps.

b) Check valves located on the discharge branch of each pump.

c) Lug butterfly isolation valves for each set of pumps and check valves.

d) Common suction and discharge manifolds.

e) 4-20 mA transducer(s) located on the system discharge manifold.

f) A 4-20 mA transducer shall be provided on the suction manifold.

g) Controls consisting of a PREMIERflow VB series controller and dedicated variable frequency drives for each pump.

h) A common base or frame for components listed above.

c. Components:

1) Pumps shall be ANSI / NSF Standard 61 and ANSI / NSF 372 approved. Pumps shall be a Grundfos Model 32-2-2 A-G-A-E-HQQE Vertical Multi-Stage pump, or approved equal. Pump Condition Point: 145 gpm at 115 feet TDH. With 7.5 HP 3600 rpm vertical motor, 460V, 3 Phase, 60 Hertz, 1.15 S.F.

2) Valve, check, wafer type:

a) The Check Valve shall be of the silent operating type that begins to close as the forward flow diminishes and fully closes at zero velocity preventing flow reversal and resultant water hammer.

b) The valves used in potable water service shall be certified to NSF/ANSI 61, Drinking Water System Components – Health Effects, and certified to be Lead-Free in accordance with NSF/ANSI 372.

3) Valve, butterfly, lug-type:

a) Body shall be lug type.

b) Disc shall be for domestic water.

c) Valve shall be certified to NSF/ANSI-372.

d) Valve shall have a maximum working pressure of 250 psig. Valve shall be tested to 110% of the rated pressure.

4) Valve, ball:

a) Ball valves shall be 2-piece full port design constructed of forged copper silicon alloy brass body and end adapter.
b) Seats and stem packing shall be virgin PTFE. Stem shall be bottom loaded blowout proof design with fluorocarbon elastomer O-ring to prevent stem leaks.
c) Ball valve shall have chrome plated brass ball and adjustable packing gland.
d) Valve shall be rated to 600psig (41 bar) WOG non-shock. Valves shall be certified to NSF/ ANSI standard 372.

5) Piping:

a) Manifolds shall be constructed of 316 stainless steel. Manifolds shall have a maximum working pressure of 300 psig.
b) Manifolds shall be grooved at both ends to allow change of suction and discharge connection geometry in the field.
c) Main and branch piping shall be sized for a maximum velocity of 10 ft/s.

6) Enclosure:

a) Provide Fiberglass enclosure Model D-303, Dyer enclosure complete with stainless steel hinge, lift up cover, exhaust fan and louver.

7) Controls:

a) The control panel shall be a PREMIERflow series VB. The control panel shall consist of:

(1) Single point power connection.
(2) Through door control power disconnect with safety interlock to prevent door from being opened while in ON position.
(3) A model V570-57 solid-state programmable logic controller (PLC) with non-volatile memory (battery backup not required).
(4) Visilogic software.
(5) Fused 120 V AC control voltage transformer.
(6) Fused 24 V DC power supply, 1 Watt.

b) Operator interface: 6-inch color scale touch screen Human Machine Interface (HMII) including but not limited to the following:

(1) Main Screen with the following features:

(a) Individual pump HOA (Hand – Off – Auto) virtual switches.
(b) Pump run indication, including current % speed.
(c) Pump Failure indication.
(d) Current pressures readings in psig (suction and system).
(e) Current flow in GPM.
(f) Adjustable manual (hand) speed setting.
(g) Direct access to menu screen.

(2) Menu screen providing direct access to all system settings and status screens.

(a) Pump settings screen displays current settings and allows user changes.
(b) Lead and lag pump start and stop pressures, psig.
(c) Lead and lag pump ON and OFF delay times, seconds.

(3) Alarm settings screen displays current settings for all alarms and allows user changes.

(a) Low suction alarm settings.

1. Low suction pressure, psig.
2. ON and OFF delays, seconds.
3. Manual or automatic reset.

(b) Low system alarm settings.

1. Low system pressure, psig.
2. ON and OFF delays, seconds.
3. Manual or automatic reset.

(c) High system alarm settings.

1. High system pressure, psig.
2. ON and OFF delays, seconds.

3. Manual or automatic reset.

(d) High suction economy mode.

1. Economy mode suction pressure, psig.
2. Economy mode enable / disable.
3. ON and OFF delays, seconds.

(4) Separate Alarm Silence and Alarm Reset buttons.

(5) Current system status screen displays:

(a) Pump(s) currently running.
(b) Active alarms and warning messages.

(6) System event history screen displays a minimum of the last 100 system events, including pump start /stops, alarm conditions and alarm acknowledgement.

(7) Pump run time screen displays the total operating time for each pump. Provide individual resets for each pump run time.

(8) Lead pump alternation options will include:

(a) Automatic alternation on lead pump shutdown.
(b) Manual alternation when operator touches alternate button.
(c) Timed alternation:

1. Daily (user specified time of day).
2. Weekly (user specified day of week and time of day).
3. Monthly (first week of month on user specified day of week and time of day).

(9) Multi-Level Security:

(a) Password protected security levels (field changeable passwords).

c) HMI, V-60 (optional): In addition to the functionality of the V570-57 controller, the controller shall allow web-enabled access and control of the local system HMI via a browser on a desktop/laptop or web enabled mobile devices. The web interface shall allow the same functionality as the local HMI.

d) A common alarm relay provides dry contacts for customer monitoring.

e) An alarm horn with a minimum sound level of 85 db, annunciating all alarm conditions.

f) The control panel shall be listed under UL/C-UL 508 and meet NEC (NFPA 70) requirements.

g) PREMIERflow Visilogic software: PV-VB Self Tuning control algorithm shall allow for varying discharge pressure with varying flow rates in order to compensate for varying friction losses in the system as described in ASHRAE 90.1. The control algorithm shall meet the requirements of ASHRAE 90.1.

h) The system control algorithm shall use a speed adjust curve calculation proportional response. Step response algorithms shall not be considered equal.

i) The VB series shall provide Building Automation System communication through Modbus or BACnet protocol. Communication shall be provided via an RS-485 ethernet port.

j) The following event reporting shall be provided via BAS communication:

(1) Individual VFD Status.
(2) Remote System Disable.
(3) Phase Loss Alarm.
(4) Flow Switch or Level Switch option enabled.
(5) Individual Pump Run.
(6) Individual Pump Fault.
(7) Individual Pump Hand/Auto Status.
(8) Low System Alarm.
(9) Low Suction Alarm.
(10) High System Alarm.
(11) General Alarm.

(12) Alarm Horn Silenced.
(13) System Sensor Failure.
(14) Suction Sensor Failure.
(15) Economy Mode Engaged.
(16) Fatal alarm.

k) The following events initiation shall be available via BAS communication:

(1) BAS System Disable.
(2) Enable BAS Set Point.
(3) BAS Set Point (psi).

l) If VFD's are mounted inside the control panel, drive keypads shall me door mounted and accessible without opening the control panel or disengaging power.

m) The control panel shall have a minimum short circuit current rating of 1200 kVa.

n) The Model V570-57 controller shall communicate with the variable frequency drives using Modbus protocol via RS-485 cables.

8) Variable Frequency Drives (VFD):

a) Each drive will have individual disconnects and short circuit protection. Drive manufacturer must provide a two year minimum warranty.

b) Drives will be configured to provide the following operating features:

(1) Drive keypad will have manual, off and automatic mode selection and will accessible to operators without opening an enclosure.
(2) When in automatic, drive will run upon closure of the respective run permissive contact.
(3) When in automatic and with a run permissive signal, drive speed will responded to a 0-10 V DC speed reference signal from pump controller.
(4) Drive will provide a limited number of automatic resets for fault conditions and will maintain a history of faults.

c) Suction and system pressure transducers:

(1) Transducer wetted parts shall be a 300series stainless steel.

(2) Transducer shall output a 4-20 mA signal with a minimum accuracy of +1%.

6. EXECUTION:

a. Installation:

1) Installation of the system shall be per the manufacturer's recommendations and shall meet applicable federal, state and local codes.

2) Coordination of building trades and subcontractors and compliance with federal, state, and local codes shall be performed by the contractor with unit responsibility.

3) Unless otherwise negotiated, remote mounted instrumentation, control wiring and mapping of BAS communication points shall be the responsibility of the Controls Contractor.

4) Unless otherwise negotiated, interfacing of the V-60 HMI to the facility's network to allow for web-enabled access shall be coordinated between the Contractor and DHHL.

b. Start-Up:

1) Four (4) hours of start-up service and field training shall be provided by the manufacturer's representative.

2) Prior to start-up, the system will be installed per manufacturer's written instruction with power and water connected, communication lines connected, data point mapped and electrical inspection performed and approved. Sufficient water flow supply and demand shall be available to emulate full system designed performance.

3) The Contractor shall coordinate with the manufacturer's representative regarding scheduling for start-up.

4) During start-up, the system shall be tested for start and stop conditions, pump condition point and full system flow.

5) Unless otherwise negotiated, each PREMIERflow system shall be warranted for a period of 12 months from date of acceptance or date of operation of the unit, whichever occurs first.

6) During project construction while the 0.1 MG temporary steel tank is in use for water storage and distribution for the Anahola Subdivision, the booster pump discharge pressure shall be set to 20 psi. When the new concrete 0.44 MG tank comes online the booster pump discharge pressure shall be set to 50 psi.

END OF SPECIFICATIONS

SECTION 01200

PROTECTION OF ENDANGERED AND THREATENED SPECIES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the required conservation measures for the protection of Hawaii's federally listed species and their native habitat. The listed species are the following: Hawaiian Goose, Hawaiian Horary Bat, Hawaiian Petrel, Newell's Shearwater, and Band-Rumped Storm-Petrel (proposed).

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 CONSTRUCTION CONSERVATION MEASURES

A. To avoid impacts to Hawaiian Geese, a biologist familiar with the nesting behavior of the Hawaiian Goose will survey the project area prior to the initiation of any work, and after any subsequent delay in the work of three or more days (during which seabirds may attempt nesting). If a nest is discovered, work will cease immediately and the U.S. Fish and Wildlife Service (Service) will be contacted. All on-site project personnel will be apprised that Hawaiian Geese may be in the vicinity of the project at any time during the year. If a Hawaiian Goose (or Geese) appears within 100 feet of ongoing work, all activity will be temporarily suspended until the Hawaiian Goose (or Geese) leaves the area of its own accord.

B. To minimize impacts to the endangered Hawaiian Hoary Bat, woody plants greater than 15 feet tall will not be disturbed, removed or trimmed during the bat birthing and pup rearing season (June 1 through September 15). Any site clearing will also be timed to avoid disturbance to Hawaiian Hoary Bats in the project area. In order to minimize potential entanglement with the new and existing barbed-wire fence that surrounds the well/tank site, two aluminum plant tags will be attached to the top strand of barbed-wire between each set of fence posts. These tags will be attached to they can dangle or swing freely in the wind; thereby providing a visual cue for the Hawaiian Hoary Bat.

C. To minimize potential impacts to seabirds, construction activities shall only occur during daylight hours. Lights that cannot be eliminated due to safety or security concerns will be positioned as low to the ground as practicable, will be motion-triggered, and shielded. Light shields will be completely opaque, sufficiently large, and positioned so that the bulb is only visible from below. With prior approval from appropriate State regulatory agencies, nighttime construction may be possible, however, to avoid take of listed seabirds during construction, nighttime work requiring construction lights should be avoided during the seabird fledging season from September 15 to December 15.

D. The following Standard Best Management Practices will be implemented during construction and grading activities, where applicable, to avoid and minimize impacts to aquatic habitats: 1) Project construction-related materials (fill, revetment rock, pipe, etc.) should not be stockpiled in, or in close proximity to aquatic habitats and should be protected from erosion (e.g., with filter fabric, etc.), to prevent materials from being carried in into waters by wind, rain or high surf. 2) All deliberately exposed soil or under-layer materials used in the project near water should be protected from erosion and stabilized as soon as possible with geotextile, filter fabric or native or non-invasive vegetation matting, hydro-seeding, etc.

3.02 MEASUREMENT AND PAYMENT

Biological monitoring and nest surveys shall be paid for under the ALLOWANCE FOR BIOLOGICAL MONITORING. Other requirements in this section not part of biological monitoring and nest surveys, but related to protection of endangered and threatened species shall not be paid for separately, but shall be included in the items of work to which this section applies.

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.01 SUBMITTALS

A. Shop drawings shall be required for:

1. Section 304 – Mechanical and Electrical;
2. Section 08110 – Frames and Doors
3. Section 08600 – Aluminum Hatch
4. Section 08710 – Door Hardware
5. Section 09961 – Protective Coating
6. Section 11220 – Chlorine Residual Analyzer;
7. Section 13201 – Temporary Steel Water Tank;
8. Section 16000 – Electrical Work;
9. Section 16300 – Emergency Generator and Accessories;
10. Any others as called for in the plans, specifications or by the Engineer.

B. Product Data, Samples, Certificate of Compliance, Test data, and other specified submittals as required for the following as stated in the specification:

1. Section 304 – Mechanical and Electrical;
2. Section 02050 – Demolition
3. Section 02230 – Aggregate Base Course
4. Section 02232 – Aggregate Subbase Course
5. Section 02512 – Asphaltic Concrete Pavement;
6. Section 02513 – Prime Coat;

7. Section 02514 – Tack Coat;
8. Section 02524 – Gravel Pad and Gravel Access Road;
9. Section 02926 – Permanent Erosion Control;
10. Section 03310 – Reinforced Concrete
11. Section 04211 – Grouted Riprap
12. Section 07161 – Tank Roof Slab Waterproofing
13. Section 08110 – Frames and Doors
14. Section 08600 – Aluminum Hatch
15. Section 08601 – Fixed Aluminum Louvers
16. Section 08710 – Door Hardware
17. Section 09960 – Exterior Coatings
18. Section 09961 – Protective Coating
19. Section 11218 – Tank Level Transmitter;
20. Section 11219 – Portable System Interconnect Pump;
21. Section 11222 – Cyberlock System
22. Section 13201– Temporary Steel Water Tank;
23. Section 13282 – Lead Containing Paint Control Measures
24. Section 13283 – Lead Based Paint Removal and Disposal;
25. Section 16000 – Electrical Work;
26. Section 16100 – Supervisory Control and Data Acquisition (SCADA) System;
27. Section 16300 – Emergency Generator and Accessories.

C. Other required submittals shall include:

1. Comprehensive List of Required Submittals;

2. Project Schedule;

3. Detailed Phasing Plan of Work Items, including Source of Water, Planned Outages, Notification Requirements, and Coordination with Phase I Work.

4. Site Specific Best Management Practice Plan (Section 01567 Pollution Control);

5. Lead Hazard Control Plan, Lead-Containing Paint Removal Plan, Occupant Protection Plan, and Closure Report;

6. Manufacturer's Data and MSDS;

7. Certificates of Warranty;

8. As-Built Drawings;

9. Training Certificates;

10. Personnel and Testing Laboratory Qualifications;

11. Any others as called for in the plans, specifications, or by the Engineer.

1.02 BIDDER'S SPECIAL RESPONSIBILITY FOR COORDINATING CONTRACTUAL WORK AND SUBMITTALS:

A. The Contractor is responsible for the coordination of all contractual work and submittals.
B. The Contractor shall stamp each submittal in the following format:

CONTRACTOR NAME

PROJECT: _____
_____

JOB NO: _____
_____

THIS SUBMITTAL HAS BEEN CHECKED BY THIS GENERAL CONTRACTOR. IT IS CERTIFIED CORRECT, COMPLETE, AND IN COMPLIANCE WITH CONTRACT DRAWINGS AND SPECIFICATIONS. ALL AFFECTED CONTRACTORS AND SUPPLIERS ARE AWARE OF, AND WILL INTEGRATE THIS SUBMITTAL INTO THEIR OWN WORK.

DATE RECEIVED _____

SPECIFICATION SECTION_____

SPECIFICATION PARAGRAPH _____

DRAWING NUMBER_____

SUBCONTRACTOR NAME_____

SUPPLIER NAME _____

MANUFACTURER NAME _____

CERTIFIED BY: _____

C. This stamp, "filled in", should appear on the title sheet of each shop drawing, on a cover sheet of submittals in an 8-1/2" x 11" format, or on one face of a cardstock tag (min. 3" x 6") tied to each sample. The tag on the samples should state what the sample is so that, if the tag is accidentally separated from the sample, it can be matched up again. The back of this tag will be used by the Engineer for his receipt, review, and log stamp and for any comments that relate to the sample.

D. All submittals for material, equipment, and shop drawings listed in the contract documents, including dimensioned mechanical shop drawings, shall be required and shall be reviewed by the Engineer, prior to any ordering of materials and equipment.

E. Unless otherwise noted or agreed upon, the Contractor shall submit to the Engineer for his review six copies of all submittals. Drawings shall be submitted in sufficient time to allow the Engineer not less than twenty regular working days for examining the drawings.

F. The drawing shall be accurate, distinct, and complete and shall contain all required information, including satisfactory identification of items, units and assemblies in relation to the contract drawings and specifications.

G. Unless otherwise approved by the Engineer, shop drawings shall be submitted only by the Contractor, who shall indicate by a signed stamp on the drawings or other approved means that the Contractor has checked the shop drawings and that the work or equipment shown is in accordance with contract requirements and has been checked for dimensions and relationship with work of all other trades involved. All deviations from the plans and specifications shall be listed. The practice of submitting incomplete or unchecked shop drawings for the Engineer to correct or finish will not be acceptable, and shop drawings which, in the opinion of the Engineer, clearly indicate that they have not been checked by the Contractor will be considered as not complying with the intent of the contract documents and will be returned to the Contractor for resubmission in the proper form.

H. When the shop drawings have been reviewed by the Engineer, two sets of submittals

will be returned to the Contractor appropriately stamped. If major changes or corrections are necessary, the drawing may be rejected and one set will be returned to the Contractor with such changes or corrections indicated, and the Contractor shall correct and resubmit eight copies of the drawings, unless otherwise directed by the Engineer. No changes shall be made by the Contractor to the resubmitted shop drawings other than those changes indicated by the Engineer. The resubmittal shall be so indicated on the shop drawing.

I. The review of such drawings and catalog cuts by the Engineer shall not relieve the Contractor from responsibility for correctness of the dimensions, fabrication details, and space requirements or for deviations from the contract drawings and specifications, unless the Contractor has called attention to such deviations, in writing, by a letter accompanying the drawings and the Engineer approved the change or deviations, in writing, at the time of submission; nor shall review by the Engineer relieve the Contractor from the responsibility for errors in the shop drawings. When the Contractor does call such deviations to the attention of the Engineer, he shall state in his letter whether or not such deviations involve any deduction or extra cost adjustment.

J. The approval of the above drawings, lists, prints, specifications, or other data shall in no way release the Contractor from his responsibility for the proper fulfillment of the requirements of this contract nor for fulfilling the purpose of the installation nor from his liability to replace the same should it prove defective or fail to meet the specified requirements.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 MEASUREMENT AND PAYMENT

SUBMITTALS shall not be paid for separately but shall be included in the items of work to which this section applies.

END OF SECTION

SECTION 01567

POLLUTION CONTROL

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Rubbish Disposal

1. No burning of debris and/or waste materials shall be permitted on the project site.

2. No burying of debris and/or waste material except for materials which are specifically indicated elsewhere in these specifications as suitable for backfill shall be permitted on the project site.

3. All unusable debris and waste material shall be hauled away to an appropriate off-site dump area. During loading operations, debris and waste materials shall be watered down to allay dust.

4. No dry sweeping shall be permitted in cleaning rubbish and fines which can become airborne from floors or other paved areas. Vacuuming, wet mopping or wet or damp sweeping is permissible.

5. Enclosed chutes and/or containers shall be used for conveying debris from above to ground floor level.

6. Clean-up shall include the collection of all waste paper and wrapping materials, cans, bottles, construction waste materials and other objectionable materials, and removal as required. Frequency of clean-up shall coincide with rubbish producing events.

B. Dust

1. The Contractor shall prevent dust from becoming airborne at all times including non-working hours, weekends and holidays in conformance with the State Department of Health, Administrative Rules, Title 11, Chapter 60 - Air Pollution Control.

2. The method of dust control and costs shall be the responsibility of the Contractor. Methods of dust control shall include the use of water, chemicals or asphalt over surfaces which may create airborne dust.

3. The Contractor shall be responsible for all damage claims in accordance with Section 7.19 - "Responsibility for Damage Claims" of the CONSTRUCTION

GENERAL CONDITIONS.

C. Noise

1. Noise shall be kept within acceptable levels at all times in conformance with the State Department of Health, Administrative Rules, Title 11, Chapter 46 - Community Noise Control for Oahu. The Contractor shall obtain and pay for the Community Noise Permit from the State Department of Health when the construction equipment or other devices emit noise at levels exceeding the allowable limits.

2. All internal combustion engine-powered equipment shall have mufflers to minimize noise and shall be properly maintained to reduce noise to acceptable levels.

3. Pile driving operations shall be confined to the period between 9:00 a.m. and 5:30 p.m., Monday through Friday. Pile driving will not be permitted on weekends and legal State and Federal holidays.

4. Starting-up of construction equipment meeting allowable noise limits shall not be done prior to 6:45 a.m. without prior approval of the Engineer. Equipment exceeding allowable noise levels shall not be started-up prior to 7:00 a.m.

D. Erosion

1. During interim grading and trenching operations, the grade shall be maintained so as to preclude any damage to adjoining property from water and eroding soil.

2. Temporary berms, cut-off ditches and other provisions which may be required because of the Contractor's method of operations shall be installed at no cost to the State.

3. The Contractor shall provide silt fence and filter socks as temporary structural practice to minimize erosion and sediment runoff. Silt fence and filter socks shall be properly installed to effectively retain sediment. Silt fences and filter socks shall be installed prior to any grading in each phase of work where erosion would occur in the form of sheet and rill erosion (e.g. clearing and grubbing, excavation, embankment, trenching and grading). Silt fence and filter socks shall be installed in the locations indicated on the drawings. Final removal of silt fence barriers and filter socks shall be upon approval by the Officer-in-Charge. Silt fence shall be synthetic filter fabric mounted on posts and embedded in compacted ground in accordance with contract documents, and shall be in compliance with ASTM D6462, Standard Practice for Silt Fence Installation.

4. The contractor shall provide catch basin inlet protection for the duration of the

project to protect all given inlets throughout the work from the passage of sediments into underground drainage systems. Protect manholes, catch basins, curb inlets, and other drop type inlets constructed for the ingress of surface water runoff into underground drainage systems. Protect storm drain inlets with sediment capture devices before soil disturbing activities that result in sediment laden storm water runoff entering the inlet. Provide effective storm drain inlet protection until the completion of paving or stabilizing of sources with potential for discharging to an inlet.

E. Others

1. Wherever trucks and/or vehicles leave the site and enter surrounding paved streets, the Contractor shall prevent any material from being carried onto the pavement. Waste water shall not be discharged into existing streams, waterways, or drainage systems such as gutters and catch basins unless treated to comply with the State Department of Health water pollution regulations.

2. Trucks hauling debris shall be covered as required by PUC Regulation. Trucks hauling fine materials shall be covered.

3. No dumping of waste concrete will be permitted at the job-site.

4. Except for rinsing of the hopper and delivery chute, and for wheel washing where required, concrete trucks shall not be cleaned on the job-site.

5. Except in an emergency, such as a mechanical breakdown, all vehicle fueling and maintenance shall be done in a designated area. A temporary berm shall be constructed around the area when runoff can cause a problem.

6. When spray painting is allowed such spray painting shall be done by the "airless spray" process. Other types of spray painting will not be allowed.

7. The contractor shall provide a stabilized construction access to reduce the tracking of mud and dirt onto public roads by construction vehicles. The stabilized construction access should be constructed prior to any grading work on the site and removed after all grading work is complete. The stabilized construction access shall consist of a pad of aggregate (3” to 6” diameter) underlain with geotextile filter cloth located at any point where traffic will be entering or leaving the construction site to or from a paved road as indicated on the plans. Require all employees, subcontractors, and suppliers to utilize the stabilized construction access. A stabilized construction entrance shall be provided for any staging areas that exit onto a paved road.

F. Suspension of Work

1. Violations of any of the above requirements or any other pollution control requirements which may be specified in the Technical Specifications herein shall be cause for suspension of the work creating such violation. No additional compensation shall be due the Contractor for remedial measures to correct the offense. Also, no extension of time will be granted for delays caused by such suspensions.

2. If no corrective action is taken by the Contractor within 72 hours after a suspension is ordered by the Engineer, the State reserves the right to take whatever action is necessary to correct the situation and to deduct all costs incurred by the State in taking such action from monies due the Contractor.

3. The Engineer may also suspend any operations which he feels are creating pollution problems although they may not be in violation of the above-mentioned requirements. In this instance, the work shall follow Subsection 4.2 -"Changes" of the CONSTRUCTION GENERAL CONDITIONS be done by force account as described in Subsection 8.3.4 – “Force Account Method”, and paid for in accordance with Subsection 8.3 - "Payment for Additional Work" therein. The count of elapsed working days to be charged against the contract in this situation shall be computed in accordance with Subsection 7.21 - "Contract Time" of the GENERAL CONDITIONS.

1.2 SUBMITTALS

Prior to construction starting a written site-specific BMP describing activities to minimize water pollution and soil erosion into State waters, drainage or sewer systems shall be submitted. BMP shall include the following:

1. An identification of potential pollutants and their sources.
2. A list of all materials and heavy equipment to be used during construction.
3. Descriptions of the methods and devices used to minimize the discharge of pollutants into State waters, drainage or sewer systems.
4. Details of the procedures used for the maintenance and subsequent removal of any erosion or siltation control devices.
5. Methods of removing and disposing hazardous wastes encountered or generated during construction.
6. Methods of removing and disposing concrete and asphalt pavement cutting slurry, concrete curing water, and hydro-demolition water.
7. Spill control.
8. Fugitive dust control, including dust from grinding, sweeping, or brooming off operations or combination thereof.
9. Methods of storing and handling of oils, paints and other products used for the project.
10. Material storage and handling areas, and other staging areas.

11. Concrete truck washouts.
12. Concrete waste control.
13. Fueling and maintenance of vehicles and other equipment.
14. Tracking of sediment offsite from project entries and exits.
15. Litter management.
16. Toilet facilities.
17. Other factors that may cause water pollution, dust and erosion control.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Fiber Rolls. Fiber Rolls shall consist of straw, flax, coconut, coir or other similar material bound into a tight tubular roll. Fiber Rolls shall be either prefabricated rolls or rolled tubes or erosion control blanket. If rolled erosion control blanket is used, bind roll at each end and every 4 feet along the length of the roll with jute type twine. Fiber Roll shall have a minimum diameter or 9 inches. Sandbags, or 2"x 2" wood stakes or metal stakes, a minimum of 24" long, shall be used to stake and secure fiber rolls.

1. Fiber rolls at the toe of slopes greater than 5:1 (H:V) shall be a minimum of 20 inches in diameter.
2. Fiber rolls should be either prefabricated rolls or rolled rubes of erosion control blanket.
3. Roll length of erosion control blanket into a tube of a minimum of 9 inches in diameter.
4. Bind roll at each end and every four (4) feet along the length of the roll with jute-type twine.

B. Silt Fence.

1. Filter Fabric. Filter fabric shall have a minimum width of 26 inches. The geotextile shall comply with the requirements of ASTM D 4439, and shall consist of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. The filament shall consist of a long-chain synthetic polymer composed of at least 95 percent by weight of polyester, propylene, or amide, and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultraviolet and heat exposure. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0 to 120 degrees F. Some acceptable geotextile for silt fence are Mirafi 100X or 1211 WinFab. These geotextiles or approved equal may be used. The geotextile filter fabric shall meet the following requirements:

MINIMUM PHYSICAL REQUIREMENTS FOR SILT FENCE GEOTEXTILE			
PROPERTY	UNITS	ACCEPTABLE VALUES TEST	METHOD
GRAB STRENGTH	lbs.	100	ASTM D 4632
ELONGATION	Percent	30 max.	
CBR PUNCTURE	lbs.	325	ASTM D 6241
TRAPEZOID TEAR	lbs.	40	ASTM D 4533
APPARENT OPENING SIZE	U.S. Sieve	30 (slit film woven geotextile) 50 (all other geotextile types)	ASTM D 4751
PERMITTIVITY	Sec - 1	.05	ASTM D 4491
ULTRAVIOLET DEGRADATION	Percent	70 at 500 Hrs.	ASTM D 4355

2. Silt Fence Stakes and Posts. The Contractor may use either wooden stakes or steel posts for fence construction. Wooden stakes utilized for silt fence construction, shall have a minimum cross section of 2 inches by 2 inches when oak is used and 4 inches by 4 inches when pine is used, and shall have a minimum length of 5 feet. Steel posts (standard "U" or "T" section) utilized for silt fence construction, shall have a minimum mass of weight of 1.33 pounds per linear foot and a minimum length of 4 feet.

3. Identification, Storage and Handling. Filter Fabric shall be identified, stored and handled in accordance with ASTM D 4873.

PART 3 – EXECUTION

3.1 FIBER ROLL INSTALLATION AND CONSTRUCTION METHODS

A. Locate fiber rolls on level contours spaced as follows:

1. Slope inclination of 4:1 (H:V) or flatter; fiber rolls should be placed at a maximum interval of 20 feet.
2. Slope inclination between 4:1 and 2:1 (H:V): fiber rolls should be placed at a maximum interval of 15 feet. (A closer spacing is more effective.)
3. Slope inclination 2:1 (H:V) or steeper: fiber rolls should be placed at a maximum interval of 10 feet. (A closer spacing is more effective.)

B. Turn the ends of the fiber roll up slope to prevent runoff from going around the roll.

C. If more than one fiber roll is placed in a row, the rolls should be overlapped not abutted.

D. Fiber rolls located on ground with less than 4:1 slope shall not require anchoring. Fiber rolls shall be installed as detailed in the plans with a minimum 6 inch overlap.

E. As work progresses, fiber rolls shall be relocated around the work area in a configuration that will best capture runoff pollutants.

3.2 SILT FENCE INSTALLATION AND CONSTRUCTION METHODS

A. Filter fabric shall be from a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, filter fabric shall be spliced together at a support post, with a minimum 6 inch overlap, and securely sealed.

B. Post shall be spaced a maximum of 6’ apart and driven into the ground a minimum of 18”. When standard strength filter fabric is used, 2” x 2” 14 ga wire mesh support fence shall be fastened securely to the upslope side of posts using heavy duty wire staples at least 1” long. The mesh should extend into the trench.

C. A trench shall be excavated approximately 6 inches wide and 6 inches deep on the upslope side of the location of the silt fence. The 6-inch by 6-inch trench shall be backfilled and the soil compacted over the filter fabric.

3.3 MAINTENANCE

A. Fiber rolls and Silt Fence shall be inspected for damage after each rainfall event. Repairs shall be performed immediately.

B. Sediments shall be removed after each rainfall event or when sediment deposits reach one-third the height of the barrier.

3.4 MEASUREMENT AND PAYMENT

Payment for Pollution Control and appurtenant work shall be paid for in the Lump Sum Bid Price under bid item Temporary Best Management Practices (BMPs), filter socks, silt fence, stabilized construction entrance, permits. Payment shall represent full compensation for furnishing all materials, labor, tools, equipment and incidentals required to complete pollution control and appurtenant work at the project site, in place complete.

END OF SECTION

SECTION 01569

TEMPORARY TRAFFIC CONTROL

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing, installing, maintaining and subsequently removing traffic control devices to control traffic during construction, as indicated in the construction drawings, the Contractor's traffic control plans and street usage permit, and as specified herein. The work shall also include services from flagmen and special duty police officers, if required. The work shall conform to applicable provisions of the "Manual on Uniform Traffic Control Devices for Streets and Highways" (MUTCD), as amended, published by the Federal Highway Administration, and the Contractor's final traffic control plans.

No work on any right-of-way will be allowed until traffic control plans and applicable permits covering the Project work have been approved by the appropriate government agencies.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials shall meet all applicable Contract and regulatory agencies' requirements.

PART 3 - EXECUTION

3.01 DETAILS

A. All barricades, signs, cones, barriers, lights, flashing signals, and other traffic control devices shall be furnished, installed and maintained as shown on the contractor's traffic control plans and in accordance with the requirements of the contract. In event of a conflict between provisions cited therein, the more restrictive laws, rules, regulations or requirements shall apply. The traffic control plan in the construction plans specifies the minimum requirements for traffic control work for the Project.

B. Construction within and on public and private streets shall be limited to the hours designated in the contract documents, unless otherwise approved by appropriate City and State agencies.

C. During non-working hours or during any suspension of work, open trenches and other excavations shall be covered with anchored non-skid steel plates.

D. No materials or equipment shall be stored where they will interfere with the free and safe passage of public traffic.

E. All barricades, construction and warning signs, and other traffic control devices shall be kept in good condition throughout their usage. The Contractor shall repair, repaint, clean, or replace the barricades, signs or other devices as necessary to maintain their effectiveness and appearance or as directed by the Officer-in-Charge. The Officer-in-Charge shall be the sole judge in determining the suitable condition of each barricade, sign, or other traffic control device.

F. During any suspension of work, the Contractor shall provide for public traffic to pass through the work over a reasonably smooth and even surface and with as little inconvenience and delay as possible.

G. Detours not specifically provided for on the Contractor's approved traffic control plans (for passage of public traffic) to facilitate the Contractor's operations or detours used exclusively by the Contractor for hauling materials and equipment shall be constructed, maintained and removed by the Contractor at his expense. The Officer-in-Charge will have the authority to regulate the Contractor's hauling over such detour if such hauling, in the judgment of the Officer-in-Charge, interferes with the free and safe passage of public traffic.

H. All detours shall be approved in writing by the appropriate City or State agency and submitted to the Officer-in-Charge.

I. The Contractor shall give two (2) weeks advance notice to the Police Department, Fire Department, ambulance services (i.e., City, State, private), and any public transit or public utility company of any work that may affect their operations, including any road closures.

3.03 MEASUREMENT AND PAYMENT

TRAFFIC CONTROL shall not be measured for payment. Payment for TRAFFIC CONTROL will be made by Lump Sum. Payment shall represent full compensation for furnishing all materials, labor, tools, equipment and incidentals required to complete the work.

END OF SECTION

SECTION 01715

EXISTING CONDITIONS – ASBESTOS / LEAD / HAZARDOUS MATERIAL SURVEY

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. This section includes the results of the State's survey for Asbestos, Lead and / or other Hazardous materials and is provided for the Contractor's information.

The objective of the survey was to identify the existence (if any), extent, and condition of hazardous materials present at the existing water tank site and surrounding areas anticipated to be disturbed by the planned rehabilitation work.

No suspect arsenic-containing materials were identified in the targeted areas. The CMU Control Building was not tested for any hazardous materials and should be tested prior to expansion work.

B. Related Sections include the following

1. SECTION 13282 – LEAD-BASED PAINT CONTROL MEASURES for requirements of all work that disturbs Lead-Based Paint (LBP) and Lead-Containing Paint (LCP).

2. SECTION 13288 – TESTING/AIR MONITORING for requirements of all work that disturbs LBP and LCP.

1.02 ASBESTOS

A. Based on the analysis of three asbestos samples at the existing water tank, no asbestos-containing materials (ACM) were identified in the targeted area. Therefore, no special control measures are warranted during work and demolition of the exiting water tank. However, no testing was performed at the CMU Control Building or at the Well Pump Motor and Well Discharge Piping. Asbestos testing must be performed by the CONTRACTOR prior to any work to the CMU Control Building, Well Pump Motor or Well Discharge Piping.

B. If applicable, the Contractor shall notify his employees, subcontractors and all other persons engaged on the project of the presence of asbestos in accordance with the requirements of Chapter 110, Article 12-110-2 (f) (1) (B) of the Occupational Safety and Health Standards, State of Hawaii.

1.03 LEAD CONTAINING PAINT

A. The Contractor shall notify his employees, subcontractors and all other persons engaged in the project that LBP and LCP are present in the existing building and at the job site. Conduct work in accordance with the requirements of Title 12 (Department of Labor and Industrial Relations), Subtitle 8 (Division of Occupational Safety and Health), Chapter 148.1 (Lead Exposure in Construction), Hawaii Administrative Rules.

B. The Contractor shall review the attached lead testing data for the existing tank site, which identifies the locations LBP and LCP was found and ensure that he/she understands the contents of the report referring to areas in which work is to be performed.

Based on the analysis of 12 lead samples at the existing tank site:

1. Five lead-containing paints (LCP) were identified, all on the exterior of the water tank (Table 3). Four of the LCP were lead-based paint (LBP), exceeding the 5,000 milligram per kilogram (mg/kg) threshold:
2. Dark green paint in good condition on metal pipe and valve, 280 mg/kg and 710 mg/kg, approximately 10 square feet.
3. Light green paint in fair condition on metal ladder, pipes, top, and walls, 110 mg/kg and 5,600 mg/kg, approximately 8,000 square feet.
4. Light gray paint in fair condition on metal wall, 13,000 mg/kg and 17,000 mg/kg, approximately 1,500 square feet.
5. Off-white paint in poor condition on metal electrical box, 47,000 mg/kg and 50,000 mg/kg, approximately 5 square feet.
6. Black paint in fair condition on metal vent, 23,000 mg/kg and 36,000 mg/kg, approximately 10 square feet.

C. The Contractor must conduct lead testing at the CMU Control Building, Well Pump Motor and Well Discharge Piping before any work is done to the building and equipment, to satisfy any of the requirements of Chapter 12-148.

1. If applicable, the Contractor shall notify his employees, subcontractors and all other persons engaged on the project of the presence of LBP and/or LCP at the CMU Control Building, Well Pump Motor or Well Discharge Piping if applicable work on the building and equipment shall be conducted in accordance with the requirements of Title 12 (Department of Labor and Industrial Relations), Subtitle 8 (Division of Occupational Safety and Health), Chapter 148.1 (Lead Exposure in Construction), Hawaii Administrative Rules.

1.04 SOIL

A. Limited Soil Testing was conducted on April 15, 2015. The objective of the soil sampling was to identify if levels of heavy metal lead were present in the soil that may pose a potential risk to construction workers and facility users during the planned rehabilitation work. Samples were analyzed for lead using EPA method 3051m/7100Bm. All results were below the Hawaii Department of Health Tier 1 Environmental Action Level for unrestricted (residential) land use above a drinking water resource.

B. No lead-contaminated soil was identified in the areas anticipated to be disturbed by the rehabilitation project.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 SURVEY

A. Attached, Hazardous Materials Survey and Limited Soil Testing Report, Anahola Farm Lots Water System Improvements, Anahola, Kauai, Hawaii, 11 pages, dated May 22, 2015, prepared by Myounghee Noh & Associates Environmental Studies and Consulting Services.

B. Based on the sampling and analysis of suspect paints, bulk materials, and soil, special hazard control measures are warranted for work involving LCP and LBP. These control measures are briefly described in Section 9 Recommendations for Renovation and Construction Work. General dust and runoff controls are also warranted.

C. The contractor must verify the location and volumes of hazardous materials and determine the appropriate dust and hazard control measures based on the area and material to be disturbed. Quantities of hazardous materials provided in this report are based on visual approximations only during the survey.

3.02 MEASUREMENT AND PAYMENT

EXISTING CONDITIONS shall not be paid for separately but shall be included in the items of work to which this section applies.

END OF SECTION

SECTION 02050

DEMOLITION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS:

The work includes demolition and removal as indicated in the plans or specified herein. This section shall apply to the Demolition, Removal and Disposal of the 0.50 MG Steel Tank, the Demolition, Removal and Disposal of the Temporary 0.1 MG Steel Tank, the Demolition and Removal of the Existing Washout CRM Drain Outlet Structure, the existing well pump, the existing well discharge piping, fencing, and concrete sidewalk.

All materials resulting from demolition work, except as indicated or specified otherwise, shall become the property of the Contractor and shall be removed from the limits of Government property. Remove rubbish and debris from the job site daily, unless otherwise directed. Store materials which cannot be removed daily in areas specified by the Engineer. The Contractor shall pay for all necessary permits and certificates that may be required in connection with this work.

1.02 SUBMITTALS: Submit proposed demolition and removal procedures to the Engineer for approval before work is started. Procedures shall provide for coordination with other work in progress and a detailed description of methods and equipment to be used for each operation, and sequence of operations.

1.03 DUST CONTROL: Take appropriate action to check the spread of dust to the surrounding area and to avoid the creation of a nuisance in the surrounding area. Do not use water if it results in hazardous or objectionable conditions, such as flooding or pollution. Comply with all dust regulations imposed by local air pollution agencies.

1.04 LEAD PAINT: The handling and proper disposal of lead-containing paint on the existing 0.5 MG Steel Tank shall be conducted in accordance with Sections 13282 – Lead Containing Paint Control Measures, Section 13283 – Lead Based Paint Removal and Disposal, and Section 13288 – Testing and Air Monitoring.

1.05 PROTECTION

A. Existing Improvements: Protect existing improvements that are to remain in place, that are to be reused, or that is to remain the property of the Owner by temporary covers, shoring, bracing, and supports. Repair items damaged during performance of the work or replace with new to the satisfaction of the Engineer. Do not overload structural elements. Provide new supports or reinforcement for existing construction weakened by demolition, removal, and relocation work. Construction equipment and vehicles shall neither be permitted on, nor shall be stored on the existing work that is to remain in place.

B. Trees: Protect trees within the project site which might be damaged during the demolition work.

C. Public Safety: Where pedestrian and driver safety is endangered in the work or storage areas, use traffic barricades with flashing lights. Notify the Engineer prior to beginning any such work. The Contractor shall conduct operations with minimum interference to streets, driveways, sidewalks, and passageways, etc.

D. Explosives: Use of explosives will not be permitted.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 EXISTING FACILITIES

A. Contractor shall not begin demolition on each item to be demolished until authorization is received from the Construction Manager.

B. The existing slab-on-grade and below grade utilities shall be secured (capped) and remain in place. Seal and cap utility lines where necessary as required by regulations of the authority having jurisdiction.

C. The existence of active utility lines traversing the construction area other than those indicated is not definitely known. Should any be encountered, the Contractor shall not disconnect same without authorization of the Engineer, but shall inform the latter immediately of each discovery, and shall follow his instructions.

D. Prior to the demolition and removal of the 0.5 MG Steel Tank and the Temporary 0.1 MG Steel Tank, the tanks shall be drained of all water. Unless the contractor obtains and fulfils the requirements of an NPDES-G permit from the Department of Health, the tanks shall be drained at a rate that will allow the water to infiltrate into the soil at the tank site. Water from the tank shall not be allowed to flow offsite.

E. Maintain existing utilities indicated to stay in service and protect against damage during demolition operations.

F. Before, during and after the demolition work the Contractor shall continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site. No structural element will be allowed to be left standing without sufficient lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

G. Comply with excavating, backfilling, and compacting procedures for soils used as backfill material to fill voids, depressions or excavations resulting from demolition of structures.

H. Do not begin excavation, filling, and other earth-moving operations that are sequential to demolition work in areas occupied by structures to be demolished until all demolition in the area has been completed and debris removed. Holes and other hazardous openings shall be filled.

I. Take the necessary precautions to protect the existing improvements not to be demolished including but not limited to the control building, 8" thick concrete wall, fencing to remain, and utilities. Protect the control building during the demolition and removal of adjacent concrete sidewalk and demolition of other nearby items. Any damage to the control building or other improvements to remain shall be properly repaired to the satisfaction of the Engineer at no cost to the Owner.

3.02 SAFETY

A. Work shall be done in accordance with safety provisions of the Manual of Accident Prevention in Construction, published by the Associated General Contractors of America.

3.03 DISPOSITION OF MATERIALS

A. Title to Materials: Title to all materials and equipment to be removed, except as specified otherwise, is vested in the Contractor upon receipt of notice to proceed. The Engineer will not be responsible for the condition or loss of, or damage to, such property after notice to proceed. Materials and equipment shall not be viewed by prospective purchasers or sold on the site. Burning or burying of materials on the site will not be permitted.

B. When removing the materials from the property, truck loads shall be trimmed and loaded as to prevent spillage.

3.04 CLEANUP

A. Debris and Rubbish: Remove and transport debris and rubbish in a manner that will prevent spillage into waterways or adjacent areas. Cleanup spillage from the site and adjacent areas. The Contractor shall leave the premises clean, neat, and orderly.

B. Regulations: Comply with Federal, State, and local hauling and disposal regulations.

3.05 MEASUREMENT AND PAYMENT

A. Payment for Demolition, Removal and Disposal of the 0.5 MG Steel Tank will be made by Lump Sum. Payment shall include all work to demolish tank, concrete floor slab, footings, concrete ring wall foundation, piping, pavement, and all related appurtenances, including sawcutting, removal, disposal, and lead paint handling, disposal and monitoring. Payment shall be full compensation for all labor, equipment, and tools necessary to complete the work.

B. Payment for Demolition, Removal and Disposal of the Temporary 0.1 MG Steel Tank will be made by Lump Sump. Payment shall include all work to demolish tank, concrete ring wall foundation, piping, and all related appurtenances, removal and disposal, including disposal of gravel base as required. Payment shall be full compensation for all labor, equipment, and tools necessary to complete the work.

C. Payment for Demolition and Removal of the Existing Washout CRM Drain Outlet Structure will be made by Each. Payment shall include all work to demolish drainage structure, including removal and disposal. Payment shall be full compensation for all labor, equipment, and tools necessary to complete the work.

D. Payment for Removal and Proper Disposal of 8" Asbestos Cement Water Line shall not be paid for under this section. Payment for this item shall be made under the Asbestos Cement Pipe Repairs, Demolition and Disposal section.

E. Demolition and Removal of the Existing Chain Link Fence will be measured and paid for by the Linear Foot. Payment shall include all work to demolish chain link fence, including removal and disposal. Payment shall be full compensation for all labor, equipment, and tools necessary to complete the work.

F. Payment for the Removal and Disposal of the existing well discharge piping, and concrete reaction block will be made by Lump Sum. Payment shall be full compensation for all labor, equipment, and tools necessary to complete the work.

G. Payment for the Removal, Cleaning, and Salvaging of the existing well pump and motor unit will be made by Lump Sum. Payment shall be full compensation for all labor, equipment, and tools necessary to complete the work.

H. Payment for Demolition of pavement shall not be paid for separately but shall be included in the items of work to which this section applies.

END OF SECTION

SECTION 02110

ASBESTOS CEMENT PIPE REPAIRS, DEMOLITION, AND DISPOSAL

PART 1 – GENERAL

1.01 WORK INCLUDED IN THIS SECTION

A. The WORK of this Section includes the repair, demolition, and disposal of asbestos cement pipe (ACP).

1.02 REFERENCED SPECIFICATIONS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section.

1. AWWA C213 Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.

2. AWWA C400 Asbestos-Cement Transmission Pipe 4 inch through 16 inch for Water and Other Liquids.

3. AWWA C401 the Selection of Asbestos Cement Distribution Pipe, 4 inch through 16 inch for Water and Other Liquids.

4. AWWA C402 Asbestos-Cement Transmission Pipe 18 inch through 42 inch for Potable Water and Other Liquids.

5. AWWA C403 the Selection of Asbestos-Cement Transmission and Feeder Main Pipe, 18 inch through 42 inch.

6. AWWA C800 Underground Service Line Valves and Fittings.

PART 2 – PRODUCTS

2.01 GENERAL

A. All connections shall be made at existing joints. Field cutting of ACP shall not be permitted.

B. ACP installations, other than for repairs and connections shall not be allowed.

C. The pipe and couplings shall be carefully inspected for defects. Any length of pipe, couplings or gaskets found to be defective in workmanship or materials, or so damaged

as to make repair and use impossible, shall be rejected and removed from the job site the day defect is discovered.

2.02 ASBESTOS CEMENT PIPE

A. The pipe and couplings shall comply with the latest edition of the AWWA Standards.

B. Pipe ends shall be step machined to provide automatic end separation without the use of mechanical spacers. When assembled, the pipe will have only two rubber rings per coupling.

C. Cast iron fittings shall be used for all bends where deflections exceed maximum allowable deflection.

PART 3 - EXECUTION

3.01 GENERAL

A. The CONTRACTOR shall install all repair and connection pipe, closure sections, fittings, valves and appurtenances shown on the plans including bolts, nuts, gaskets, and jointing materials.

B. The CONTRACTOR shall maintain the inside of the pipe clean, sanitary, and free from foreign materials. At all times when the work of installing pipe is not in progress, all openings into the pipe and the ends of the pipe in the trenches shall be kept tightly closed to prevent the entrance of animals and foreign materials.

C. Where closure sections are required by the CONTRACTOR's laying operations, the sections shall be installed in accordance with the manufacturer's installation guide and shall only be used with the approval of the Engineer.

D. Combined deflections at rubber gasket or flexible coupling joints shall not exceed 2 1/2 degrees.

E. Any ACP water line(s) being abandoned shall be abandoned in place unless otherwise noted.

3.02 ABANDONMENT AND DISPOSAL

A. If it is necessary to remove any abandoned ACP line(s) and/or appurtenances to accommodate improvements, the ACP line(s) and/or appurtenances shall be removed and disposed of in accordance with all applicable laws.

B. All work involved in the removal, salvage or disposal of ACP shall be the responsibility

and at the expense of the CONTRACTOR.

C. All scrap ACP shall be properly manifested and prepared for transport following the criteria of the Kauai County Department of Public Works, Solid Waste Division. The scrap material shall be delivered to a landfill permitted for disposal of non-friable asbestos containing materials.

D. Kauai County landfills do not accept friable asbestos-containing materials for disposal. Friable asbestos-containing materials are regulated as hazardous waste (22 CCR 66261.24). A friable material is defined as material that can be crumbled, pulverized, or reduced to powder in the hand.

3.03 INSTALLATION

A. Proper care shall be used to prevent damage in handling, moving, and placing the pipe. Tools and equipment satisfactory to the Engineer shall be provided and used by the CONTRACTOR.

B. The pipe shall not be dropped, dragged, or handled in a manner that will cause bruises, cracks, or other damage.

C. All pipe, fittings, valves, and other pipeline materials shall be lowered into the trench in a manner that prevents damage.

D. Rubber rings for pipe joints shall be stored and protected in a proper manner to prevent deterioration.

E. All material damaged in the course of installation shall be identified and removed from the job site.

E. Pipe sections shall be laid by mechanical means in the trench to true alignment and grade in accordance with the drawings. The pipe grade shall be approved by the Engineer.

F. Bell holes shall be excavated at each joint to permit proper assembly and inspection of the entire joint.

G. Field cutting of ACP will not be permitted. All connections shall be made at existing joints.

I. The CONTRACTOR shall take all necessary precautions to prevent the pipe from floating due to water entering the trench from any source. The CONTRACTOR shall assume full responsibility for any damage due to this cause; and shall, at their own expense, restore and replace the pipe to its specified condition and grade before any displacement occurred due to floating.

J. Fittings shall be temporarily supported by placing concrete blocks under the bells until thrust blocks and supports are poured so that the pipe is not subjected to the weight of the fitting.

K. Concrete thrust blocks of the size shown on the Standard Drawings or as instructed by the Engineer, shall be provided at the locations of all fittings and valves, at no additional cost to the Engineer.

3.04 MEASUREMENT AND PAYMENT

Payment for REMOVAL AND PROPER DISPOSAL OF 8-INCH ASBESTOS CEMENT WASHOUT LINE, OVERFLOW LINE AND PORTION OF EXISTING INFLUENT/EFFLUENT LINE will be made by Linear Foot of asbestos cement pipe removed. Payment shall represent full compensation for all labor, tools, equipment, removal, hauling and proper disposal, including excavation, backfill, grading, compacting, permits, permit fees, and other incidentals required to complete the work.

END OF SECTION

SECTION 02200 – SITEWORK

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for project sitework, including site preparation, fills and backfills, fill placement and compaction requirements, excavations, and cut and fills slopes. The report by Geolabs, Inc. titled "Geotechnical Engineering Exploration, Anahola Farm Lots Water System Improvements", Anahola, Kauai, Hawaii, dated October 25, 2017 including the June 13, 2018 amendment letter (Geotechnical Report) shall be made a part of these contract documents. The Water System Standards, 2002, for State of Hawaii, including any amendments, shall be followed unless specified otherwise in this specification or in Geolabs' Geotechnical Report.

PART 2 – PRODUCTS

2.01 Products shall be as indicated in the project Geotechnical Report.

PART 3 – EXECUTION

3.01 SITE PREPARATION

At the on-set of earthwork, the area within the contract grading limits shall be cleared and grubbed thoroughly. Vegetation, debris, deleterious materials, existing structures and pavements to be demolished, and other unsuitable materials should be removed and disposed of properly off-site or in a designated area to reduce the potential for contamination of the excavated materials. Soft and yielding areas encountered during clearing and grubbing below areas designated to receive fill and/or future improvements shall be over-excavated to expose firm material, and the resulting excavation shall be backfilled with well-compacted fill. The excavated soft soils should not be re-used as fill materials and should be properly disposed of off-site or in landscaped areas, if appropriate.

Slabs and foundations of the existing reservoir tank structure, pavements, and walkways to be demolished should be completely removed. Over-excavations resulting from the demolition operations should be backfilled with well-compacted general fill material.

The on-site materials should be moisture-conditioned to about 2 percent above the optimum moisture content, placed in 8-inch level loose lifts, and compacted to a

minimum of 90 percent relative compaction. Utilities to be abandoned in-place should be backfilled by pumping lean concrete or CLSM (Controlled Low Strength Material) under low pressure.

After clearing, grubbing, and demolition, areas to receive fills and finished subgrades in cut areas should be scarified to a depth of 8 inches, moisture-conditioned to at least 2 percent above the optimum moisture content, and compacted to a minimum of 90 percent relative compaction.

Where shrinkage cracks are observed after the subgrade compaction, prepare the subgrade soil again as recommended above. Saturation and subsequent yielding of the exposed subgrade due to inclement weather and poor drainage may require over-excavating the soft areas and replacing these areas with engineered fill. A registered geotechnical engineer should evaluate the need for over-excavation due to soft subgrade soil conditions.

3.02 FILLS AND BACKFILLS

In general, the on-site soils may be re-used as a source of general fill material, provided they are free of vegetation, deleterious materials, and rock fragments greater than 3 inches in maximum dimension. Imported fill materials should consist of non-expansive, select granular materials such as crushed basalt or coral. Select granular fill, if required, should be well-graded from coarse to fine with particles no larger than 3 inches in largest dimension and should contain between 10 and 30 percent particles passing the No. 200 sieve. The material should have a laboratory CBR value of 20 or more and should have a maximum swell of less than 1 percent when tested in accordance with ASTM D1883.

Aggregate base course and subbase course materials should consist of crushed basaltic aggregates and should conform to the State of Hawaii, Standard Specifications for Road and Bridge Construction (2005). Imported fill materials should be tested for conformance with these recommendations prior to delivery to the project site for the intended use.

3.03 FILL PLACEMENT AND COMPACTION REQUIREMENTS

General fills and backfills should be moisture-conditioned to about 2 percent above the optimum moisture, placed in level lifts not exceeding 8 inches in loose thickness, and compacted to at least 90 percent relative compaction. The finished subgrades of future pavement areas should be compacted to a minimum of 95 percent relative compaction.

Aggregate base course and aggregate subbase materials should be moisture-conditioned to above the optimum moisture content, placed in level lifts not exceeding 8 inches in loose thickness, and compacted to a minimum of 95 percent relative compaction.

Footing subgrades should be recompacted to a firm and unyielding surface prior to the placement of reinforcing steel or concrete. Soft and/or loose materials encountered at the bottom of footing excavations should be over-excavated to expose the underlying firm materials. The over-excavation should be backfilled with fill materials compacted to a minimum of 95 percent relative compaction, or the footing may be deepened to bear on the underlying firm materials.

Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density as determined by ASTM D1557. Optimum moisture is the water content (percentage by dry weight) corresponding to the maximum dry density. Compaction of fill materials should be accomplished by sheepsfoot rollers, vibratory rollers, or other types of acceptable compaction equipment. Water tamping, jetting, or ponding should not be allowed to compact the fills.

3.04 CUT AND FILL SLOPES

Cut slopes and permanent fill slopes constructed of the on-site soils may be designed with a slope inclination of 2H:1V or flatter. Fills placed on slopes steeper than 5H:1V should be keyed and benched into the existing slope to provide stability of the new fill embankment against sliding. The filling operations should start at the lowest point and continue up in level horizontal compacted layers in accordance with the above general fill placement recommendations.

Fill slopes should be constructed by overfilling and cutting back to the design slope ratio to obtain a well-compacted slope face. Surface water should be diverted away from the tops of slopes, and slope planting should be provided as soon as possible to reduce the potential for erosion of the finished slopes.

3.05 MEASUREMENT AND PAYMENT

Sitework shall not be paid for under this section, but shall be included in the items of work to which this section applies.

END OF SECTION

SECTION 02227

COLD PLANING OF EXISTING PAVEMENT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section describes removing existing pavement by a cold planing process.

This specification shall follow the requirements specified in the State of Hawaii, Department of Transportation "Hawaii Standard Specifications for Road and Bridge Construction," 2005 unless specified otherwise.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

(A) Equipment. Use self-propelled cold planing machine capable of removing pavement to depth and cross slope indicated in the contract documents, without tearing or gouging underlying surface to remain and without contaminating milled pavement with underlying base course material.

Equip machine with cutting drum capable of producing a uniform surface finish. Enclose cutting drum in shroud to prevent discharge of loosened material into adjacent work areas. As standard equipment, provide dust suppression system, storage tanks with adequate water, and high- pressure spray bar with spray nozzles. Provide machine capable of cutting crown and depth by tilting drum axis and equipped with guidance system that controls transverse slope and longitudinal profile, matches adjacent pavements, and controls depth of cut.

Where cold planing is required to improve existing pavement profile for subsequent resurfacing, set guidance system grade sensor on string line or mobile reference. If mobile reference is used, provide 30-foot-minimum length of mobile reference to provide average elevation variations.

(B) Planed Surface and Removed Material. Cold plane surface to remove pavement and to eliminate high spots and surface irregularities for roadway resurfacing. Remove thickness of existing pavement to a 2-inch depth as indicated in the contract documents.

Adjust machine blades to avoid damaging existing items that are to remain, such as underlying pavement structure, monuments, manholes, and pipes. Remove and replace or reconstruct items damaged by planning operations.

For roadways open to traffic, cold plane each day across full width of traffic lane to avoid

longitudinal pavement drop-off between passes. At end of each day's production, construct tapered transitions along longitudinal and transverse pavement drop-offs. Use maximum slopes of 6:1 for longitudinal and 48:1 for transverse tapered transitions. Limit drop-off depths to maximum of 3 inches. Remove transition material before resurfacing.

Provide for drainage of cold-planed surface and adjacent pavement. Perform this operation on same day as cold planing.

Finish surface shall be suitable for maintaining traffic. Except at crown areas, limit surface deviations to maximum of 3/8 inches, measured along 10-foot straight edge laid longitudinally and transversely.

Clean and sweep surface of planed pavement in accordance with Section 310 - Brooming Off of the "Hawaii Standard Specifications for Road and Bridge Construction," 2005 before opening cold-planed area to public traffic. Dispose of cold-planed and removed transition materials in accordance with Section 02050 - Demolition.

Minimize dust escaping from cold planing operation and contain or remove runoff water used for dust control in accordance with Section 620 - Dust Control of the "Hawaii Standard Specifications for Road and Bridge Construction," 2005.

Cold plane surface no more than three calendar days prior to placement of resurfacing material. Do not expose cold-planed surface to public traffic for more than three calendar days.

3.02 MEASUREMENT AND PAYMENT

Cold planing will not be measured for payment. Cold planing shall be considered as incidental and included in the cost for the Asphalt Pavement item in the contract proposal.

END OF SECTION

SECTION 02230

AGGREGATE BASE COURSE

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. This work shall consist of furnishing and placing one or more courses of aggregate base on a prepared surface in accordance with the requirements of the contract.

B. This section shall apply to the construction of the 8” County Standard Pipe, 6” PVC Drain Pipe, Drain Outlet Structures, Concrete Pads and Restoration of Asphaltic Pavement.

1.02 SUBMITTALS

Before construction, submit six (6) sets of test data and other certification information for the aggregate. Contractor shall include the source of the material.

PART 2 - PRODUCTS

2.01 MATERIALS

Materials shall meet the requirements specified in the following Subsections of Division 700 Materials of the "Standard Specifications for Road and Bridge Construction."

Aggregate	703.06
Water	712.01

PART 3 - EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

A Placing

1. The base material shall be placed on the prepared surface without segregation. Segregated materials shall be remixed until a uniform distribution is obtained. The material shall not be dumped in piles on the prepared surface.

2. Depositing and spreading shall commence at that part of the work farthest from the point of loading the material and shall progress continuously without breaks, unless otherwise directed by the Engineer.

3. If the required compacted depth of the base course exceeds 6 inches, the base shall be constructed on 2 or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed 6 inches.

4. If the contractor uses a vibratory roller weighing 9 tons or more, the lift thickness may be increased to 7 inches.

5. Spreading of binder material over the surface of the compacted base will not be permitted. Additional material if required shall be incorporated uniformly throughout the thickness of the compacted material by scarifying and blading. The combined material shall meet all quality requirements as specified.

B. Shaping and compacting

1. The Contractor shall perform such shaping work as necessary and such that the finished base shall conform to the required grade and cross-section. The finished base where not controlled by adjacent structures or features shall not vary more than 0.04 foot above or below the theoretical grade.

2. Compaction of each layer shall continue until a density of not less than 95 percent of the maximum density, determined in accordance with the requirements of Subsection 106.09 - Special Test Methods, of the "Standard Specifications for Road and Bridge Construction, has been achieved. Field density determination will be made in accordance with Hawaii Test Method HWY-TC 1. The surface of each layer shall be maintained during the compaction operations in such a manner that a uniform texture is produced and the aggregates firmly keyed. Water shall be uniformly applied over the base materials during compaction in the quantity necessary for proper consolidation.

3. Should high or low spots develop during rolling operations, such spots shall be smoothed out by blading with a self-propelled and pneumatic-tired motor grader having a wheel base not less than 15 feet long and a blade not less than 10 feet long.

4. Each layer shall be compacted initially by rolling with three-wheel rollers followed by intermediate rolling with pneumatic-tired rollers. Final rolling shall be done with three-wheel rollers.

C. Equipment. Three-wheel rollers and pneumatic-tired rollers shall conform to the requirements specified in Subsection 401.03(B)(4) - Rollers.

3.02 MEASUREMENT AND PAYMENT

Aggregate Base Course will not be measured for payment. Aggregate Base Course will be considered as incidental and included in the cost for the 8" County Standard Pipe, 6" PVC Drain Pipe, Drain Outlet Structures, Concrete Pads and Restoration of Asphaltic Pavement items in the contract proposal.

END OF SECTION

SECTION 02232

AGGREGATE SUBBASE COURSE

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. This work shall consist of furnishing and placing one or more courses of aggregate subbase on a prepared surface in accordance with the requirements of the contract.

B. This section shall apply to construction of the Reinforced Concrete Tank, Temporary 0.1 MG Tank, 8” County Standard Pipe, 6” PVC Drain Pipe, CMU Control Building Expansion, and Restoration of Asphaltic Pavement.

1.02 SUBMITTALS

Before construction, submit six (6) sets of test data and other certification information for the aggregate. Contractor shall include the source of the material.

PART 2 - PRODUCTS

2.01 MATERIALS

Materials shall meet the requirements specified in the following Subsections of Division 700 Materials of the "Standard Specifications for Road and Bridge Construction."

Aggregate	703.17
Water	712.01

Aggregate subbase course shall not include cullet.

PART 3 - EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

A. Placing

Haul, deposit, and spread aggregate subbase on a prepared surface in a manner that minimizes rutting, uneven compaction, and segregation. Should segregation occur, remove segregated material and replace with material conforming to the contract documents, at no increase in contract price or contract time.

Where compacted thickness is greater than 6 inches, spread and compact mixture in two or more lifts approximately equal in thickness. Maximum compacted thickness of one lift shall be 6 inches.

B. Shaping and compacting

Prior to shaping, add water uniformly to aggregate subbase, as necessary, to obtain moisture content within 2 percent above or below optimum moisture content for compaction. Immediately after spreading aggregate subbase, shape and compact each lift across full width using power roller. Roll in direction parallel to centerline of road. For areas inaccessible to roller, compact using tampers or compactors.

Compact each lift to produce uniform surface texture and to attain at least 95 percent of maximum density in accordance with Subsection 203.03(C)(2) – Relative Compaction Test.

Limit surface deviations of finished areas to not more than 1/2 inch above or below theoretical grade. Correct surface deviations more than 1/2 inch above or below theoretical grade by scarifying, adding or removing material, blading, watering, and compacting. Reshape high or low spots with self-propelled, pneumatic-tired motor grader. Use graders with wheelbase not less than 15 feet long and blade not less than 10 feet long.

3.02 MEASUREMENT AND PAYMENT

Aggregate Subbase Course will not be measured for payment. Aggregate Subbase Course will be considered as incidental and included in the cost for the Reinforced Concrete Tank, Temporary 0.1 MG Tank, 8” County Standard Pipe, 6” PVC Drain Pipe, CMU Control Building Expansion, and Restoration of Asphaltic Pavement in the contract proposal.

END OF SECTION

SECTION 02512

ASPHALTIC CONCRETE PAVEMENT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Asphaltic Concrete Pavement shall follow the requirements specified Section 401 – Hot Mix Asphalt (HMA) Pavement, in the State of Hawaii, Department of Transportation "Hawaii Standard Specifications for Road and Bridge Construction," 2005, unless specified otherwise.

Asphaltic concrete shall consist of a mixture of mineral aggregate and bituminous material, mixed at a central plant in the proportions hereinafter specified and spread and compacted on a prepared base or existing road surface.

The pavement may consist of a surface course mixture and leveling or base course mixture, as hereinafter specified.

1.02 SUBMITTALS

Establish and submit job-mix formula for each type of HMA pavement mix indicated in the contract documents as follows:

A. Design percent of aggregate passing each required sieve size.
B. Design asphalt content added to aggregate, based on total weight of mix.
C. Design proportion of processed RAP.
D. Design temperature of mixture at point of discharge at paver.
E. Source of aggregate.
F. Grade of asphalt cement
G. Test data used to develop job-mix formula

With the exception of D. in this subsection, if design requirements are modified after the Engineer accepts job-mix formula, submit new job mix formula before using HMA produced from modified mix design.

Submit a certificate of compliance for asphalt cement, accompanied by substantiating test data.

PART 2 - PRODUCTS

2.01 MATERIALS

All materials shall meet the requirements specified in the State of Hawaii, Department

of Transportation "Hawaii Standard Specifications for Road and Bridge Construction," 2005, with the following subsections of Division 700 - Materials.

Asphalt Cement	702.01
Emulsified Asphalt	702.04
Aggregate for Hot Mix Asphalt Pavement	703.09
Filler	703.15
Hydrated Lime	712.03

Leveling or base course mixture shall be Mix No. 2, surface wearing course mixture shall be as shown on the plans or called for in the special provision or proposal.

A. Grading and Composition Requirements: The aggregate grading requirements shall conform to Table 1 below:

TABLE 1 - AGGREGATE GRADING REQUIREMENTS

MIX NO.	II	III	IV	V
		COMBINED AGGREGATE		
SIEVE SIZE		Total Percent Passing by Weight		
1-1/4"	100	-	-	-
1"	85-100	100	-	-
3/4"	-	90-100	100	-
1/2"	60-85	70-90	90-100	100
3/8"	-	-	72-90	80-100
No. 4	36-55	40-57	48-66	55-75
No. 8	26-41	30-47	32-48	35-52
No. 16	17-32	20-36	21-37	22-38
No. 30	12-25	16-28	15-27	14-26
No. 50	8-18	10-22	9-21	8-20
No. 100	5-14	8-17	6-16	6-15
No. 200	1-8	4-8	4-8	4-8
	Asphalt Content (Percent of Total Weight of Mix)			
	3.8-6.1	4.3-6.1	4.3-6.5	4.8-7.0
	Minimum to Maximum Compacted Thickness for Lifts (Inches)			
	2-1/4 to 3	2 to 3	1-1/2 to 3	1-1/4 to 3

Provide Hot Mix Asphalt within allowable tolerances of accepted job mix formula as specified below:

Passing No. 4 and larger sieves	7% above or below
Passing No. 8 and No. 100 sieves	4% above or below
Passing No. 200 sieves	3% above or below
Bituminous Binder	0.4% above or below
Temperature of Mixture on Delivery	20^{o}F above or below

PART 3- EXECUTION

3.01 DETAILS

A. Mixing: The asphaltic cement shall be heated in a kettle of approved type, and maintained at a temperature between 275°F and 300°F. The heat must be so applied that there can be no burning of any portion of the asphaltic cement. No live steam shall be injected into the cement. The mineral aggregate shall be heated in an approved appliance to a temperature of not less than 275°F nor more than 320°F.

After heating to the required temperature, the required amount of asphalt cement shall be added to the heated aggregate. This mass shall be introduced into the mixer within 25°F of each other's temperature.

B. Prime Coat: All surfaces on or against which asphalt concrete is to be placed shall first be given an asphaltic cement prime or tack coat as specified in Section 02513, "Prime Coat," of these specifications.

Before applying the prime and tack coat, the Contractor shall prepare the existing surfaces by power brooming to remove all loose particles, dust, sand, and other foreign materials.

C. Laying Wearing Surface: In advance of placing asphalt concrete over an existing base, surfacing, or pavement, and after the base, surfacing, or pavement has been prepared as herein specified, and if ordered by the Engineer or shown on the plans, a leveling course mixture shall be spread to level irregularities, dips, depressions, sags, and excessive crown, and to provide a smooth base of uniform grade and cross-section in order that the surface course will be of uniform thickness. The above specified material shall not be placed more than one day in advance of placing the surface course. No additional compensation will be allowed for placing leveling course mixture as specified above and full compensation for all work incidental to such operations shall be considered as included in the contract prices or price paid for the asphalt concrete mixture used.

The mixture as prepared above shall be brought to the work in suitable vehicles at a temperature of not less than 250°F. Tarpaulins shall be provided and used upon all loads.

The wearing surface shall be spread with self-propelled mechanical spreading and finishing equipment, provided with a screed or strike-off assembly capable of distributing not less than the full width of a traffic lane. The screed shall be adjustable to the required crown and elevation. Screeding includes any cutting, crowding or other action which is effective on the mixture without tearing, shoving, or gouging, and which produces a finished surface of an even texture. The equipment shall be provided with rolling, tamping, or other suitable compacting devices, and shall be operated with a forward speed of not more than 20 feet per minute.

If the spreading and finishing equipment leaves ridges, indentations, or other marks in the surface that cannot be eliminated by rolling or prevented by adjustment in operation, its use shall be discontinued and other acceptable equipment shall be furnished by the Contractor.

If more than one course is to be laid in any area, not more than 24 hours shall elapse between the spreading and finishing of any two successive courses in that area.

The self-propelled mechanical spreading and finishing machine shall be capable of propelling the vehicle being unloaded in uniform manner and, if necessary, the load of the haul vehicle shall be so limited that satisfactory spreading will be obtained. While being unloaded, the vehicle shall be firmly attached to the machine and the brakes on

the vehicle shall not be depended upon to obtain contact between the vehicle and the machine.

Before placing asphalt concrete wearing surface adjacent to cold transverse construction joints, such joints shall be trimmed to a vertical face in a neat line. The location of the proposed joint shall be tested with a 10-foot straight-edge and cut back such that when the straight-edge is laid on the finished surface parallel with the center line of the street, the surface shall in no place vary from the lower edge of the straight-edge more than 1/8 inch.

Before placing asphalt concrete adjacent to any existing asphalt concrete, the face of the existing asphalt concrete shall be trimmed to a vertical face in a neat line.

Where asphalt concrete wearing surface is placed adjacent to a Portland cement concrete gutter, the asphalt concrete wearing surface shall be so laid that its surface, after compaction, will approximately be 1/4-inch above the surface of the adjacent concrete. The edge of the asphalt concrete wearing surface shall then be smoothed and sealed over a width of approximately 3 inches with hot hand-irons having a self-contained heating unit.

At locations where the width of asphalt concrete mixture to be spread is too narrow to permit the use of self-propelled mechanical spreading and finishing equipment, or where the surfacing is to extend to a featheredge and the use of such a machine is not practicable, the mixture may be spread by hand-raking. Where hand-raking is permitted, the mixture shall be finally shaped and smoothed by means of a wooden float 8 feet long, one-inch thick and 4 inches wide. The float shall be rigidly ribbed, and to insure a true and flat surface on the underside, adjusting screws shall be placed between the rib and float at not more than 24-inch centers. The float shall be operated by means of a long handle, from the side of the area being paved or surfaced, and parallel with the center line of the pavement or surfacing. High spots and irregularities that are transverse to the path of traffic shall be cut down and the material redistributed over the area. The maximum depth of wearing surface which may be spread and rolled in one course shall not exceed a compacted thickness of 2 inches. Where such thickness exceeds 2 inches, it shall be spread and rolled in courses each not to exceed a compacted thickness of 1-1/2 inches unless otherwise specified in these specifications.

Wearing surface mixture shall not be spread from hauling vehicles.

No wearing surface shall be spread when the atmospheric temperature is below 50^{o}F or during other unsuitable weather, or when the base is wet.

D. Rolling: Immediately after the wearing surface has been laid as specified above, it shall be compressed with power rollers, smooth running, and in first-class mechanical condition. Initial rolling or tamping shall be performed when the temperature of the mixture is between 220°F and 245°F.

After the first pass of the roller, any low or grainy spots shall be broken up with a hot rake and more material worked in to insure a surface of uniform texture and maximum density. Rolling equipment shall be self-propelled. Initial rolling of asphalt concrete mixtures shall be performed by means of a three-wheeled roller weighing not less than 12 tons and with a compression on the rear wheels of not less than 325 pounds per linear inch of tire width, or in lieu thereof, by means of a three-axle tandem roller weighing not less than 12 tons. For production not exceeding 150 tons per hour, not less than one of the above specified rollers shall be used for initial rolling. For productions in excess of 150 tons per hour, one additional roller of a type designated by the Engineer will be required for each additional 100 tons or fraction thereof of asphalt concrete mixture placed.

Three-axle-tandem type rollers shall be so constructed that the rolls, when locked in position for all treads to be in one plane, are held with a rigidity which will permit the following test under full load. With the weight of the roller supported on the central roll, the tread of the central roll shall not be more than 1/8-inch above the plane tangent to the treads of the end rolls. With the weight of the roller supported on the end rolls, the tread of the central roll shall not be more than 1/4-inch below the plane tangent to the treads of the end rolls.

In general, three-axle tandem roller shall not be used in rolling over a crown or on warped surfaces when the axle is in a locked position.

Finishing rolling of asphalt concrete mixtures shall be performed by means of a tandem roller weighing not less than 10 tons.

Rolling shall continue until the compressed pavement or surfacing has a relative specific gravity of not less than 95 percent of the specific gravity of the combined mixture without voids.

E. Smoothness: The finished surface of the pavement shall be true to grade and cross-section, free from depressions, or grainy spots, and shall show a uniform distribution of aggregate.

When a straight-edge, 10 feet long, is laid on the finished surface parallel to the center line of the pavement, the surface shall in no place vary from the lower edge of the straight-edge more than 3/16 of an inch.

No traffic shall be permitted on any course of asphalt concrete until it has cooled and set, except such traffic as may be necessary for construction purposes.

3.02 MEASUREMENT AND PAYMENT

Payment for RESTORATION OF ASPHALTIC PAVEMENT will be made by Square Yard of asphalt concrete pavement laid. Payment shall represent full compensation for furnishing all materials, labor, tools, equipment and incidentals, including excavation, backfill, grading, compacting, and other incidentals required to complete the work.

Included in the payment for RESTORATION OF ASPHALTIC PAVEMENT shall be the following work: cold planning, roadway striping, restoration of street monuments, prime coat, tack coat and all other incidentals required to complete the work, in place complete.

END OF SECTION

SECTION 02513

PRIME COAT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and installing of prime coat.

PART 2 - PRODUCTS

2.01 MATERIALS

Bituminous Material: Bituminous material for prime coat shall emulsified asphalt, Type CSS-1h or SS-1h, conforming to the applicable requirements of Section 420 – Primer for Untreated Permeable Base Course, and Section 702 - Bituminous Materials, of the "Hawaii Standard Specifications for Road and Bridge Construction," 2005.

Water shall conform to the requirements of Subsection 712.01 - Water.

The Engineer reserves the right to waive any of the requirements for the MC-30 provided that its performance is not affected.

2.02 SUBMITTALS

The Contractor shall submit a Certificate of Compliance accompanied by certified test data, in accordance with AASHTO M 208 (Type CSS-1h) or AASHTO M 140 (Type SS-1h)

PART 3 - EXECUTION

3.01 DETAILS

A. Immediately before applying the prime coat, the surface to be treated shall be swept clean of all loose material, dirt, excess dust or other objectionable material.

Prime coat shall not be applied when the surface to be treated is appreciably damp or when weather conditions are unsuitable.

B. The material shall be uniformly applied by a vehicle, mounted, pressure operated, sprayer type distributor at an approximate rate of 0.35 of a gallon per square yard. The exact rate of application shall be determined by the Engineer. After the prime coat has penetrated the surface, deficient areas shall receive additional applications and areas of excess bituminous material shall be blotted with clean sand. Traffic shall be kept off the prime coat until the material has been completely absorbed.

C. Curbs, sidewalks and gutters shall be protected from prime coat. Any material sprayed on adjoining improvements shall be immediately cleaned off. The edges of existing asphalt paving, manholes and catch basin frames, concrete gutters, etc., against which asphaltic concrete pavement is to be placed shall be given a prime coat.

3.02 MEASUREMENT AND PAYMENT

Prime coat will not be measured for payment. Prime coat will be considered as incidental and included in the cost for the Restoration of Asphalt Pavement item in the contract proposal.

END OF SECTION

SECTION 02514

TACK COAT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and installing bituminous tack coat.

PART 2 - PRODUCTS

2.01 All sections or subsections called for in the specifications shall be referred to the State of Hawaii, Department of Transportation, "Hawaii Standard Specifications for Road and Bridge Construction," 2005.

2.02 MATERIALS

Bituminous material for tack coat shall be slow-setting emulsified asphalt, Type SS-1 or Type SS-1h, conforming to the applicable requirements of Section 407 - Tack Coat and Section 702 – Bituminous Material.

Water shall conform to the requirements of Subsection 712.01 - Water.

2.03 SUBMITTALS

Submit certificate of compliance for emulsified asphalt, accompanied by certified test data in accordance with AASHTO M 140 (Type SS-1 or SS-1h).

PART 3 - EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

A. Weather Limitations: Tack coat shall not be applied on a wet surface or when weather conditions otherwise shall prevent proper construction.

B. Equipment: The Contractor shall provide equipment for heating and applying the bituminous material. This equipment shall meet the requirements of Subsection 405.03(B) - Equipment.

C. Preparation of Surface: Immediately before applying the tack coat, the surface to be treated shall be swept clean of all loose material, dirt, excess dust or other objectionable matter. A power broom or power blower, supplemented by hand methods if necessary, shall be used.

D. Application of Bituminous Material: The emulsified asphalt shall be diluted with water at a rate of one part emulsion to one part of water by volume. The quantity, rate of application, temperature, and areas to be treated will be approved prior to application.

Tack coat shall be placed only so far in advance of the surface course placement as is necessary for it to cure to the proper condition for placement of such surface course.

Unless otherwise specified, tack coat shall be applied at the rate of 0.12 - 0.18 gallon per square yard on surface of base course.

3.02 MEASUREMENT AND PAYMENT

Tack coat will not be measured for payment. Tack coat will be considered as incidental and included in the cost for the Restoration of Asphalt Pavement item in the contract proposal.

END OF SECTION

SECTION 02524

GRAVEL PAD AND GRAVEL ACCESS ROAD

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This item of work shall include all labor, materials, tools, equipment and incidentals required to complete the access road and gravel pad to the lines, grades, and details as shown on the plans and as specified in this section.

1.02 SUBMITTALS

Before construction, submit six (6) sets of test data and other certification information for the aggregate. Contractor shall include the source of the material.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Aggregate shall conform to the applicable requirements of ASTM D 1241. The aggregate material shall be free from vegetable matter and other deleterious substances.

a. The surface course shall meet the requirement of ASTM D 1241 for Type I with Gradation C or any other gradation, which will grade within the followings limits:

Sieve Size	Percent Passing by Weight
3/4”	100
No. 4	38 - 65
No. 8	25 - 60
No. 30	10 - 40
No. 200	3 - 12

b. The gravel road and pad surfacing shall meet the following requirements:

i. Percentage of Wear: When tested in accordance with ASTM C 131, the percentage of wear shall not exceed 40 percent after 500 revolutions.

ii. Plasticity Index: When tested in accordance with ASTM D 4318, the plasticity index shall not be more than five (5).

iii. Liquid Limit: When tested in accordance with ASTM D 4318, the liquid limit shall not be more than 25 percent.

PART 3 - EXECUTION

3.01 EXCAVATION

A. All excavation for the access road and pad shall be unclassified and shall consist of the removal and proper disposal of all materials necessary and required for the formation of roadway prism, including the construction of the roadbed, embankments, subgrade, the removal and disposal of surplus and undesirable materials. Slopes on cut or fill shall be in conformity with the details as shown on the plans.

3.03 BASE PREPARATION

A. The area to be surfaced shall be properly compacted by rolling until the surface is in a relatively smooth and even condition to receive the top course. The surface shall be inspected and approved by the Construction Manager before any aggregate surfacing material is placed.

3.03 PLACEMENT

A. The aggregate shall be deposited, spread, processed, and compacted on the prepared subgrade to the required thickness as shown on the drawings. In the event segregation occurs, the material shall be bladed until the various sizes of aggregate are uniformly and satisfactorily blended. After being spread, the material shall be watered, mixed, shaped to the required section. The material shall be proof rolled with power rollers weighing between 10 and 12 tons. The completed course shall be smooth, true to grade and cross-section, and free from ruts, humps, depressions, and irregularities.

3.04 MEASUREMENT AND PAYMENT

A. Measurement and Payment for GRAVEL PAD will be made per cubic foot. Payment shall represent full compensation for furnishing all materials, labor, tools, equipment and incidentals, including excavation, backfill, grading, compacting, and other incidentals required to complete the work.

B. Measurement and Payment for GRAVEL ACCESS ROAD will be made per square foot. Payment shall represent full compensation for furnishing all materials, labor, tools, equipment and incidentals, including excavation, backfill, grading, compacting, and other incidentals required to complete the work.

END OF SECTION

SECTION 02611

PIPE AND FITTINGS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and installing of County Standard pipe and fittings. The Water System Standards, 2002, for State of Hawaii, including any amendments, shall be followed unless specified otherwise in this specification.

A. The class of water mains shall be determined by the maximum pressure to be expected in the line.

B. Furnish all labor, materials, tools, equipment and related items necessary to complete, in place, and ready for use, water pipes in conformity with the dimensions, profiles, sections, and details shown on the plans.

1.02 SUBMITTALS

A. Submit manufacturers' information bulletins, catalog cuts, drawings and other data to show that the proposed items conform to the specifications requirements. The manufacturer and details of the flanged pipe and fittings must be approved by the Engineer before the piping layout drawings are submitted.

B. Submit six sets of piping layout drawings. Drawings shall show all dimensions, valves, piping, fittings, and appurtenances.

PART 2 - PRODUCTS

2.01 WATER PIPE

A. Pipe materials shall meet County Standards. Pipes shall be furnished in lengths not shorter than 18 feet nor longer than 20 feet.

B. Flange materials shall meet County Standards. Bolt holes shall straddle the vertical center line.

2.02 DRAIN PIPE

A. Drain pipe shall be C900 PVC, Class 150.

2.03 FITTINGS: Fittings shall meet the County Standards. Compact fittings are not allowed.

2.04 INTERIOR LINING: All pipes, fittings, and special castings, except sleeves and plugs, shall be cement mortar lined in accordance with ANSI A-21.4 and AWWA C104. Interior linings shall have tapered ends and shall be sealed with a bituminous seal coat.

2.05 GASKET:

A. Gaskets shall meet the County Standards.

B. Gaskets shall be vulcanized natural or vulcanized synthetic rubber, free of porous areas, foreign materials, and visible defects. No reclaimed rubber shall be used.

2.06 BOLTS AND NUTS:

A. All bolts and nuts shall meet the County Standards

B. All bolts and nuts shall be either silicon bronze (ASTM F467 and F468) or stainless steel (ASTM F593 and F594, type 316). All bolts and nuts shall be silicon bronze only if submerged in water. Bolts and nuts installed shall be compatible in strength and material characteristics. Bolts shall protrude beyond the nuts and protrusion shall be a minimum of 1/8-inch but shall not exceed 1/2-inch. All stainless steel bolt and nut threads shall be pre-coated with anti-seizing graphite compound before installation.

PART 3 - EXECUTION

3.01 INSTALLATION

Prior the installation of the pipe, the circumference of the spigot ends shall be marked showing the depth of the bell of the pipe.

Prior to installation, the contractor shall confirm existing waterline locations by toning. The waterline locations on the plans are based on record drawings, not surveyed locations.

A. After the trench bottom has been prepared, each pipe shall be laid so that the barrel of the pipe shall have bearing along its laying length with the bell end properly set to grade and alignment. The spigot end of the pipe shall then be centered and firmly embedded against the bell end of the pipe previously laid. There shall be uniform clearance around the bell. The pipe shall be firmly held in place by proper blocking on each side of the pipe.

B. No pipe "springing" or "buckling" into place between installed pipe or special castings shall be allowed.

C. Whenever it is necessary to install pipe sleeves, the space between the ends of the adjoining pipes shall be filled by inserting a full ring piece. The filler piece shall be of

the same material as the pipe.

F. Install polyethylene loose wrap around pipes and fittings as required by the County Standards. Installation of polyethylene loose wrap shall be in accordance with AWWA C105. The wrap shall consist of an 8-mil thickness polyethylene tube or flat sheet installed to completely encase the pipe and fittings and secured thereto with 2-inch wide plastic adhesive tape.

G. When pipe laying is interrupted or delayed, all openings shall be tightly closed with removable plugs or caps. The plugs shall be held securely in place.

H. Mechanical Joint. In making the joint, the bell and the spigot ends of the pipe as well as the rubber gasket shall be thoroughly cleaned before assembly. The gland, followed by the gasket, shall be placed over the spigot end of the pipe. The spigot end of the pipe shall be inserted into the bell of the pipe previously laid. The small side of the gasket and the lip side of the gland shall face the bell. The gasket shall then be pushed into position so that it is evenly seated in the bell. The gland shall be moved against the face of the gasket.

a) Bolts shall be inserted with threaded ends on the gland side. Nuts shall be screwed on by hand and made hand tight in pairs, 180 degrees apart. Bolts shall be alternatively tightened (180 degree apart) to the required tension with an ordinary ratchet wrench, beginning at the bottom, then the top and so on. The ranges of bolt torques to be applied shall be as follows:

Bolt Size, Inches	Range of Torque, Ft. Pounds
5/8	45-60
3/4	75-90
1	85-100
1-1/4	105-120

b) The following lengths of wrenches should satisfactorily produce the above ranges of torques when used by the average man:

Bolt Size, Inches	Length of Wrench, Inches
5/8	8
3/4	10
1	12
1-1/4	14

c) When the joint is assembled, the distance between the face of the bell and the face of the gland shall be uniform all around the pipe.

d) All stainless steel bolt and nut threads shall be pre-coated with anti-seizing graphite compound before installation.

I. Push-on Joint. The gasket and gasket seat in the socket of the pipe shall be wiped clean. The gasket shall be placed in the socket with the large round end entering first. The gasket shall be sprung into place. The groove of the gasket shall fit over the bead in the seat.

a. A thin film of non-toxic lubricant, supplied by the manufacturer, shall be applied to the inside of the gasket that comes in contact with the pipe. A thin film of lubricant may also be applied to the outside of the plain end of the pipe.

b. The joint shall be assembled by entering the plain end of the pipe past the gasket until contact is made with the base of the socket.

c. When pipes are cut in the field, the outside edges of the cut end shall be tapered with a coarse file or portable grinder. The taper shall be about 1/8 inch at an angle of about 30 degrees with the center line of the pipe.

J. Flanged Ends. All flanged pipes, fittings and valves shall be installed to the lines and grade shown on the plans. The face of flanges shall be true and free of projections and shall be cleaned of all rust and foreign matter. Gaskets shall be "full face" carefully cut to fit flanges and bolt holes. "Flange-Tyte" gaskets may also be used. Flanges shall be brought up to true alignment and fit with uniform tension on all bolts. All stainless steel bolt and nut threads shall be pre-coated with anti-seizing graphite compound before installation.

3.02 MEASUREMENT AND PAYMENT

A. Payment for the furnishing and installation of 8” County Standard Pipe will be made at the Unit Price Bid per linear foot based on the actual linear feet of pipe installed, cleaned or pigged, successfully hydrotested and disinfected.

The Unit Price Bid for the furnishing and installation of pipe shall be full compensation for all labor, tools, equipment for all handling, hauling, unloading, placing, cutting, jointing, cleaning or pigging, hydrotesting, disinfecting, painting, pavement sawcutting and demolition, unclassified trench excavation and backfill for pipe and appurtenances, pipe cushion, warning tape, temporary road patch, restoration of improvements (curbs, gutters, sidewalks, concrete driveways, concrete pavement, landscaping etc.), sheeting and shoring as required, compaction, dewatering, and all incidental work necessary to construct the water system as indicated on the plans, in place complete.

B. Payment for the furnishing and installation of 6” County Standard Pipe for Well Blow Off will be made at the Unit Price Bid per linear foot based on the actual linear feet of

pipe installed, cleaned or pigged, successfully hydrotested and disinfected.

The Unit Price Bid for the furnishing and installation of pipe shall be full compensation for all labor, tools, equipment for all handling, hauling, unloading, placing, cutting, jointing, cleaning or pigging, hydrotesting, disinfecting, painting, pavement sawcutting and demolition, unclassified trench excavation and backfill for pipe and appurtenances, pipe cushion, warning tape, temporary road patch, restoration of improvements (curbs, gutters, sidewalks, concrete driveways, concrete pavement, landscaping etc.), sheeting and shoring as required, compaction, dewatering, and all incidental work necessary to construct the water system as indicated on the plans, in place complete.

C. Payment for the furnishing and installation of 6" Solid PVC Drain Pipe will be made at the Unit Price Bid per linear foot based on the actual linear feet of pipe installed.

The Unit Price Bid for the furnishing and installation of pipe shall be full compensation for all labor, tools, equipment for all handling, hauling, unloading, placing, cutting, jointing, pavement sawcutting and demolition, unclassified trench excavation and backfill for pipe and appurtenances, pipe cushion, temporary road patch, restoration of improvements (curbs, gutters, sidewalks, concrete driveways, concrete pavement, landscaping etc.), 4" drain line observation port, sheeting and shoring as required, compaction, dewatering, and all incidental work necessary to construct the drain line as indicated on the plans, in place complete.

D. Payment for the furnishing and installation of 6" Perforated PVC Perimeter Drain Pipe will be made at the Unit Price Bid per linear foot based on the actual linear feet of pipe installed.

The Unit Price Bid for the furnishing and installation of pipe shall be full compensation for all labor, tools, equipment for all handling, hauling, unloading, placing, cutting, jointing, pavement sawcutting and demolition, unclassified trench excavation and backfill for pipe and appurtenances, pipe cushion, warning tape, temporary road patch, restoration of improvements (curbs, gutters, sidewalks, concrete driveways, concrete pavement, landscaping etc.), sheeting and shoring as required, compaction, dewatering, and all incidental work necessary to construct the drain line as indicated on the plans, in place complete.

E. Payment for the furnishing and installation of the various sizes of pipe fittings shall be paid for by each fitting, as shown on the Proposal items or included in the lump sum bid item of which they are a part, in place complete.

END OF SECTION

SECTION 02926

PERMANENT EROSION CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION:
This work includes furnishing and applying hydromulch seeding and permanent erosion control/turf reinforcement matting according to the contract or as ordered by the Engineer. This work shall also include watering, continuous care, and maintenance.

1.02 SUBMITTALS:

A. The following shall be submitted in accordance with Section 01330 – SUBMITTALS.

B. Permanent Erosion Control/Turf Reinforcement Matting
1. Product Data.
2. Samples.
3. Certificate of compliance stating that the matting meets the requirements of this section.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Grass Seeds

Seed shall be certified according to the following:

1. Buffelgrass Common

Purity and Germination Analysis of Seed Sample

Pure Seed	75%	minimum
Inert Matte	25%	maximum
Other Crop	1%	maximum
Weed Seeds	1%	maximum
Germination	85%	minimum

Rate of application: 75 to 100 pounds per acre (unhulled seeds)

2. Annual Ryegrass

Purity and Germination Analysis of Seed Sample

Pure Seed	98%	minimum
Inert Matter	.50%	maximum

Other Crop	1.50%	maximum
Weed Seeds	1%	maximum
Germination	90%	minimum

Rate of application: 50 pounds per acre

B. Fertilizer

Mixed commercial fertilizer shall be a complete fertilizer, shall bear manufacturer's guaranteed statement of analysis, and shall conform to the following minimum requirements in available form:

10%	Nitrogen
30%	Phosphoric Acid and
10%	Potash

The Contractor shall furnish the fertilizer in new, clean, sealed and properly labeled bags. The Contractor shall protect the fertilizer, delivered on the job, properly from the weather.

C. Gypsum Based Land Plaster/Geobinder

Gypsum based land plaster/geobinder shall consist of a naturally-occurring high purity processed gypsum and necessary additives that, when combined with water, will form a cementitious binder that will produce a protective crust-like barrier within 4 to 8 hours after application. The gypsum shall be processed into a ground, dry, calcium sulfate hemihydrate ($CaSO_4$ $1/2H_2O$). The plaster plus necessary additives shall be furnished in 50 pound bags and shall be labeled as to its intended use/application, gypsum's purity, dry weight and source of manufacture. Material which has become partially air set, hardened, lumpy or caked prior to use shall not be utilized and will be rejected. This gypsum based land plaster/geobinder shall be formulated to form a protective cementitious crust-like barrier that reduces water and wind induced erosion, thus allowing for the establishment of seeded plant materials.

D. Cellulose Wood Fiber Mulch

Cellulose wood fiber mulch shall consist of "Non-Virgin Wood Products" such as recycled newspaper, card board and other paper sources. This mulch shall be formulated for the purpose of hydro seeding and/or hydraulic planting. The cellulose wood fiber mulch shall be of the non-tackified variety.

E. Permanent Erosion Control/Turf Reinforcement Matting

Permanent erosion control/turf reinforcement mat shall be constructed of 100% coconut fiber evenly distributed over the entire area of the mat and stitch bonded between a heavy-duty UV stabilized bottom net, and a heavy-duty UV stabilized dramatically

cuspated intermediate netting overlaid with a heavy-duty UV stabilized top net. The cuspated (crimped) netting shall form prominent, closely spaced ridges across the entire width of the mat. The three nettings shall be stitched together on 1.5 inch (3.8 cm) centers with UV stabilized polyester thread to form a permanent three dimensional structure.

The erosion control/turf reinforcement matting should be used after proper soil preparation, fertilization and seeding. The matting should be designed to control soil loss, facilitate revegetation, and reinforce vegetation on disturbed sites. The matting should be ideal for severe slopes with heavy runoff, channels with super-critical flow velocities, and shorelines with elevated wave action.

The erosion control turf reinforcement mat shall be North American Green C350 or approved equivalent. The mat shall be installed and fastened per the manufacturer's recommendations. The C350 or approved equivalent permanent erosion control/turf reinforcement mat shall have the following physical properties.

Material Content

Coconut Fiber 100%
(.5 lb. /y2) (.27 kg/m2)
Nettings Top – Super Heavy UV Stabilized
Polypropylene .5 inch (1.3 cm) Openings
(8.5 lbs. /1,000 sq. ft)
(Mid – Super Heavy UV Stabilized)
Cuspated .5 inch (1.3 cm) Openings
(20 lb. /1,000 sq. ft)
Bottom – Super Heavy UV Stabilized
Polypropylene .5 inch (1.3 cm) Openings
(8.5 lbs. /1,000 sq. ft)
Thread -UV Stabilized Polyester

Physical Specifications (Roll)

Width	6.5 feet (2 m)
Length	55.5 ft (16.9 m)
Weight	37 lbs. +/- 10% (16.8 kg)
Area	40 sq. yd. (33.4 m^2)

PART 3 EXECUTION

3.01 PROCEDURES:

A. Conform to Section 307 – Landscaping and Irrigation, Water System Standard, 2002, State of Hawaii and the following:

1. Permanent ground cover shall be applied at a minimum rate per acre of:

75	lbs.	Buffelgrass seed
50	lbs.	Annual Ryegrass seed
6,000	lbs.	Gypsum Based Land Plaster/Geobinder
2,000	lbs.	Cellulose Wood Fiber Mulch
400	lbs.	Fertilizer (10-30-10)

with Permanent Erosion Control/Turf Reinforcement Matting.

2. Upon completion of mixing, the mixture shall be spread over the areas indicated. The equipment used to apply the mixture shall be equipped to provide adequate mixing and eject it uniformly at the proper coverage as specified above. To prevent set-up, all equipment must be flushed within 4 hours after mixing. All equipment shall be flushed and cleaned after each daily use.

3. The mixture shall be placed at a minimum of 36 inches beyond the top and toe of the cut and fill slopes. Prior to watering, the applied material shall be fully cured.

3.02 PERIOD OF MAINTENANCE:

B. Planting Maintenance.

1. General. Maintenance shall begin immediately after completion and approval of all planting and shall continue for 90 calendar days thereafter. The care of plants prior to completion of entire planting shall not be considered as part of the maintenance period, but only as an incidental to landscape work. In the event any planting is replaced, the maintenance period for such planting shall be 90 calendar days after replanting is completed. Maintenance shall include watering, weeding, fertilizing, topdressing, mowing, repairing soil surface, regrassing, repairing stakes, guys and ties, spraying for disease and insects, replanting and any other work necessary to maintain all plants in a healthy growing condition. The Contractor shall be responsible for the protection of all plants and planting area during the maintenance period. During the last week of the maintenance period, the Contractor shall fertilize the entire planting areas as specified or as directed by the Engineer.

2. Watering. Each tree, shrub and ground cover areas shall be hand watered at time of planting and immediately after each application of fertilizer at the specified periods. Care should be taken to assure that fertilizer is completely washed off from leaves to avoid burning. Daily watering throughout the maintenance period (using irrigation system, if desired) shall be the responsibility of the Contractor.

3. Weeding. All planting areas shall be kept free of weeds throughout the maintenance period.

4. Mowing. The Contractor shall begin mowing lawn when grass is 1½ inches high. Do not cut more than half the height of the grass at any one time. Use only sharp mower blades.

5. Repairing Soil Surface and Regrassing. When any portion of the surface becomes gullied or otherwise damaged or ground cover has failed to grow within the maintenance period, the aforementioned planting procedure shall be repeated to bring the damaged area up to the standards desired.

B. Clean Up.

The Contractor shall keep the work areas free from accumulation of waste material or rubbish. Upon completion of the work, the Contractor shall remove all waste material or rubbish from and about the work area together with all tools, equipment and materials and shall leave said area in a condition satisfactory to the Manager.

C. Protection.

The Contractor shall exercise extreme care in the execution of the Contractor's work and shall in no way adversely affect the work of others or adjoining properties.

D. Final Inspection and Acceptance.

1. At the completion of all planting operations and a 90-day maintenance period, an inspection shall be performed.

2. The Contractor shall request the inspection in writing to the Manager seven (7) working days prior to the completion of the maintenance period in order that a mutually agreeable time for inspection may be arranged.

3. The Contractor and the Manager, or their representatives shall be present at the inspection.

4. After the maintenance period of 90 calendar days, the Manager will recommend acceptance of the landscape work subject to the following conditions:

   a. All plant materials must exhibit satisfactory growth progress and have evidence of a sufficient degree of maintenance as determined by the Manager.

   b. The site must be thoroughly cleaned and all excess material removed.

   c. Any dead plants and plants not in a vigorous, thriving condition at the time of the final inspection shall be replaced.

   d. Plants used for replacement shall be of the same kind and size as originally specified; they shall be planted, maintained and guaranteed as specified elsewhere in these Standards.

e. The cost of replacement under all circumstances shall be borne by the Contractor, except for possible replacement resulting from removal, loss or damage due to occupancy of the project, vandalism or other acts of negligence by others.

5. All defects observed at the time of final inspection must be corrected to the satisfaction of the Engineer prior to acceptance of the landscape work.

6. Acceptance of the ground cover planting after the 90 days maintenance period shall be contingent upon the following:

   a. 90% germination of the overall area shall be required for ground cover planting. Each bare spot shall not be greater than 1 sq. ft. in any one sector.

   b. All germinated areas shall be healthy and living at the end of 90 days.

   c. Weeds shall not exceed an area greater than 10% of the overall ground cover area.

7. The maintenance period shall be extended at no additional cost if the ground cover planting does not meet the above requirements.

8. If all plant materials are approved and accepted at this inspection by the Manager, the Contractor shall be relieved of further maintenance.

9. The landscaping and landscape maintenance shall not be accepted as individual entities. These items shall be accepted as part of the entire project.

3.03 MEASUREMENT AND PAYMENT

Payment for furnishing materials and installing the TURF REINFORCEMENT MAT will be made at the Unit Price Bid per square foot of TURF REINFORCEMENT MAT installed.

The Unit Price Bid for furnishing materials and installing the TURF REINFORCEMENT MAT shall be full compensation for all labor, materials, tools and equipment for all handling, unloading, excavating, placing, grading, watering, fertilizing, care, maintenance, incidentals, and all other work required to install the TURF REINFORCEMENT MAT, in place complete.

END OF SECTION

SECTION 03310 REINFORCED CONCRETE

SPECIAL PROVISIONS

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and construction of reinforced concrete structures including the new concrete reservoir, concrete pads, footings, and thrust blocks, retaining wall, and control building slab and sidewalks. The Water System Standards, 2002, for State of Hawaii, including any amendments, shall be followed unless specified otherwise in this specification.

A. The following are amendments to Section 303 Structures of the Water System Standards, 2002.

B. The terms TANK and RESERVOIR are interchangeable.

1.02 AMENDMENT TO WATER SYSTEM STANDARD

A. SECTION 303.03 – CONCRETE WORK.

1. Amend the entire paragraph "1. Cement" of the "B. Materials" subsection to read:

2. Cement shall conform to "Standard Specifications for Portland Cement" (ASTM C150) for Type I or Type II cement. Only one brand of cement from one manufacturing plant may be used.

3. The Contractor shall submit a certificate of a test with each lot of cement proposed for use on the project. The Manager may require additional test of the cement as required.

4. Add the following paragraphs to paragraph "3. Concrete Aggregates" of the "B. Materials" subsection:

    c. Aggregate shall not contain elongated particles in quantities considered deleterious. A thin, flat or elongated particle is defined as a particle having a maximum dimension in excess of five times its minimum dimension.

    d. When crushed stone is used, the crusher shall be equipped with a screening system which will entirely separate with dust from the stone and convey it to a separate bin.

5. Add the following paragraph to paragraph "4. Admixture" of the "B. Materials"

subsection:

a. Use integral waterproofing admixture to concrete for bottom slab, walls and columns of Reservoir(s). The admixture shall be added at the plant and shall conform to ASTM C94 and be approved for use with potable water by the NSF. Admixture shall be "KIM" as manufactured by Kryton or other approved manufacturer. Dosage rate shall be as recommended by the manufacturer.

b. Shrinkage Compensating Admixture for Reservoir foundation, bottom floor slab, columns and walls: Dosage shall be such that it compensates for total shrinkage anticipated of concrete. Total shrinkage shall be based on historical or test data by ready mix concrete producer. Dosage shall be as determined by ready mix concrete producer to compensate for total shrinkage anticipated. Admixture must be NSF approved.

6. Amend the entire "Table 300-9 – CONCRETE CLASSES AND USES" of the "C. Proportioning Concrete Mix" subsection to read:

Table 300-9 – CONCRETE CLASSES AND USES

Table 300-9 – CONCRETE CLASSES AND USES						
Class of Concrete	Minimum 28-Day Compressive Strength (psi)	Minimum Sacks per Cu. Yd. of Concrete	Maximum Water to Cement Raito	Maximum Size of Aggregate (in.)	Slump Range (in.)	Location Required In Project
DWS4000	4,000	7.0	0.42	3/4	5	Reservoir walls, columns, floor slabs (including jackets), roof slabs, and footings. Retaining Wall footing, keys, and walls. Equipment Bldg., floor slab

Table 300-9 – CONCRETE CLASSES AND USES						
Class of Concrete	Minimum 28-Day Compressive Strength (psi)	Minimum Sacks per Cu. Yd. of Concrete	Maximum Water to Cement Raito	Maximum Size of Aggregate (in.)	Slump Range (in.)	Location Required In Project
						on grade, sidewalks, landing slab, footings and concrete pads.
DWS4000M	4,000	7.0*	0.42	--	5	First 4-1/2 inch pour above construction joints of all reservoir walls. (*One half the amount of coarse aggregate used in DWS4000 mix.)
DWS2500	2,500	--	0.50	3/4	5	Manholes, catch basins, pipe jackets (not under reservoir), duct lines, pipe reaction blocks.

7. Amend the “P. Conveying, Placing and Handling” subsection such that wherever

"DWS 3000M" is stated, it is replaced with "DWS4000M."

8. Amend the "T. Payment" subsection such that it reads:

   "Payment for concrete work (1) will be made at the respective Unit Price Bids or Lump Sum Bids, for the various bid items, or (2) will not be made directly but shall be included in the payment of which it is a part. In either case, such payment shall represent full compensation for furnishing all materials, labor, tools, equipment, reinforcing, admixtures and incidentals required to complete the work.

   Payment quantity under Unit Price Bid shall be determined from computation based on the concrete dimensions as shown on the plans or as directed by the Manager."

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 04211

CEMENT RUBBLE MASONRY

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and installing of cement rubble masonry (CRM), including the CRM Grade Adjustment Wall, the CRM Diversion Curb and the CRM Drainage Outlet Structure.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Material shall be as described in Section 303.14 (B) of the WSS.

B. Duckbill check valve shall have 8-inch diameter and shall have a flanged connection. Contractor shall use the Tideflex Series 35-1 or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation shall be as described in Section 303.14 (C) of the WSS.

3.02 MEASUREMENT AND PAYMENT

A. CRM GRADE ADJUSTMENT WALL shall be measured for payment by the linear foot as provided for and indicated in the Bid Proposal Form.

Payment for the CRM GRADE ADJUSTMENT WALL shall be made at the unit bid price per linear foot and shall be full compensation for all equipment, tools, materials and labor, including backfill, crushed rock, granular structural fill, geotextile, mortar foundation, and other required items and incidentals required to complete the work in-place complete.

B. CRM DIVERSION CURB shall be measured for payment by the cubic yard as provided for and indicated in the Bid Proposal Form.

Payment for the CRM DIVERSION CURB shall be made at the unit bid price per linear foot and shall be full compensation for all equipment, tools, materials, labor and other required items and incidentals required to complete the work in-place complete.

C. CRM DRAIN OUTLET STRUCTURE shall be measured for payment by each as provided for and indicated in the Bid Proposal Form.

Payment for the CRM DRAIN OUTLET STRUCTURE shall be made at the unit bid price per each and shall be full compensation for all equipment, tools, materials, labor, including excavation, CRM, duckbill check valve, backfill, and other required items and incidentals required to complete the work in-place complete.

END OF SECTION

SECTION 04410

GROUTED RIPRAP

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and installing of grouted riprap.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stones: Shall be clean, free of seams and blemishes or other imperfections, and when tested in accordance with AASHTO test method T90 shall show wear not to exceed 50%. All stones shall be obtained from the same source. All stones shall be moss rock or blue stone (quarried or shattered face exposed). The stones shall be variable in sizes. Except stones for filling voids, the average D_{50} stone shall be 12" and the largest stone shall be 1.5 times the D_{50} size. The smallest stone size shall have a volume not less than 1/3 cubic foot.

Stones required for riprap shall be quarried, field stones or salvaged from an approved source. The source(s) of stones shall be approved by the Engineer prior to the start of construction. Approval of a source of stones shall not be construed as an approval of all material from that source, nor that will the source produce the quantity and size required by this specification.

Stones shall be sufficiently hard, sound, dense, and durable to ensure permanence in the structure and the environment in which it is to be used and shall have a minimum unit weight of 155 pounds per cubic foot. Stones fragments shall be free from cracks, seams, and other defects that would increase the risk of deterioration from natural causes.

B. Mortar: Shall have a 2000 psi, 28-day compressive strength.

1. Portland Cement shall conform to ASTM C-150, Type I or Type II.

2. Aggregates shall consist of natural or manufactured sand in conformance with ASTM C144.

3. Contractor shall submit to the Contracting Officer the design mix he intends to use and secure approval before construction of grouted riprap apron.

PART 3 - EXECUTION

3.1 GENERAL

All grouted riprap shall be constructed by experienced workmen.

3.2 INSTALLATION

A. Free foundation bed of brush, trees, stumps, roots, debris, and other objectionable materials, and dress to smooth surface.

B. Mortar: Shall be composed of one part Portland cement to three parts of fine aggregate in damp and loose condition and a sufficient amount of water. The cement and fine aggregate shall be thoroughly mixed dry and water shall be added until the proper consistency is attained. Mortar not placed within thirty minutes after mixing shall not be used. Retampering will not be permitted.

C. Laying of Riprap: The bed for grouted riprap shall be compacted to 90% and finished to a smooth surface to a depth that the surface of the grouted riprap shall be at the planned grade. All soft and yielding material shall be removed and replaced with satisfactory material and recompacted to form a stable bed. Riprap or geotextile shall not be placed until the foundation preparation is completed and the subgrade surface has been inspected and approved by the CM.

Stones shall be placed to match the limits, elevations, lines and slopes as indicated on the drawings and as specified hereinafter. The finish surface of the riprap structure shall be irregular and stones shall extend between 2-inches and 5-inches above the level of grout, with no more than 1/3 of the rock extended above the level of grout. The exposed rock shall not have a plastered appearance. Stones shall be in pieces generally rectangular in cross section, the least dimension of any piece being not less than one-third its greatest dimension.

Stones shall be selected with care as to size and shape and placed in such a manner as to produce the required section as indicated on the drawing. Each stone shall be fitted and keyed with adjacent stones, leaving voids through which underlying stones cannot pass. Resetting of adjacent in-place stone to provide for proper placing of shifted or separated stone shall be considered incidental to this work. All stone shall rest securely upon the underlying stone. Voids shall not be more than 2 inches in diameter. The placement of stone shall proceed as soon as practicable after placement of the underlying stone to prevent displacement of the underlying stone.
If a newly placed stone or reset stone is found defective in quality, size, shape, weight

or placement, the Contractor shall promptly remove the defective stone and replace it with a new stone or reset the required stone to the satisfaction of the CM, at no increase in contract price.

D. Curing and Protection: After completion of grouted riprap, no individual(s) or equipment shall be permitted on the grouted surface for 24 hours. The grouted surface shall be protected from injurious action by the sun, rain, flowing water, mechanical injury, or other potential damaging activity. The completed finished surface shall be prevented from drying for a minimum curing period of 7 days following placement. Exposed surfaces shall be maintained in a moist condition continuously for the 7-day curing period or until curing compound has been applied as specified in this section. Moisture shall be maintained by sprinkling, flooding, or fog spraying or by covering with continuously moistened canvas, cloth mats, straw, sand, or other approved material. Water or moist covering shall be used to protect the grout during the curing process without causing damage to the grout surface by erosion or other mechanisms that may cause physical damage.

The grouted rock may be coated with an approved curing compound as an alternative method to maintaining a continuous moisture condition during the curing period. The compound shall be sprayed on the moist grout surface as soon as free water has disappeared and all surface finishing has been completed. The compound shall be applied at a minimum uniform rate of 1 gallon per 175 square feet of surface and shall form a continuous adherent membrane over the entire surface. Curing compound shall not be applied to surfaces requiring bond to subsequently placed grout and/or concrete. If the membrane is damaged during the curing period, the damaged area shall be resprayed at the rate of application specified for the original treatment.

3.3 MEASUREMENT AND PAYMENT

Payment for furnishing materials and installing the GROUTED RIPRAP APRON will be made at the Unit Price Bid per square foot of GROUTED RIPRAP APRON installed.

The Unit Price Bid for furnishing materials and installing the GROUTED RIPRAP APRON shall be full compensation for all labor, materials, tools and equipment for all handling, unloading, excavating, placing, grouting, grading and all other work required to install the GROUTED RIPRAP APRON, in place complete.

The cost of the geotextile fabric shall be considered incidental and shall not be paid for separately.

END OF SECTION

SECTION 07161 TANK ROOF SLAB WATERPROOFING

SPECIAL PROVISIONS

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

GENERAL: This section covers furnishing of labor, tools, equipment, materials to install the tank roof slab waterproofing, including surface preparation, flashing in place complete, as shown on the plans. The reservoir roofing defined in Water System Standards, Section 303.06 REINFORCED CONCRETE RESERVOIR shall be deleted and replaced with the following.

A. PACKAGES AND LABELS: Deliver materials in original containers, manufacturer's labels thereon. Do not open container or remove labels until Engineer has approved material.

B. STORAGE: Store coating materials out of direct sunlight and as recommended by the manufacturer. Do not store containers exposed to weather. Storage place shall be a location agreed upon by the Contractor and Manager.

C. FIRE PROTECTION: Contractor shall exercise extraordinary care to prevent fire.dd.

D. PROTECTION AND CLEANING: Protect adjacent work with drop cloths. Clean material splatters and stains from completed surfaces.

E. Begin waterproof coating process only after coating manufacturer's representative has approved the substrate surface for coating. The work shall be performed in strict conformance with the manufacturer's direction.

1.02 SUBMITTALS:

A. MATERIALS: Submit complete and detailed list of materials proposed for use, their MSDS sheets and certification that the proposed products meet the project requirements.

B. INSTALLATION INSTRUCTIONS: Submit installation instructions from coating manufacturer, including recommended coverage for all system components.

C. LETTER FROM COATING MANUFACTURER: Stating that proposed materials are the best of their respective kinds and suitable for the intended purpose and project conditions.

D. INSTALLER CERTIFICATES: Installer certificates signed by roof waterproofing system manufacturer certifying that contractor is authorized to install the waterproofing system.

E. SAMPLES: Submit sample of proposed color and texture of the coating system assembly for approval by DHHL before ordering materials. Submit as many samples as required to secure approval from the Department of Water. The finish color shall be selected from the standard color choices offered by the manufacturer.

F. SAMPLE WARRANTY: Copy of special waterproofing manufacturer's warranty stating obligations, remedies, limitations, and exclusions before starting installation.

1.03 QUALITY ASSURANCE:

A. The Applicator proposing on this Work must submit to DHHL a currently dated applicator's license certificate issued by the manufacturer for the specific coating system to be installed as part of this project.

B. Waterproofing coating manufacturer's representative is required to be on-site as often as the representative deems necessary to assure the coated surfaces and the coating are in accordance with the manufacturer's directions and in no way negate the manufacturer's warranty.

C. Coating shall not contain any materials determined hazardous, such as lead.

D. All coating components shall be from the same manufacturer or the primary coating components manufacturer shall provide a written statement indicating the proposed materials are compatible and acceptable for the system to be guaranteed.

E. All materials shall be delivered to the job site in the original factory containers. Containers shall be clearly labeled with the coating type and batch number. Damaged containers shall be rejected or noted by receiver at the time of delivery.

F. The coating manufacturer shall have 5 years minimum experience in the manufacture of fluid applied waterproof coatings.

G. All work shall be done in a manner that produces a good workmanlike finish. The applicator shall adhere to the manufacturer's instructions for use, handling, storage, application and clean-up.

H. Non-compliance with any portion of this Specification without prior written approval of DHHL and, if necessary, confirm by the coating manufacturer, may cause for rejection of the entire job or portion thereof.

1.04 PROJECT CONDITIONS:

A. EXAMINATION OF SURFACES: The Contractor and manufacturer's representative shall examine the surfaces before commencement of work. The roof areas shall be in proper condition to receive the coating system. If the contractor considers any surface unsuitable for the proper finish of the work, he shall not apply any material until the unsuitable surface(s) has been adequately addressed.

B. WEATHER CONDITIONS: Do not apply waterproof coating materials in rain, fog or mist, or when such weather conditions are predicted in the next 8 hours. Take adequate precautions to ensure that materials, applied coating are protected from possible moisture damage or contamination.

C. PROTECTION: Before applying waterproof coating, system remove or provide ample protection for hardware, plates, light fixtures, and similar items. Replace upon completion. Employ skilled craftsmen for removing and reinstalling above items. Protect surfaces not to be coated and remove any unintended primer or coating immediately from the surface.

D. SIGNS: Post "No Smoking" signs in area during and for a minimum of 8 hours after the application.

E. PROTECTION REQUIREMENTS:

A. Membrane Protection: Provide protection against staining and mechanical damage for newly applied waterproof coating and adjacent surfaces throughout this project.

B. Debris Removal: Remove all debris daily from the project site and take to a legal dumping area authorized to receive such materials.

F. CONTRACTOR'S ACCEPTANCE: Application of the primer constitutes the Contractor's acceptance of the surfaces and the responsibility for it, including the removal of hazardous materials.

PART 2 – PRODUCTS

2.01 GUARANTEE:

Contractor shall furnish a five (5) year guarantee as described in Water System Standards, Section 303.16.C. The guarantee shall be without deductibles or limitations on coverage amount, and shall be issued at no cost to the Department of Water. The guarantee shall not exclude random areas of ponding from coverage.

2.02 MATERIALS:

A. SYSTEM DESCRIPTION: A fluid-applied, single component, moisture-cured, polyurethane deck elastomeric waterproof coating in compliance with ASTM C957, such as Elasto-deck 5000X2 by Pacific Polymers International; Sikalastic 710/715 Traffic System by Sika or approved equal.

B. COMPONENTS: Components shall be products of a single manufacturer, or shall be certified by the manufacturer as compatible with components produced by manufacturer.

C. PRIMER: Primer shall be a fast-drying, two component, water based epoxy primer with low odor and non-flammable. Primer is designed to be used with polyurethane based coatings and joint sealants, such as Elasto-poxy Primer W.B. by Pacific Polymers International; Sikafloor FTP by Sika or approved equal.

D. BASE COAT: Base coat shall be a liquid-applied, single component, aromatic moisture-cured polyurethane waterproof membrane that is non-gassing, non-blistering, such as Elasto-Deck 5001 Non-Gassing by Pacific Polymers International; Sikalastic 710 by Sika or approved equal.

A. Properties:

(1) Ultimate Tensile Strength (ASTM D412)	800 psi
(2) Adhesive Peel Strength on Primed Concrete (ASTM D903)	90 pli
(3) Moisture Vapor Transmission (ASTM E96)	3.7 perms
(4) Tear Resistance (ASTM D1004)	170 pli
(5) Ultimate Elongation (ASTM D412)	500% min.

E. TOP COAT: Top coat shall be liquid-applied, moisture cured polyurethane based on aliphatic Isocyanates in combination with additives and pigments to produce a wear-resistant, protective coating, such as Elasto-Glaze 6001 AL by Pacific Polymers International; Sikalastic 715 by Sika or approved equal.

A. Properties:

(1) Percent Solids	70% Min.
(2) Adhesive Peel Strength on Primed Concrete (ASTM D903)	200 pli
(3) Moisture Vapor Transmission (ASTM E96)	1.0 perms
(4) Tear Resistance (ASTM D1004)	185 pli
(5) Ultimate Elongation (ASTM D412)	180% min.
(6) Tensile Strength (ASTM D412)	2,500 psi.

F. FINISH AGGREGATE: 20 mesh sand as provided by coating system manufacturer as part of the roofing system materials.

G. ROOFING ACCESSORIES:

A. Discontinuity Cant Joint Material: Two-part, gun grade polyurethane joint sealant product that cures to a firm, flexible tear-resistant rubber with excellent recovery characteristics, such as Elasto-Thane 227/227R by Pacific Polymers, Garden Grove, CA (714-898-0025)(www.pacpoly.com) or Sikaflex 2c NS Sealant by Sika, Lyndhurst, NJ (800-933-7452) (www.usa.sika.com) or approved equal.

B. Sealant: Single-component, gun-grade/non-sag, polyurethane joint sealant which cures at ambient temperature to a firm, flexible, tear-resistant rubber, such as, Elasto-Thane 230, Elasto-Thane 920 by Pacific Polymers or Sikaflex 1a Sealant by Sika or approved equal.

C. Backing Rod: Expanded polyethylene rod equal to "Ethafoam" by DOW Chemical.

D. Flashing Tape: Fiberglass tape, commercial grade.

PART 3 – EXECUTION

3.01 SURFACE PREPARATION:

A. All surfaces must conform to manufacturer's recommendations and to the satisfaction of the Manager. All surfaces of different material are to be considered separately and are to be treated as recommended by the manufacturer.

B. Properly cure surfacing material and concrete repairs shall be cleaned by water pressure washing with 5,000 psi pressure. All surfaces must be free of dirt, debris, organic growth, chalk, loose laitance, and other loose materials and be clean and dry.

C. Caulk all substrate seams, vertical/horizontal surface intersections and protrusions with continuous bead of sealant. Caulk all expansion, control and construction joints in concrete substrate to be over coated with base coating with sealant.

E. Sawcut all cracks exceeding 1/16-inch wide and fill with sealant. Install a strip of base coating material, 25 mils thick over all caulked saw cut cracks.

F. Protect adjacent surfaces not to be coated with drop clothes or masking as required.

3.02 APPLICATION:

A. WORKMANSHIP: Highest quality, by skilled workers, in accordance with best trade practices. Apply materials evenly, without runs or sags. Cut sharp lines against other materials. Allow ample time between coats for thorough drying. Rate of application shall be in strict conformance with manufacturer's direction.

B. DEFECTIVE WORK: Contractor responsible whatever the cause; refinishing work will be at Contractor's expense. Repair work that is damaged during construction. Leave coated surfaces in first class condition at time of final acceptance.

C. PRIMER: Apply primer in accordance with roofing system manufacturer's instructions. Primer shall be applied in a solid coat at the rate recommended by the manufacturer.

D. BASE COATING: After primer has been allowed to cure as recommended by manufacturer, apply two coats of base coating at the rate and dry film thickness recommended by the coating manufacturer. Application must be made uniformly to avoid thin spots, care must be taken to avoid pinholes and repair them as they occur. Allow time between coats as recommended by manufacturer.

E. TOP COAT: Apply the top coat at the recommended rate to achieve the recommended dry film thickness. Broadcast aggregate into the wet top coat until refusal.

F. ADDITIONAL TOP COAT: After a minimum of 16 hours, sweep or blow off all loose aggregate and apply another coating of top coat over the aggregate at the recommended rate.

G. ALLOWANCE FOR FOOT TRAFFIC: Allow at least 96 hours (4 full days) before allowing foot traffic on installed coating system.

3.03 FIELD QUALITY CONTROL:

A. FINAL INSPECTION: Contractor to notify coating system manufacturer in writing of the completion of installation in order to schedule a final inspection by manufacturer's representative.

B. VISUAL CHECK: All surfaces coated shall be visually checked to insure areas have not been missed and all holidays in the coating are repaired.

C. FIELD INSPECTION: The Contractor and the manufacturer's representative shall compile a punch list of items required for completion.

D. ISSUANCE OF GUARANTEE: Contractor will be responsible for completing post-installation procedure and meet the manufacturer's final endorsement for issuance of the specified guarantee.

3.04 CLEAN-UP: Clean off all misplaced primer and coating and remove all excess materials and equipment from the job site upon completion.

Leave premises neat and clean in a manner acceptable to the Manager. Remove all temporary protection and barriers from the work.

3.05 MEASUREMENT AND PAYMENT: Tank Roof Slab Waterproofing shall not be measured for payment and will not be paid for separately, but shall be included in the lump sum payment for the Reinforced Concrete Tank.

END OF SECTION

SECTION 08110- FRAMES AND DOORS

SPECIAL PROVISIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES: Steel doors and frames; non-rated and fire rated.

1.02 SUBMITTALS:

A. SHOP DRAWINGS: Indicate door and frame elevations, internal reinforcement, cut-outs for glazing, and finish.

B. PRODUCT DATA: Indicate door and frame configurations, location of cut-outs for hardware reinforcement.

C. WARRANTIES: Provide manufacturer's warranties against corrosion and deformities, minimum 10 years.

1.03 QUALITY ASSURANCE: Conform to the following:

A. SDI-100 - Standard Steel Doors and Frames.
B. DHI - Door Hardware Institute - The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.
C. Fire Rated Door and Frame Construction: UL 10B and NFPA 80.
D. Handicapped: ANSI A117.1.
E. Handicapped: ADA - Americans with Disabilities Act.

PART 2 – PRODUCT

2.01 PRODUCTS:

A. DOORS AND FRAMES:

B. Manufacturers:
1. Steelcraft.
2. Ceco.
3. Curries.
4. Substitutions: Submit Per Section 1600

C. Exterior Doors: SDI-100 Grade I, as required by Drawings.

D. Exterior Frames: 16 gage thick material, core thickness.

E. ACCESSORIES:

1. Silencers: Resilient rubber.

2. Removable Stops: Rolled steel channel shape.

3. Bituminous Coating: Fibered asphalt emulsion.

F. FABRICATION – DOORS:

1. Astragals for Double Doors: Steel, T shaped, specifically for double doors.

2. Fabricate doors with hardware reinforcement welded in place.

3. Attach fire rated label to each fire-rated door unit.

4. Close top and bottom edge of exterior doors with inverted steel channel closure. Seal joints watertight.

5. All door hardware shall be Cyberlock compatible.

G. FABRICATION – FRAMES:

1. Fabricate frames for knock down field assembly.

2. Mullions for Double Doors: Fixed type, of same profiles as jambs.

3. Fabricate frames with hardware reinforcement plates welded in place. Provide mortar guard boxes.

4. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.

5. Prepare frame for silencers and install.

6. Fabricate frames to suit masonry wall coursing with 2-inch head member.

H. DOOR LOUVERS:

1. Fixed Blade: Stationary, sight proof hood or Y type blades, 18 gage minimum steel, inserted into door panels, full door thickness, no exposed trim. Provide insect screen in removable frame for louvers in exterior doors. All parts shall be hot dipped galvanized.

I. FINISH:

1. Steel Sheet: Galvanized to ASTM A525 - A60.

2. Primer: Baked on manufacturer primer.

3. Coat inside of frame profile with bituminous coating.

4. Finish: Baked on manufacturers finish to match existing and as selected by architect

PART 3 – EXECUTION

3.01 EXECUTION:

A. INSTALLATION:

1. Install doors and frames in accordance with ANSI/SDI-100.

2. Coordinate installation of doors and frames with installation of hardware.

3. Coordinate with masonry and wallboard wall construction for frame anchor placement.

4. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

5. Install door louvers, plumb and level.

B. TOLERANCES:

Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.02 MEASUREMENT AND PAYMENT: Frames and Doors will not be measured for payment. Payment for steel doors and frames will not be paid as a separate line item. The cost shall be included in the lump sum price of the bid items that includes the work covered in this section.

END OF SECTION

SECTION 08600 – ALUMINUM HATCH

SPECIAL PROVISIONS

PART 1 - GENERAL

1.01 GENERAL:

Work includes furnishing and installing factory-fabricated vault access doors.

1.02 REFERENCES:

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In case of conflict between the requirements of this specification and those of the listed documents, the requirements of this specification shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Request for Proposal (RFP). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued, or replaced.

A. ASTM A 36-93a: Standard Specification for Structural Steel.

1.03 SUBMITTALS:

The Contractor shall submit manufacturer's product data for all materials in this specification. Shop drawings must show profiles, accessories, location and dimensions. Manufacturer to provide samples upon request; sized to represent material adequately. Vault access door manufacturer shall provide Manufacturer's Warranty.

1.04 PRODUCT HANDLING:

All materials shall be delivered in manufacturer's original packaging. Materials must be stored in a dry, protected, well-vented area. The Contractor shall thoroughly inspect product upon receipt and report damaged material immediately to the delivery carrier and note such damage on the carrier's freight bill of lading.

1.05 JOB CONDITIONS:

The Contractor shall verify that other trades with related work are complete before installing vault access door(s). Mounting surfaces shall be straight and secure; substrates shall be of proper width. Refer to construction documents, shop drawings, and manufacturer's

installation instructions. Contractor shall observe all appropriate OSHA safety guidelines for this work.

PART 2-PRODUCTS

2.01 WARRANTY / GUARANTEE:

Manufacturer's standard warranty: Materials shall be free of defects in material and workmanship for a period of twenty-five (25) years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge. Electric motors, special finishes, and other special equipment shall be warranted separately by the manufacturers of those products.

2.02 MANUFACTURER:

Aluminum horizontal access doors shall be as manufactured by The Bilco Company or approved equal.

2.03 ACCESS DOOR:

A GENERAL:

The Contractor shall furnish and install where indicated on the plans vault access doors. Type, size, and hinge side shall be as indicated on the plans.

1. PERFORMANCE CHARACTERISTICS:

    a. Covers: Shall be reinforced to support AASHTO H-20 wheel load with a maximum deflection of $1/150^{th}$ of the span. Manufacturer to provide structural calculations stamped by a registered professional engineer licensed in the State of Hawai'i.

    b. Operation of the covers shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.

    c. Operation of the covers shall not be affected by temperature.

    d. Entire door, including all hardware components, shall be highly corrosion resistant.

2. COVERS: Shall be ¼" (6.3 mm) aluminum diamond pattern.

3. FRAME: Channel frame shall be ¼" (6.3 mm) extruded aluminum with bend down anchor tabs around the perimeter. A continuous EPDM gasket shall be mechanically attached to the aluminum frame to create a barrier around the entire perimeter of the cover and significantly reduce the amount of dirt and debris that may enter the channel frame.

4. HINGES: Shall be specifically designed for horizontal installation and shall be through bolted to the cover with tamperproof Type 316 stainless steel lock bolts and shall be through bolted to the frame with Type 316 stainless steel bolts and locknuts.

5. DRAIN COUPLING: Provide a 1-1/2" (38 mm) drain coupling located in the right front corner of the channel frame, unless otherwise indicated on the plans.

6. LIFTING MECHANISMS: Manufacturer shall provide the required number and size of compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe fastened to a formed ¼" gusset support plate.

7. TURN/LIFT HANDLE: A removable exterior turn/lift handle with a spring-loaded ball detent shall be provided to open the covers and the latch release shall be protected by a flush, gasketed, removable screw plug.

8. HARDWARE:

    a. Hinges: Heavy forged aluminum hinges, each having a minimum ¼" (6.3 mm) diameter Type 316 stainless steel pin, shall be provided and shall pivot so the cover does not protrude into the channel frame.

    b. Covers shall be equipped with a hold open arm that automatically locks the covers in the open position.

    c. Covers shall be fitted with a required number and size of compression spring operators. Springs shall have an electrocoated acrylic finish. Spring tubes shall be constructed of a reinforced nylon 6/6-based engineered composite material.

    d. A Type 316 stainless steel snap lock with fixed handle shall be mounted on the underside of the cover.

    e. Hardware: Shall be Type 316.

9. FINISHES: Factory finish shall be mill finish aluminum with bituminous coating applied to the exterior of the frame.

10. SPARE KEYS: Contractor shall furnish three (3) door keys for each door to DHHL at the completion of the project.

PART 3 - EXECUTION

3.01 INSPECTION: Verify that the vault access door installation will not disrupt other trades. Verify that the substrate is dry, clean, and free of foreign matter. Report and correct defects prior to any installation.

3.02 INSTALLATION:

A. SHOP DRAWINGS: Submit shop drawing for review and approval before fabrication.

B. CONTRACTOR CHECK: The Contractor shall check as-built conditions and verify the manufacturer's vault access door details for accuracy to fit the application prior to fabrication. The Contractor shall comply with the vault access door manufacturer's installation instructions.

C. MECHANICAL FASTENERS: The Contractor shall furnish mechanical fasteners consistent with the vault access door manufacturer's instructions.

3.03 MEASUREMENT AND PAYMENT: Payment for the work described herein shall not be made directly but shall be considered incidental to the various items of the Proposal and no additional compensation shall be made.

END OF SECTION

SECTION 08601 - FIXED ALUMINUM LOUVERS

SPECIAL PROVISIONS

PART 1 - GENERAL

1.01 DESCRIPTION: This item of work shall include the furnishing of all labor, materials, tools and equipment necessary for providing and installing aluminum fixed weather louvers designed to protect air intake and exhaust openings in building exterior walls, with anchors, brackets and attachments into existing masonry wall openings work covered in this special provision and project drawings.

1.02 PERFORMANCE REQUIREMENTS: The beginning point of water penetration, based on AMCA Water Penetration Test criteria, shall be a minimum of 1000 fpm free area velocity.

Individual louver panels shall be designed to withstand the wind loading per the Building Code of Kauai County, International Building Code, amended 2006 edition or 25 pounds per square foot, whichever is greater. Adjust list below to suit Project

1.03 SUBMITTALS:

A. PRODUCT DATA: Include manufacturer's product specifications, technical support data, installation and maintenance recommendations and standard details for each type of louver required, including flashing methods, hardware and accessories.

B. CERTIFICATION: Provide certification by a recognized, independent testing laboratory certifying that each required type of louver complies with performance requirements indicated.

1.04 DELIVERY, STORAGE, AND HANDLING:

A. DELIVERY: Deliver materials to Project site in manufacturer’s original, sealed and labeled packaging with manufacturer's name, product brand name and type, date of manufacture, and directions for storing.

B. STORAGE: Store materials in a dry area indoors, protected from damage and in accordance with manufacturer’s instructions for protection of units.

C. HANDLING: Handle all materials in such a manner as to preclude damage to finish or unit.

1.05 PROJECT CONDITIONS:

A. ENVIRONMENTAL CONDITIONS: Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by the manufacturer.

B. FIELD MEASUREMENTS: Verify actual dimensions of openings by field measurements before fabrication. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.06 WARRANTY: Manufacturer shall provide a standard warranty for louver systems for a period of 1 year from date of installation, no more than 18 months after shipment from manufacturing plant. The louver coating system shall have a 5-year minimum warranty for defects or premature wear. When notified in writing from DHHL of a manufacturing defect, manufacturer shall promptly correct deficiencies without cost to DHHL.

Warranty includes coverage of materials and labor in full by the manufacturer.

PART 2 – PRODUCTS

2.01 FABRICATED FIXED ALUMINUM LOUVER:

A. Description and Features: The 6-inch wide, aluminum fixed weather louvers shall be designed to protect air intake and exhaust openings in building exterior walls with drain gutters in the head member and horizontal blades, channeling water to the jambs where water travels down a vertical downspout and out at the sloped sill. The louver construction shall utilize mechanical fasteners.

B. Extrusion Frame Members and Louver Frame: Extrusion frame members are to be 0.081-inch nominal thickness 6063-T6 aluminum. The louver frame shall be fitted with a manufacturer-provided 1 1/2-inch wide aluminum (6063-T6) perimeter flange at the exterior wall face.

C. Louver blades: are to be 0.081-inch nominal thickness 6063-T6 aluminum positioned at 37 or 37.5 degrees on approximately 6-inch centers.

D. Manufacturers: Examples of manufacturers meeting the above requirements:

1. Greenheck – Model "ESD-603" (www.greenheck.com), Schofield, WI (808) 678-3911
2. NCA Manufacturing, Inc. – Model "XAD-6-GL" (www.ncamfg.com), Clearwater, FL (727) 441-2651
3. Approved equal

E. Bird Screen: Provide factory-provided bird screens for each louver opening, ¾-inch by 0.051 inches flattened expanded aluminum in a removable frame, inside mounted. Locate screens on inside of window louvers.

F. Insect Screen: Provide aluminum mesh or fiberglass mesh insect screens for each louvered opening Locate bug screens on inside (toward building interior) of required bird screens. Design louver and hardware to accommodate screens in a tight-fitting removable arrangement with a minimum of exposed fasteners and latches.

G. Fasteners: Provide aluminum, non-magnetic steel, epoxy adhesive, or other materials warranted by the manufacturer to be non-corrosive and compatible with window members, trim, hardware, anchors and other components of louver unit. Where fasteners screw-anchor into aluminum frame members less than 0.125 inches thick, reinforce the interior with aluminum to received screw threads, or provide standard, non-corrosive, pressed-in, splined grommet nuts.

H. Anchors, Clips and Louver Accessories: Fabricate anchors, clips and louver accessories of aluminum or non-magnetic stainless steel. Anchors, clips and louver accessories fabricated of hot-dip zinc coated steel or iron may be used for concealed work.

2.02 FABRICATION REQUIREMENTS: Fabricate to minimize field adjustments, splicing, mechanical joints and field assembly nuts.

Preassemble units to greatest extent possible and disassemble as necessary for shipping and handling.

Clearly mark units for reassembly and coordinated installation.

Join frame-to-frame connections by welding in shop, and frame and lade members to one another by riveting, except where field bolted/screwed connections between frame members are necessary due to size of louver.

Maintain equal blade spacing to produce uniform appearance.

2.03 FINISHES:

A. FINISHES IN FACTORY: Apply finishes in factory in compliance with NAAMM "Metal Finishes Manual" for finish designations and application recommendations.

B. CLEAR ANODIZE: Coating shall conform to AA-M10C21A41 (>0.7 mil). All aluminum shall be thoroughly cleaned, etched, and given a chromatic conversion pretreatment before application of coating. The manufacturer shall provide a minimum of 5-year warranty for the coating system.

PART 3 - EXECUTION

3.01 LOUVER INSTALLATION: Verify opening preparation is within installation tolerances and proceed only after unsatisfactory conditions have been corrected.

Install louver in accordance with manufacturer's instructions, resulting in a plumb, level, in-plane of wall and aligned with adjacent work installation.

Install continuous exterior grade elastomeric joint sealant at louver-wall opening joint on full perimeter.

Clean louver surface in accordance with manufacturer's instructions.

3.02 MEASUREMENT AND PAYMENT: Payment for Fixed Aluminum Louvers will not be paid as a separate line item. The cost shall be included in the lump sum price of the bid items that includes the work covered in this section.

END OF SECTION

SECTION 08710 DOOR HARDWARE

SPECIAL PROVISIONS

PART 1 - GENERAL

1.01 GENERAL: This section includes Door hardware.

1.02 REFERENCES**:**

A. Use date of standard in effect as of RFP date.

1. American National Standards Institute – ANSI 156.18 – Materials and Finishes.

    a. ICC/ANSI A117.1 - 1998 – Specifications for making buildings and facilities usable by physically handicapped people.

    b. ANSI A156.18 Materials and Finishes

2. ADA/ABA Guidelines – Americans with Disabilities Act Accessibility Guide- lines.

3. BHMA – Builders Hardware Manufacturers Association

4. DHI – Door and Hardware Institute

5. NFPA – National Fire Protection Association

    a. NFPA 80 – Fire Doors and Windows

    b. NFPA 105 – Smoke and Draft Control Door Assemblies

    c. NFPA 252 – Fire Tests of Door Assemblies

6. UL – Underwriters Laboratories

    a. UL10C – Positive Pressure Fire Tests of Door Assemblies.

7. WHI – Warnock Hersey Incorporated

8. Local applicable codes

9. SDI – Steel Door Institute

10. NAAMM – National Association of Architectural Metal Manufacturers

1.03 SUBMITTALS & SUBSTITUTIONS:

A. SUBMITTALS**:** Submit six copies of schedule. Only submittals printed one sided will be accepted and reviewed. Organize vertically formatted schedule into "Hardware Sets" with index of doors and headings, indicating complete designations of every item required for each door or opening. Minimum 10pt font size. Include following information**:**

1. Type, style, function, size, quantity and finish of hardware items.
2. Use BHMA Finish codes per ANSI A156.18.
3. Name, part number and manufacturer of each item.
4. Fastenings and other pertinent information.
5. Location of hardware set coordinated with floor plans and door schedule.
6. Explanation of abbreviations, symbols, and codes contained in schedule.
7. Mounting locations for hardware.
8. Door and frame sizes, materials and degrees of swing.
9. List of manufacturers used and their nearest representative with address and phone number.
10. Catalog cuts.
11. Date of jobsite visit.

B. BID: Bid and submit manufacturer's updated/improved item if scheduled item is discontinued.

1. DEVIATIONS**:** Highlight, encircle or otherwise identify deviations from "Schedule of Finish Hardware" on submittal with notations clearly designating those portions as deviating from this section.
2. DISCREPANCIES: If discrepancy between drawings and scheduled material in submittal and request direction from Architect for resolution.
3. PRODUCT DATA: Include product data and indicate benefit to the Project. Furnish operating samples on request.
4. Items listed with no substitute manufacturers have been requested by Owner to meet existing standard.
5. AS-BUILT/AS-INSTALLED SCHEDULE: Furnish as-built/as-installed schedule with closeout documents, including keying schedule, manufacturers' installation, adjustment and maintenance information, and supplier's final inspection report.

PART 2 - PRODUCTS

2.01 QUALITY ASSURANCE**:**

A. QUALIFICATIONS**:**

1. Hardware supplier**:** direct factory contract supplier who employs a certified architectural hardware consultant (AHC), available at reasonable times during the course of work for project hardware consultation to Owner and Contractor.

    a) Responsible for detailing, scheduling and ordering of finish hardware. Detailing implies that the submitted schedule of hardware is correct and complete for the intended function and performance of the openings.

B. Hardware**:** Free of defects, blemishes and excessive play. Obtain each kind of hardware (latch and locksets, hinges and closers) from one manufacturer.

1. Fire-Rated Openings**:** NFPA 80 compliant. Hardware UL10C / IBC 2003 Section 715.4.1 (positive pressure) compliant for given type/size opening and degree of label. Provide proper latching hardware, non-flaming door closers, approved-bearing hinges, and resilient seals. Furnish openings complete.

2. Furnish hardware items required to complete the work in accordance with specified performance level and design intent, complying with manufacturers' instructions and code requirements.

3. Coordinate door hardware (components/wiring) with Telecommunication and Electrical Drawings

PART 3- EXECUTION

3.01 DELIVERY, STORAGE AND HANDLING:

A. Delivery**:** coordinate delivery to appropriate locations.

1. Permanent keys and cores**:** secured delivery direct to Owner's representative.

B. Acceptance at Site**:** Items individually packaged in manufacturers' original containers, complete with proper fasteners and related pieces. Clearly mark packages to indicate contents, locations in hardware schedule and door numbers.

C. Storage: Provide securely locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, dust, excessive heat and cold, etc.

3.02 PROJECT CONDITIONS AND COORDINATION:

A. Where exact types of hardware specified are not adaptable to finished shape or size of members requiring hardware, provide suitable types having as nearly as practical the same operation and quality as type specified.

B. COORDINATION**:** Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents. Furnish related trades with the following information**:**

1. Location of embedded and attached items to concrete.
2. Location of wall-mounted hardware, including wall stops.
3.
4. Location of finish floor materials and floor-mounted hardware.
5.
6. At masonry construction, coordinate with the anchoring and hollow metal supplier prior to frame installation by placing a strip of insulation, wood, or foam, on the back of the hollow metal frame behind the rabbet section for continuous hinges, as well as at rim panic hardware strike locations, silencers, coordinators, and door closer arm locations. When the frame is grouted in place, the backing will allow drilling and tapping without dulling or breaking the installer's bits.
7.
8. Coordinate: flush top rails of doors at outswinging exteriors, and throughout where adhesive-mounted seals occur.
9.
10. Manufacturers' templates to door and frame fabricators.

C. Check Shop Drawings for doors and entrances to confirm that adequate provisions will be made for proper hardware installation.

D. Prior to submittal, carefully inspect existing conditions to verify finish hardware required to complete Work, including sizes, and quantities.

3.03 WARRANTY:

A. Part of respective manufacturers' regular terms of sale. Provide manufacturers' written warranties:

1.	Locksets:	Three years
2.	Extra Heavy Duty Cylindrical Lock:	Seven Years
3.	Closers:	Ten years mechanical
		Two years electrical
4.	Hinges:	One year
5.	Other Hardware	Two years

3.04 COMMISSIONING:

A. Conduct these tests prior to request for certificate of substantial completion**:**

1. With installer present, test door hardware operation.

3.05 MANUFACTURERS:

Manufacturers and their abbreviations used in this schedule**:**

IVE	H. B. Ives
ADA	Adams Rite
PEM	Pemko
SCH	Schlage Lock
Company SCE	Schlage Electronics
VON	Von Duprin

3.06 HINGING METHODS:

A. Drawings typically depict doors at 90 degrees, doors will actually swing to maximum allowable. Use wide-throw conventional or continuous hinges as needed up to 8 inches in width to allow door to stand parallel to wall for true 180-degree opening.

B. Conform to manufacturer's published hinge selection standard for door dimensions, weight and frequency, and to hinge selection as scheduled. Where manufacturer's standard exceeds the scheduled product, furnish the heavier of the two choices.

C. Conventional Hinges: Steel or stainless-steel pins and concealed bearings. Hinge open widths minimum, but of sufficient throw to permit maximum door swing.

1. Outswinging exterior doors**:** non-ferrous with non-removable (NRP) pins and security studs.

2. Non-ferrous material exteriors and at doors subject to corrosive atmospheric conditions.

3. Pivots: high-strength forged bronze or stainless steel, tilt-on precision bearing and bear- ing pin.

    a) Bottom and intermediate pivots**:** adjustability of minus 0.063 inch, plus 0.125 inch.

3.07 LOCKSETS, LATCH SETS, DEADBOLTS:

A. Extra Heavy Duty Cylindrical Locks and Latches**:**

1. Chassis**:** cylindrical design, corrosion-resistant plated cold-rolled steel, through bolted.

2. Locking Spindle**:** stainless steel, integrated spring and spindle design.

3. Latch Retractors**:** forged steel. Balance of inner parts**:** corrosion-resistant plated steel, or stainless steel.

4. Latchbolt**:** solid steel.

5. Backset**:** 2.75 inches typically, more or less as needed to accommodate frame, door or other hardware.

6. Lever Trim**:** accessible design, independent operation, spring-cage supported, minimum 2.00 inches clearance from lever mid-point to door face.

7. Strikes**:** 16 gage curved steel, bronze or brass with 1.00 inch deep box construction, lips of sufficient length to clear trim and protect clothing.

8. Lock Series and Design**:** Schlage ND series, "Rhodes" design.

9. Certifications**:**

   (1) ANSI A156.2, 1994, Series 4000, Grade 1.

   (2) UL listed for A label and lesser class single doors up to 4 feet x 8 feet.

10. Accepted substitutions: Falcon T Series. Best 9K Series.

B. Replacement of Mechanical Cylindrical Locks with "Cyberlock"

1. Mechancial Cylinders locks shall be changed out to "Cyberlock". Keying for for all cylinders shall be the same for this entire project and similar to "Cyberlock PL-2 used for padlocks.

3.08 CLOSERS:

A. Surface Closers**:**

1. Full rack-and-pinion type cylinder with removable non-ferrous cover and cast iron body. Double heat-treated pinion shaft, single piece forged piston, chrome- silicon steel spring.

2. ISO 2000 certified. Units stamped with date-of-manufacture code.

3. Independent lab-tested 5,000,000 cycles.

4. Non-sized, non-handed and adjustable. Place closers inside building, stairs and rooms.

5. Plates, brackets and special templating when needed for interface with particular header, door and wall conditions and neighboring hardware.

6. Adjustable to open with not more than 8.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors.

7. Separate adjusting valves for closing speed, latching speed and backcheck, fourth valve for delayed action where scheduled.

8. Extra-duty arms (EDA) at exterior doors scheduled with parallel arm units.

9. Exterior door closers**:** tested to 100 hours of ASTM B117 salt spray test, furnish data on request.

10. Exterior doors**:** seasonal adjustments not required for temperatures from 120 degrees F to 0 degrees F, furnish checking fluid data on request.

11. Non-flaming fluid, will not fuel door or floor covering fires.

12. Pressure Relief Valves (PRV) not permitted.

13. Accepted Substitutions: Falcon SC80 Series. Stanley D3550 Series.

3.09 OTHER HARDWARE:

A. Kick Plates: Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of bronze or stainless steel to match other hardware.

B. Door Stops: Provide stops to protect walls, casework or other hardware.

C. Unless otherwise noted in Hardware Sets, provide floor type with appropriate fasteners. Where floor type cannot be used, provide wall type. If neither can be used, provide overhead type.

D. Seals: Inelastic, rigid back, not subject to stretching. Self-compensating for warp, ther- mal bow, door settling, and out-of-plumb. Adhesive warranted for life of installation.

E. Thresholds: As scheduled and per details. Comply with ICC/ANSI A117.1 Section 404.2.4 & 303. Substitute products: certify that the products equal or exceed specified material's thickness. Proposed substitutions: submit for approval.

F. Saddle thresholds: 0.125 inches minimum thickness.

G. Exteriors: Seal perimeter to exclude water and vermin. Minimum 0.25 inch diameter fasteners and lead expansion shield anchors, or Red-Head #SFS-1420 (or approved equivalent) Flat Head Sleeve Anchors (SS/FHSL).

H. Fire-rated openings, 90-minutes or less duration: use thresholds to interrupt floor covering material under the door where that material has a critical radiant flux value less than 0.22 watts per square centimeter, per NFPA 253. Use threshold unit as scheduled. If none scheduled, request direction from Architect.

I. Plastic plugs with wood or sheet metal screws are not an acceptable substitute for specified fastening methods.

J. Fasteners: Generally, exposed screws to be Phillips or Robertson drive. Pinned TORX drive at high security areas. Flat head sleeve anchors (FHSL) may be slotted drive. Sheet metal and wood screws: full-thread. Sleeve nuts: full length to prevent door compression.

K. Silencers: Interior hollow metal frames, 3 for single doors, 4 for pairs of doors. Leave no unfilled/uncovered pre-punched silencer holes. Intent: door bears against silencers, seals make minimal contact with minimal compression – only enough to effect a seal.

3.10 FINISH:

A. Generally: BHMA 626 Satin Chromium.

1. Areas using BHMA 626: furnish push-plates, pulls and protection plates of BHMA 630, Satin Stainless Steel, unless otherwise scheduled.

B. Door closers: factory powder coated to match other hardware, unless otherwise noted.

3.11 KEYING REQUIREMENTS: All keying for all door locks be by “Cyberlock” and shall be the same as the “Cyberlock” padlocks.

3.12 ACCEPTABLE INSTALLERS: Can read and understand manufacturers’ templates, suppliers’ hardware schedule and printed installation instructions. Can readily distinguish drywall screws from manufacturers’ furnished fasteners. Available to meet with manufacturers’ representatives and related trades to discuss installation of hardware.

3.13 PREPARATION:

A. Ensure that walls and frames are square and plumb before hardware installation. Make corrections before commencing hardware installation. Installation denotes acceptance of wall/frame condition.

B. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes.

1. Notify Architect of code conflicts before ordering material.

2. Locate latching hardware between 34 inches to 44 inches above the finished floor.

3. Where new hardware is to be installed near existing doors/hardware scheduled to remain, match locations of existing hardware.

C. Existing frames and doors to be retrofitted with new hardware**:**

1. Field-verify conditions and dimensions prior to ordering hardware. Fill existing hardware cut outs not being reused by the new hardware. Remove existing hardware not being reused, return to Owner unless directed otherwise.

2. Remove existing floor closers not scheduled for reuse, fill cavities with non-shrinking concrete and finish smooth.
3. Cut and weld existing steel frames currently prepared with 2.25 inch height strikes. Cut an approximate 8-inch section from the strike jamb and weld in a reinforced section to accommodate specified hardware's strike.

4. Provide wrap-around repair plates at doors where required to cover the original preparation and allow installation of new hardware.

3.14 INSTALLATION:

A. Install hardware per manufacturer's instructions and recommendations. Do not install surface-mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation. Remove and reinstall or replace work deemed defective by Architect.

1. Gaskets**:** install jamb-applied gaskets before closers, overhead stops, rim strikes, etc; fasten hardware over and through these seals. Install sweeps across bottoms of doors before astragals, cope sweeps around bottom pivots, trim astragals to tops of sweeps.

2. When hardware is to be attached to existing metal surface and insufficient reinforcement exists, use RivNuts, NutSerts or similar anchoring device for screws.

3. Use manufacturers' fasteners furnished with hardware items.

4. Replace fasteners damaged by power-driven tools.

B. Locate floor stops no more than 4 inches from walls and not within paths of travel. See paragraph 2.02 regarding hinge widths, door should be well clear of point of wall reveal. Point of door contact no closer to the hinge edge than half the door width.

C. Core concrete for exterior door stop anchors. Set anchors in approved non-shrink grout.

D. Lubricate and adjust existing hardware scheduled to remain. Carefully remove and give to Owner items not scheduled for reuse.

E. Field-verify existing conditions and measurements prior to ordering hardware. Fill existing hardware cut outs not being used by the new hardware.

F. Remove existing hardware not being reused. Tag and bag removed hardware, turn over to Owner.

G. Where existing wall conditions will not allow door to swing using the scheduled hinges, provide wide-throw hinges and if needed, extended arms on closers.

H. Provide manufacturer's recommended brackets to accommodate the mounting of closers on doors with flush transoms.

3.15 ADJUSTING:

A. Adjust and check for proper operation and function. Replace units, which cannot be adjusted to operate freely and smoothly.

1. Hardware damaged by improper installation or adjustment methods: repair or replace to Owner's satisfaction.

2. Adjust doors to fully latch with no more than 1 pound of pressure.

3. Adjust door closers for proper function.

B. Fire-rated doors:

1. Steel doors**:** adjust to 0.063 inches minimum to 0.188 inches maximum clearance at heads, jambs, and meeting stiles.

2. Adjust steel doors to 0.75 inches maximum clearance (undercut) above threshold or finish floor material under door.

C. Final inspection: Installer to provide letter to Owner that upon completion installer has visited the Project and has accomplished the following:

1. Has re-adjusted hardware.

2. Has evaluated maintenance procedures and recommend changes or additions, and instructed Owner's personnel.

3. Has identified items that have deteriorated or failed.

4. Has submitted written report identifying problems.

3.16 DEMONSTRATION: Demonstrate mechanical hardware and electrical hardware systems, including adjustment and maintenance procedures.

3.17 PROTECTION/CLEANING:

A. Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion.

B. Clean adjacent wall, frame and door surfaces soiled from installation / reinstallation process.

3.18 SCHEDULE OF FINISH HARDWARE:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE LOCK	ND50PD RHO	626	SCH
1	EA	SURFACE CLOSER	1461 RW/PA	689	LCN
1	EA	WALL STOP	WS407CCV	630	IVE
1	SET	SEALS	S88D	DKB	PEM

All door hardware shall be Cyberlock compatible

3.19 MEASUREMENT AND PAYMENT: Payment for this section will not be paid as a separate line item. The cost shall be included in the lump sum price of the bid items that includes the work covered in this section.

END OF SECTION

SECTION 09960- - EXTERIOR COATINGS

SPECIAL PROVISIONS

PART 1 - GENERAL

1.01 GENERAL:

A. GENERAL: This section covers furnishing of labor, tools, equipment, materials and applying paint to the exterior reservoir wall, roof slab vertical edge and other elements of the reservoir specified to have a paint finish in place complete, as shown on the plans and as specified in DIVISION 300 - CONSTRUCTION, Section 303.27 PAINTING of the Water System Standards, 2002, and as amended hereinafter as they apply to this project.

B. PROTECTION OF MATERIALS: All material shall be delivered to the jobsite in their original unopened containers bearing the manufacturer's name, brand and batch number. All coatings and paints shall be stored in enclosed structures to protect them from weather and excessive heat and cold. Flammable coatings or paints must be stored in conformance with city, county and state safety codes for flammable coating or paint materials.

C. SUBSTITUTIONS: Requests for material substitutions must be made and approved in writing by DHHL.

D. The terms TANK AND RESERVOIR are interchangeable.

1.02 SUBMITTALS

A. PRODUCT DATA: Submit product data in accordance with these Specifications. Unless otherwise specified here-in, submit manufacturer's data sheets showing the following information:

1. Percent solids by volume.
2. Minimum recommended dry-film thickness per coat for prime, intermediate and finish coats.
3. Recommended surface preparation.
4. Recommended thinners.
5. Statement verifying that the specified prime coat is recommended by the manufacturer for use with the specified intermediate and finish coats.
6. Application instructions including recommended equipment and temperature limitations.
7. Verification from the manufacturer that the product meets current California VOC requirements.
8. Color chips for alkyd enamel and exterior tank coatings.

B. PAINTING CONTRACTOR: Painting Contractor experience documentation as described in Section 10.3 below.

1.03 PAINTING CONTRACTOR QUALIFICATIONS:

The Painting Contractor must be capable of performing the various items of work as specified. If required by the Manager, the Painting Contractor shall furnish a statement covering experience on similar work, a list of machinery and other equipment available for the proposed work, and a financial statement, including a complete statement of the Paint Contractor's financial ability and experience in performing similar painting and coating work.

The Painting Contractor shall have a minimum of five (5) years practical experience and a successful history in the application of the specified products to concrete surfaces.

Upon request, the Painting Contractor shall substantiate this requirement by furnishing a list of references, which shall include jobs of similar nature, listing name of project, year completed, owner, name and contact telephone number for reference for each project listed.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. ABOVEGROUND EXTERIOR WALL AND ROOF EDGE AREAS:

1. Prime Coat - (1) coat, ICI Devoe Coatings 4030 TRU-GLAZE-WB Waterborne Epoxy Primer at 4.0 - 8.0 mils wet; 2.0 - 4.0 mils DFT. (200-270 sf/gal.) or approved equal.

2. Finish Coat- (2) coats, Glidden Fortis 350 (formerly ICI Devoe Coatings 2406 Dulux Professional) Waterborne Acrylic Latex Semi-Gloss at 4.0–4.6 mils wet; 1.4-1.6 mils DFT. (350-400 sf/gal) or approved equal.

3. The finish coat color shall be “Kauai Green.”

B. BELOW GRADE WATERPROOFING: Two-component liquid-applied urethane coating that forms an elastomeric waterproof membrane after curing, such as “CIM 1000” by C.I.M. Industries, Inc. (www.cimindustries.com) or approved equal.

PART 3 - EXECUTION

3.01 EQUIPMENT: The Contractor’s coating and painting equipment shall be designed for application of materials specified and shall be maintained in first class working condition. Compressors shall have suitable traps and filters to remove water and oils from the air. Contractor's equipment shall be subject to approval of the Engineer.

3.02 SURFACE PREPARATION:

1. All concrete surfaces shall be prepared in accordance with the recommendations of the coating manufacturer.

2. The surfaces shall be thoroughly cleaned, if they are not free of grease, curing compounds or other deleterious matter, as recommended by the coating manufacturer.

3.03 APPLICATION:

1. Contractor shall comply with manufacturer's recommended application rates, methods, and instructions.

2. Each coat shall be free of runs, skips or "holidays".

3. All work shall be done in accordance with the manufacturer's safety recommendations, adequate ventilation shall be provided within the tank by the contractor during the course of interior painting work.

a. SURFACES NOT TO BE COATED:

The following surfaces shall not be painted and shall be protected during the surface preparation and painting of adjacent areas:

1. Mortar-coated pipe and fittings.
2. Stainless-steel, aluminum, brass or copper.
3. Metal letters.
4. Nameplates.
5. Grease fittings.
6. Buried pipe, unless specifically required in the piping specifications.

3.04 PROTECTION OF SURFACES NOT TO BE PAINTED: Remove, mask, or otherwise protect hardware, lighting fixtures, switchplates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted.

Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.

Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process.

Mask openings in motors to prevent paint and other materials from entering the motors.

3.05 THINNING: The Contractor shall not add thinner to any paint product without prior approval of the Engineer and the paint manufacturer. Only thinner manufactured by the paint manufacturer will be allowed if thinning is approved.

3.06 WEATHER CONDITIONS: No painting shall be done under unfavorable weather conditions unless the work is well-protected from such conditions, and then only with the specific approval of the Engineer.

No painting shall be done when the air temperature is less than 50 degrees Fahrenheit (F), when the relative humidity is greater than 70 percent, or when the surface temperature is less than 5 degrees F above the dew-point, unless otherwise approved by the Engineer. If dew or moisture condensation should be anticipated and if such conditions are prevalent, painting should be delayed until surfaces are dry. Further, the day's painting should be completed in advance of

the problem time when condensation will occur, in order to permit the film sufficient drying time prior to the formation of moisture.

No painting shall be applied on any surface whose temperature is less than 50 degrees F or more than 120 degrees F or in conflict with the manufacturer's recommendations, unless otherwise approved by the Engineer.

3.07 SAFETY:

A. PERSONAL PROTECTIVE LIFE-SAVING EQUIPMENT: In accordance with requirements of the latest revision of the OSHA Regulations for Construction, the Contractor shall provide and require use of personal protective life-saving equipment for persons working in or about the project site.

B. HEAD AND FACE PROTECTION AND RESPIRATORY DEVICES: Equipment shall include protective helmets conforming to the requirements of ANSI Standard Z89.2, and shall be worn by all persons while in the vicinity of the work. In addition, workers engaged in or near the work during sandblasting shall wear eye and face protection devices meeting the requirements of ANSI Standard Z87.1 and OSHA Regulations for Sandblasting Operations, and air-purifying half-mask or mouthpiece respirator with appropriate filter.

C. VENTILATION: Where ventilation is used to control potential exposure as set forth in section 1910.924 of the OSHA Regulations for Construction, ventilation shall reduce the concentration of air contaminant to the degree a hazard does not exist.

D. SOUND LEVELS: Whenever the occupational noise exposure exceeds the maximum allowable sound levels as set forth in Table D-2 of Subpart C, Section 1926.52 of the OSHA Regulations for Construction, the Contractor shall provide and require the use of approved ear protection devices.

E. ILLUMINATION: Adequate illumination shall be provided while work is in progress. Whenever required by the Engineer, the Contractor shall provide additional illumination and necessary supports to cover all areas to be inspected. The level of illumination for inspection purposes shall be determined by the Engineer.

F. TEMPORARY LADDERS AND SCAFFOLDING: All temporary ladders and scaffolding shall conform to the applicable requirements of Subpart L, Sections 1926.45 and 1926.451 of the OSHA Regulations for Construction. They shall be erected where requested by the Engineer to facilitate inspection and be removed by the Contractor to locations requested by the Engineer.

3.08 INSPECTION AND TESTING: The Contractor shall give DHHL and Inspector 3 days' advance notice of the start of any field surface preparation work or coating application work.

The Contractor shall provide a full time NACE Certified Coating Inspector at the work site anytime work is being done on this section of the project. The Inspector shall have the authority to coordinate work and make decisions pertaining to the fulfillment of this phase of the contract. The Inspector shall have a minimum of 5 years of experience in the application of

the specified coatings. The contractor shall provide a list of three (3) potential NACE inspectors for DHHL to select one (1) for the project.

All work relative to preparation for the application of coatings shall be conducted under the full time Inspector. The Inspector's services shall be provided and paid for by the Contractor. The Inspector shall have the authority to act on behalf of DHHL to reject any coating work that does not comply with these specifications or the manufacturer's written specifications.

Prior to the start of any work, the Contractor shall establish with the Inspector, schedules and notification procedures to ensure all surface preparation work has been inspected prior to the application of any coating. These procedures shall remain in effect for the duration of the coating project. Under no circumstances shall any surfaces be coated without prior approval of the inspector. Coatings applied without the Inspector's authorization shall be removed and reapplied at the sole expense of the Contractor.

The Contractor shall make the following equipment available to the Inspector upon request:

a) Holiday testers
b) Film thickness testers
c) Surface preparation concrete comparators
d) Adhesion testers

3.09 MEASUREMENT AND PAYMENT: Exterior Coatings shall not be measured for payment. Payment for the application and furnishing of the Exterior Coatings in this section will not be made directly but shall be included in the payment items of which they are a part. Such payment shall represent full compensation for furnishing all materials, labor, tools, equipment and incidentals to complete the work.

END OF SECTION

SECTION 09961 PROTECTIVE COATING

SPECIAL PROVISIONS

PART 1 - GENERAL

1.01 GENERAL

Work includes the furnishing of all labor, tools, materials, and equipment required for surface preparation, waste disposal, pretreatment, coating application, touch-up, protection of uncoated surfaces, inspection, clean-up and all appurtenant work for protective coating on the interior concrete surfaces and internal piping of the reservoir. The specified coating systems shall be applied only to the surfaces and miscellaneous surfaces as noted in these specifications or shown on the Drawings. This specification modifies and supplements the painting of the interior concrete surfaces and internal piping of the reservoir as specified in "Water System Standards," State of Hawai'i, dated 2002, as amended.

The work shall be as follows:

1. Submit Worker Health and Safety Plan.
2. Submit scaffolding plan.
3. Pre-construction meeting.
4. Install scaffolding.
5. Abrasive blast surfaces to be coated per manufacturer's specifications to provide an anchor pattern suitable for coating system components.
6. Test for chlorides and pH to confirm levels are within manufacturer's acceptable levels.
7. If chlorides and pH testing results require additional cleaning, the Contractor shall steam clean the area(s) in question using steam at 275 degrees F.
8. Feather all broken edges of concrete to form a smooth transition, by grinding or other mechanical methods.
9. Vacuum concrete surface to remove dust and all loose debris
10. Apply protective coatings as required per these specifications, and in accordance with manufacturer's recommendations.
11. Provide full time, NACE inspection for dry film thickness, holiday detection, and adhesion testing. Contractor shall furnish all inspection equipment at the request of the Inspector as needed.
12. Remove scaffolding.
13. Restore the site to its original condition, or better.

The following surfaces shall not be coated hereunder unless indicated elsewhere in the bid documents:

1. Interior stainless steel ladder
2. Stainless steel items
3. Machined surfaces
4. Nameplates
5. Valve assemblies

1.02 RELATED WORK SPECIFIED ELSEWHERE: Section 303 – Structures of the "Water System Standards," State of Hawai'i, dated 2002, as amended.

1.03 REFERENCES: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In case of conflict between the requirements of this specification and those of the listed documents, the requirements of this specification shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Request for Proposal (RFP). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued, or replaced.

1. 29 CFR – Code of Federal Regulations Title 29, Occupational Safety and Health Administration (OSHA), U.S. Department of Labor
2. 29 CFR 1910 – Occupational Safety and Health Standards
3. 29 CFR 1910.146 – Permit Required Confined Space
4. 29 CFR 1910.502 – Fall Protection Systems Criteria and Practices
5. 40 CFR – Code of Federal Regulations Title 40, Environmental Protection Agency
6. 40 CFR 50 – National Primary and Secondary Ambient Air Quality Standards
7. 40 CFR 50.12 – National Primary and Secondary Ambient Air Quality Standards for Lead
8. 40 CFR 60 – Standards of Performance for New Stationary Sources
9. 40 CFR 60.372 – Standards for Lead
10. 40 CFR 302 – Designation, Reportable Quantities, and Notification
11. ASTM – American Society for Testing and Materials International
12. ASTM D4258 – Standard Practice for Surface Cleaning Concrete for Coating
13. ASTM D4259 – Standard Practice for Abrading Concrete
14. ASTM D4262 – Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces

15. ASTM D4263 – Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method

16. ASTM D4414 – Standard Practice for Measurement of Wet Film Thickness by Notched Gages
17. ASTM D4417 – Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel

18. EPA – Environmental Protection Agency

19. EPA Method 1311 – Toxicity Characteristic Leaching Procedure (TCLP)

20. EPA Method 3050 – Acid Digestion of Sediments, Sludges and Soils

21. EPA SW 846 - Test Method for Evaluating Solid Waste Physical/Chemical Methods

22. ICRI Technical Guideline No. 310.2 – Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays (formerly No. 03732)

23. NACE – National Association of Corrosion Engineers, the Corrosion Society

24. NACE No. 2 – Near-White Metal Blast Cleaning

25. NACE No. 3/SSPC-SP6 – Joint Surface Preparation Standard: Commercial Blast Cleaning

26. NACE No. 5/SSPC-SP12 – Joint Surface Preparation Standard: Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating

27. NACE No. 6/SSPC-SP13 – Joint Surface Preparation Standard: Surface Preparation of Concrete

28. NACE RPO-287 – Field Measurements of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using Replica Tape

29. NIOSH – National Institute for Occupational Safety and Health

30. NSF – National Sanitation Foundation

31. NSF 61 – Drinking Water System Components

32. SSPC – Steel Structures Painting Council, the Society for Protective Coatings

33. SSPC Guide 6 – Guide for Containing Surface Preparation Debris Generated During Paint Removal Operations

34. SSPC Guide 15 – Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates

35. SSPC-SP1 – Solvent Cleaning

36. SSPC-SP2 – Hand Tool Cleaning

37. SSPC-SP3 – Power Tool Cleaning

38. SSPC-SP5 – White Metal Blast Cleaning

39. SSPC-SP6 – Commercial Blast Cleaning

40. SSPC-SP10 – Near-White Metal Blast Cleaning

41. SSPC-SP11 – Power Tool Cleaning to Bare Metal

42. SSPC-SP13 – Surface Preparation of Concrete

43. SSPC PA 1 – Shop, Field, and Maintenance Painting of Steel

44. SSPC PA 2 – Measurement of Dry Film Thickness with Magnetic Gauges

45. SSPC VIS 1 – Guide and Reference Photographs for Steel Surfaces Prepared by Dry Adhesive Blast Cleaning

46. SSPC VIS 3 – Guide and Reference Photographs for Steel Surfaces Prepared by Hand and Power Tool Cleaning

Whenever the Drawings or these Specifications require a higher degree of workmanship or better quality of material indicated by the above standards, then these Drawings and Specifications shall prevail.

1.04 SUBMITTALS: The Contractor shall submit the following items:

A. TECHNICAL DATA SHEET: on each product used, including ASTM test results indicating the product conforms to and is suitable for its intended use per these specifications.

B. STANDARD COLOR OPTIONS. The tank lining shall be white or off-white, unless otherwise directed by the DHHL.

C. MATERIAL SAFETY DATA SHEETS: (MSDS) for each product used.

D. GUIDELINES AND RECOMMENDATIONS: for each product used including surface preparation, mixing, application, handling, storage, and cleanup. This shall include minimum time requirements for coating, recoating, and surface patches.

E. INDEPENDENT TESTING: Copies of independent testing performed on the protective coating materials indicating that the protective coating materials meet the requirements as specified herein. Material test results and measurements.

F. SHOP DRAWINGS: Forced heating, dehumidification, shading, and ventilation equipment specifications as required.

G. SAMPLES:

1. Samples of each coating system shall be submitted on a 3-inch by 3-inch by 1-inch thick concrete or mortar block. Each block shall be completely coated at the specified thickness over one 3-inch by 3-inch surface with the applicable coating system. Samples shall be labeled with the coating type, application method, and dry film thickness.

2. Samples shall be provided for each batch of material to be used on the project, and shall be accompanied with certification from the manufacturer that the batches provided as samples match the batches supplied to the job site. Failure to comply may result in rejection of the finished work by the DHHL.

3. The manufacturer's standard details for coating over joints/cracks, pipe penetrations, edge terminations, plate overlaps, and welds shall be provided.

H. APPLICATION CONTRACTOR'S QUALIFICATIONS:

1. Manufacturer certification that Applicator has been trained and approved in the handling, mixing, and application of the products to be used.

2. Certification that the equipment to be used for applying the products has been approved by the protective coating manufacturer and Applicator personnel have been trained and certified for proper use of the equipment.

3. Three references which verify that the coating contractor has demonstrated successful application of the specified coating systems in the past three years. Provide the site (area of coating), date of completion, the project owner's name, address and telephone number for each installation referenced.

4. Applicator must provide written documentation of having installed a minimum of 50,000 square feet (sf) of plural component spray applied protective coating the same or similar to that specified herein within the last five (5) years.

5. Proof of any necessary federal, state, or local permits or licenses necessary for the project.

6. The Contractor shall provide SSPC QP 1 Certification for application equipment.

1.05 QUALITY ASSURANCE:

A. QUALITY CONTROL PROCEDURES: The Applicator shall initiate and enforce quality control procedures consistent with applicable ASTM, NACE, and SSPC standards and the protective coating manufacturer's recommendations.

B. PRODUCTS: Protective coating products shall be standard products by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions and have proven reliability of at least five (5) years. If requested, the Contractor shall provide the DHHL with the names of not less than five (5) successful applications of the proposed manufacturer's products demonstrating compliance with this requirement.

C. MATERIALS: Materials have been specified from catalogues of manufacturers in most of the cases, to show the type and quality coatings required. Materials by other manufacturers are acceptable provided they are established as being compatible with and of equivalent quality to the coatings of the companies referenced. The Contractor shall provide satisfactory documentation from the manufacturer of the proposed substitute material that said material meets the requirements and is equivalent to or better than the listed materials in the following properties:

1. Quality
2. Durability
3. Resistance to abrasion and physical damage
4. Life expectancy
5. Ability to recoat in future
6. Solids content by volume
7. Dry film thickness per coat
8. Compatibility with other coatings
9. Suitability for the intended service
10. Resistance to chemical attack
11. Temperature limitations in service and during application
12. Type and quality of recommended undercoats and top coats
13. Ease of application
14. Ease of repairing damaged areas
15. Stability of colors
16. Adhesion strength

Three references which verify that the submitted coating system has been used in similar environments and on similar surfaces in the past five (5) years. Provide the name, the owner's address and telephone number for each installation referenced.

The cost of all testing and analysis of the proposed substitute materials that may be required by the Inspector, shall be paid by the Contractor. If the proposed substitution requires changes in the contract work, the Contractor shall bear all costs involved and the costs of allied trades affected by the substitution.

D. PRE-CONSTRUCTION MEETING: A pre-construction meeting shall be convened three (3) weeks prior to start of coating system application. Meeting attendance is required of all parties directly affecting work of this Section, including DHHL, General Contractor, application Contractor, Inspector and manufacturer's representative. In the meeting the following shall be discussed/reviewed:

1. Safety
2. Shutdown plan and schedule

3. Environmental requirements
4. Protection of surfaces not scheduled to be coated
5. Field quality control
6. Cleaning
7. Surface preparation
8. Application
9. Repair of coating
10. Inspection
11. Coordination with other work
12. Required reports
13. Contractor/Inspector/Owner relationship

E. NACE CERTIFIED COATING INSPECTOR: A NACE Certified Coating Inspector shall be provided by the Contractor. The Inspector will observe daily operations, procedures, and final product to ensure adherence to the specifications by Applicator.

F. QUALIFICATIONS: The Contractor shall provide a list of three (3) potential NACE inspectors in their proposal with qualifications for DHHL to select one (1) to provide quality assurance on the project. All costs associated with the inspector chosen shall be borne by the Contractor.

G. ON-SITE OBSERVATION: The protective coating manufacturer shall provide at least two (2) days of on-site observation and site-specific recommendations relative to surface preparation, handling, application, and curing of the manufacturer's products.

1.06 HEALTH AND SAFETY:

A. CONFINED SPACE: In confined space environments, as defined in 29 CFR 1910.146, work shall comply with the requirements set forth by OSHA applicable to the construction industry. The Contractor shall provide the require use of safety and personnel life-saving equipment for persons working in Confined Space areas, including but not limited to the following:

1. Adequate forced ventilation, harnesses, and gas detection meter(s) that continually monitors for oxygen, hydrogen sulfide, carbon monoxide, and low explosive limit (LEL) gas levels.

2. Fall protection shall be in accordance with 29 CFR 1926.502. All temporary ladders and scaffolding shall conform to applicable safety requirements.

3. Contractor shall provide all head and face protection equipment and respiratory devices required to safely perform this work. Equipment shall include any applicable masks recommended by the manufacturer while performing blasting or application of the coating materials.

4. Use of ear protection devices shall be provided and required by the Contractor whenever the occupational noise exposure exceeds OSHA limits.

B. Failure to comply with health and safety laws, regulations, codes, permits, and Standard Operation Procedures will be grounds for shutting down the Work. All costs resulting from a shutdown of the Work that are due to Contractor's negligence or failure to comply with applicable safety requirements shall be borne by the Contractor. After a shutdown of the Work, the Work will not be permitted to begin again until the Inspector is satisfied that all necessary health and safety precautions are provided and implemented.

C. Flammable or volatile solvents in coating system components constitute a hazard with regard to fire and explosions wherever flame or spark exposure is possible. All flames, smoking, and welding, etc., are strictly prohibited in work or storage areas. Fire abatement devices shall be readily available and in operating condition. Necessary precautions shall be taken to keep fire hazard to a minimum; all oily rags, waste, and other combustibles not in covered containers shall be removed from the area daily. All flammable products shall be stored in conformance with applicable State, Owner and local fire codes pertaining to flammable materials.

1. The coating products shall never exceed the current VOC limits set by EPA and the State of Hawai‘i Clean Air Branch. The Contractor shall be responsible for all fines or legal costs resulting from any VOC limit violations.

1.07 INSPECTION AND TESTING:

A. ADVANCE NOTICE: The Contractor shall give the DHHL and Inspector 3 days' advance notice of the start of any field surface preparation work or coating application work.

B. NACE CERTIFIED COATING INSPECTOR: The Contractor shall provide a full time NACE Certified Coating Inspector (hereinafter "Inspector") at the work site anytime work is being done on this section of the project. The Inspector shall have the authority to coordinate work and make decisions pertaining to the fulfillment of this phase of the contract. The Inspector shall have a minimum of 5 years of experience in the application of the specified coatings. The contractor shall provide a list of three (3) potential NACE inspectors for DHHL to select one (1) for the project.

C. INSPECTOR'S SERVICES: All work relative to preparation for the application of coatings shall be conducted under the Inspector. The Inspector's services shall be provided and paid for by the Contractor. The Inspector shall have the authority to act on behalf of the DHHL to reject any coating work that does not comply with these specifications or the manufacturer's written specifications.

D. SCHEDULES AND NOTIFICATION PROCEDURES: Prior to the start of any work, the Contractor shall establish with the Inspector, schedules and notification procedures to ensure all surface preparation work has been inspected prior to the application of any coating. These procedures shall remain in effect for the duration of the coating project. Under no circumstances shall any surfaces be coated without prior approval of the inspector. Coatings applied without the Inspector's authorization shall be removed and reapplied at the sole expense of the Contractor.

E. EQUIPMENT: The Contractor shall make the following equipment available to the Inspector upon request:

1. Holiday testers
2. Film thickness testers
3. Surface preparation concrete comparators
4. Adhesion testers

1.08 APPLICATION RECORDS: The Contractor shall maintain an accurate, written record of the quantity of coating material applied and the corresponding surface area covered, a description of the area coated, the batch number, surface temperature, ambient temperature, relative humidity, dew point, and applicator on a daily basis. The Contractor shall furnish a signed copy of said record to the Inspector at the beginning of the next working day. These quantities shall be independently verified by the Inspector and reported on the Inspector's log. The Inspector shall immediately investigate and resolve any discrepancies between these reported quantities.

1.09 SERVICES OF MANUFACTURER:

The Contractor shall require the coating manufacturers to furnish the following services:

A. The manufacturer's representative shall furnish at least 6 hours of on-site instruction in the proper surface preparation, use, mixing, application, and curing of the coating systems.

B. The manufacturer's representative shall personally observe the start of surface preparation, mixing, and application of coating systems.

C. The manufacturer's representative shall provide technical support to resolve field problems associated with the manufacturer's products furnished under this Contract or the application thereof throughout the duration of the work.

D. The coating manufacturer shall provide written certification that the coating contractor's Supervisor and each applicator performing work on the project has been trained and approved to apply the selected coating system.

1.10 WARRANTY:

A. The Contractor and manufacturers shall warrant the coating system applications for a period of 3 years after final acceptance of the work. The contractor shall submit to the DHHL a 3-year warranty bond for the total value of the complete coating system which shall cover any defects and workmanship repairs completed during the warranty period. The Contractor, at no cost to the DHHL, shall perform all work and supply all equipment and materials associated with the repair of failures identified in the warranty inspection.

B. The material manufacturer shall warrant, for a period of 5 years, that its products meet published physical properties and that they are free of manufacturing defects. The manufacturer shall replace any defective product.

C. The Contractor shall, within a reasonable time after receipt of written notice thereof, repair defects in materials or workmanship which may develop during the warranty period, and any

damage to other work caused by such defects or the repairing of same, at his own expense and without cost to the DHHL.

D. In the event of fault disagreement, warranty issues will be resolved through mediation involving the services of a NACE Certified Coating Inspector. Mediation and Inspection costs shall be borne by the party found to be responsible for the coating failure.

PART 2 – PRODUCTS

A. DEFINITIONS: The terms "paint," "coatings," and "finishes," as used herein, shall mean surface treatments, emulsions, enamels, paints, epoxy resins, and all other protective coatings, except galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat.

B. COMPATIBILITY: In any coating system only compatible materials from a single manufacturer shall be used in the Work. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, subject to the approval of the Inspector, a barrier coat shall be applied between existing prime coat and subsequent top coats to ensure compatibility.

C. COLORS: All colors of all paint coatings shall be as indicated by the DHHL. If colors are not indicated, then colors other than the final coat shall be selected by the Contractor. Finish colors shall be selected by the DHHL from the manufacturer's standard color samples.

2.01 PRODUCT DELIVERY AND STORAGE:

A. Coating materials shall be delivered to the job site in sealed containers with weather resistant labels that clearly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer, all of which shall be plainly legible at the time of use. Any products exceeding the manufacturer's recommended shelf life shall not be used.

B. The Contractor shall be responsible for providing temporary storage facilities to protect materials and equipment stored on-site from the elements and unauthorized personnel. The storage facility shall be capable of 24-hour climate control to maintain products within the storage temperature and humidity limits recommended by the manufacturer. The location of the storage container shall be approved in advance by the Inspector. If materials delivered to the site are used within 24 hours, the Contractor does not need to provide a storage facility as stated above.

1. The storage facility shall be capable of containing a spill or rupture of the coating system containers within the storage facility.

2.02 ABRASIVES: The type and size of abrasive shall be selected to produce a surface profile that meets the coating manufacturer's recommendations. All abrasives shall be new, clean, and delivered to the project site in unopened, weather resistant containers. Abrasive materials shall not be recycled for further use on this project unless approved by the Inspector.

All abrasives shall meet the requirements of the EPA. At no time will silica sand be allowed or used on the job site.

All abrasives shall be disposed of in accordance with all federal, state, and local laws at the Contractor's expense with no cost to the DHHL. Abrasives shall not be disposed of on-site.

2.03 EXISTING PRODUCTS: Standard Portland cement or new concrete (not quick setting high strength cement) must be well cured (minimum 28 days) prior to application of the protective coating system components.

Cementitious patching and repair materials must be approved prior to use as compatible with the protective coating. The manufacturer of the cementitious material shall provide to its suitability as a top coating with the specified protective coating. Project-specific submittals and procedures shall be provided, including application, cure time, and surface preparation procedures which permit optimum bond strength with the protective coating.

Remove existing coatings prior to application of the new protective coating. The Applicator shall maintain strict adherence to applicable NACE and SSPC recommendations with regard to proper surface preparation and compatibility with existing coatings.

2.04 COATING SYSTEMS:

A. COATING: One of the following 100 percent solids coating systems, NSF 61 certified, or an approved equal, shall be used to coat the interior surfaces of the tank:

Product:	**AquataPoxy A-6**	**Novaguard 810**
Type:	100% solids, amine cured epoxy	Two-component, solvent-free, amine rapid-cured novolac phenolic epoxy coating
Manufacturer:	Raven Lining Systems (800) 324-2810	PPG Protective & Marine Coatings (888) 9PP-GPMC
Surface Filler:	Per Manufacturer's recommendation	Per Manufacturer's recommendation
Primer:	Per Manufacturer's recommendation	Per Manufacturer's recommendation
Topcoat:	AquataPoxy A-6, @ 40 mils DFT	Novaguard 810 50-60 mils DFT
Joint Sealant:	Per Manufacturer's recommendation	Per Manufacturer's recommendation
Total Systems DFT:	40 mils DFT	50-60 mils DFT

B. SURFACE PREPARATION PRODUCTS FOR CONCRETE: Biodegradable water-basedsurface cleaner shall be "Devprep 88" by Devoe or equivalent.

PART 3 – EXECUTION

3.01 WORKMANSHIP: Skilled craftsman and experienced supervision shall be used on all work.

All coatings shall be applied under dry and dust-free conditions. Coating shall be applied in a workmanlike manner to produce an even film of uniform thickness. Edges, corners, crevices, and joints shall receive special attention to ensure that these areas are thoroughly cleaned and an adequate thickness of coating material is applied. The finished surfaces shall be free from runs, drops, ridges, waves, laps, brush marks, and variations in color, texture, and finish. The hiding shall be so complete that the addition of another coat would not increase the hiding.

3.02 PROTECTION OF SURFACES NOT TO BE COATED: Remove, mask, or otherwise protect all surfaces not intended to be coated. Provide drop cloths to prevent coating materials from falling on, marring, or over spraying adjacent surfaces.

Surfaces not to receive protective coatings shall be protected during surface preparation, cleaning, and coating operations.

3.03 ENVIRONMENTAL CONSIDERATIONS:

A. COATING LIMITATIONS: No coating work shall be performed under the following conditions:

1. Temperatures exceed the manufacturer's recommended maximum or minimum allowable.

2. Dust or smoke laden atmosphere.

3. Damp or humid conditions, where the relative humidity is above the manufacturer's maximum allowable limit.

4. Substrate or ambient temperatures are less than 5°F above the dew point. Dew point shall be measured by use of an instrument such as a Sling Psychrometer in conjunction with U.S. Department of Commerce, Weather Bureau psychrometric tables.

5. Ambient temperature that is expected to drop below 50°F or less than 5°F above the dew point within 8 hours after application of coating.

6. Concrete surfaces contain a moisture content above that specified by the coating manufacturer.

B. HUMIDITY CONTROL: Desiccant or Direct Expansion Refrigeration dehumidification will be required to control the environment in the space 24 hours a day during blast cleaning, coating application and coating cure. Equipment will conform to the following requirements:

1. Equipment – Desiccant dehumidifiers will be a solid desiccant design having a single rotary desiccant wheel capable of fully automatic continuous operation. No liquid, granular, or loose lithium chloride drying systems will be accepted. The use of direct expansion (DX) refrigeration type dehumidifiers with reheat may be considered if the expected ambient temperature will remain above 60°F. Heating the space changes relative humidity only and does not change the dew point temperature. Heat alone, therefore, is not a substitute for dehumidification, unless substrate temperature is high enough to meet the dew point differential. The dehumidification system may consist of a combination of desiccant and refrigerant equipment.

2. Air Changes – the air change rate for maintaining the required spread of 17°F between inside surface temperature and inside space dew point temperature with a maximum relative humidity of 45% in the space will depend upon the type of equipment to be used and the time of year during the application. There shall be a minimum of 2 air changes to hold the desired degree of cleanliness of the blast.

C. TEMPERATURE CONTROL:

1. Auxiliary cooling or insulation maybe necessary to maintain the surface temperature at an acceptable level for the coating manufacturer's application parameters. This auxiliary equipment must be approved for use by the supplier of the dehumidification equipment and will meet the following requirements.

   a. Refrigerant type systems must be installed in the process air supply duct and/or blended with the dehumidifier as close to the work space as possible.

   b. Only electric, indirect fired combustion, or steam coil auxiliary heaters will be used. No direct – fired space heaters will be allowed during the blasting, coating, or curing phases.

   c. The space to be controlled will be sealed off as well as possible, allowing air to escape the work space away from the point where the dehumidified air is being introduced. If it is necessary to filter the air escaping the space, the filtration system must be designed so that it does not interfere with the dehumidification equipment's ability to control the dew point and relative humidity of the work space.

D. ATMOSPHERIC CONDITIONS: The work and structure are located in an area that may be subject to extended periods of high humidity. The Contractor shall be expected to maintain the established production schedule despite these potentially adverse conditions by providing all labor, equipment and materials necessary to maintain a controlled environment in the area where work is to be performed. The substrate and atmospheric conditions within the controlled environment, with respect to temperature, relative humidity and dew point, shall be maintained within the limits established by the manufacturer of the selected coating system to ensure proper application and cure of the coating.

E. DEWATERING: The Contractor shall dewater and stop any active water flow into areas to be coated.

3.04 SURFACE PREPARATION (CONCRETE SURFACES):

A. All surfaces to be coated and protected shall be inspected as indicated below by the Contractor prior to starting surface preparation. Contractor shall notify the Inspector in writing of any defects or discrepancies that will not allow the coating to be properly installed. Commencement of work shall be construed as acceptance of the surfaces and it shall be the responsibility of the Contractor to correct any defect appearing in the surfaces once the coating preparation work has begun.

B. Concrete repair materials shall be compatible with the specified coating system and shall be thoroughly cured per the coating manufacturer's recommendations prior to the start of installation.

C. The Contractor shall comply with the applicable EPA and State of Hawai'i Clean Air Branch regulations for blast cleaning.

D. Abrasive blasting shall be performed only by skilled personnel utilizing appropriate equipment. A pattern shall be followed by the blaster to ensure a uniform surface, free of contaminants and having an open pore structure is produced.

E. Abrasive blasting, water jetting and coating application hoses shall be grounded to prevent accumulation of static electricity.

F. Compressed air for air blast cleaning shall be supplied at adequate pressure from compressors equipped with oil/moisture separators that remove at least 95% of the contaminants. The performance of the oil/moisture separators will be subject to blotter tests for conformance.

G. SURFACE PREPARATION SHALL BE AS FOLLOWS:

1. All degraded concrete and loose mortar shall be removed in accordance with SSPC SP2 and SP3.

2. The Contractor shall test the surfaces for soluble salts with the use of Chlor*Test as manufactured by Chlor*Rid International or approved equivalent. The interior surfaces of the tank shall have a maximum concentration of 5 micrograms per square centimeter ($\mu g/cm^2$). A test shall be conducted for every 500 square feet (ft^2) of surface area to be coated at locations determined by the Inspector.

3. If the soluble salt test indicates chloride concentrations greater than the limit outlined in these Specifications, the Contractor shall use Chlor*Rid, as manufactured by Chlor*Rid International, in the water source during water cleaning to remove the salts from the substrate. A substrate's surface preparation will be accepted once the soluble salt concentration is below the limit listed in these Specifications.

4. If there are no soluble salts on the surfaces after removal of the existing coating and damaged concrete, the surfaces shall be cleaned with a detergent in accordance with ASTM D4258. Detergent residue shall be thoroughly removed from the concrete surface with clean water.

5. Abrasive blast cleaning shall be performed using dry abrasive blasting procedures in accordance with ASTM D4259 and SSPC SP 13/NACE No. 6. Abrasive particle size and type shall be sufficient to produce a surface profile conforming to the manufacturer's recommendations for each coating product. Abrasive material in the blast cleaning operation shall be free of contaminants that would interfere with adhesion of the coatings and shall not be reused.

6. The blast pattern shall be by systematic removal from a defined rectangular area. Evidence of random blast patterns or contaminants will result in rejection of the surface and the blasting will be repeated until a suitable surface is obtained. The texture of the concrete surface after blasting shall be similar to that of coarse sandpaper. Any sharp, protruding edges shall be rounded or trimmed by chipping, peening, brushing or other approved methods.

7. During abrasive blast cleaning, prevent damage to adjacent coatings or structures. Blast cleaning and coating shall be scheduled such that dust, dirt, blast, particles, old coatings, or other contaminants, will not damage or fall upon uncured coatings.

8. After abrasive blasting, surfaces shall be cleaned by vacuum, or washed with clean water to remove dust, salts and detergent residue.

9. The finished surface shall consist of sound concrete with exposed aggregate. The Contractor shall not remove more material than necessary from the concrete surface in order to meet these requirements.

10. Concrete surfaces to be coated shall have an even color, gray or gray-white. The surface shall not have pockets, holes, or sharp changes of surface elevation. Scrubbing with a stiff bristle-fiber brush shall produce no dusting or dislodging of cement or sand. Sprinkling water on the surface shall produce no water beads or standing droplets.

11. In accordance with ASTM D4262, test to determine the pH of the concrete surface after the surface has been thoroughly cleaned and washed. If the pH is outside the range recommended by the coating manufacturer, then the surface must be neutralized by removing concrete until the surface pH of 7 or greater is obtained prior to any coating application. One pH test shall be performed every 500 square feet, or less, and at locations determined by the Inspector.

12. The Contractor shall test for capillary moisture in accordance with ASTM D4263. Moisture tests shall be taken every 500 square feet or less and at locations determined by the Inspector. If capillary moisture is present, the coating manufacturer shall be consulted to determine primer requirements and special coating application criteria.

13. All abrasive blasting material and debris generated by the cleaning procedure shall be removed from the site to an appropriate disposal facility at the Contractor's expense.

14. In the event that questions arise concerning the quality of the blast cleaning, the Inspector shall be the sole judge as to whether the level of cleanliness conforms to the standard and specifications.

H. The Contractor shall keep the work area in a clean condition and shall not permit materials to accumulate as to constitute a nuisance or hazard to the work performance or the operation of the existing facilities.

I. Concrete surfaces requiring spot repair shall be rehabilitated following surface cleaning and abrasive blasting. After the applied concrete repair materials have cured per the manufacturer's recommendations, they shall be swept blasted to remove surface residuals and establish an anchor profile equivalent to coarse sandpaper prior to coating application.

J. All prepared surfaces shall be observed and approved by the Inspector prior to subsequent work.

3.05 SURFACE PREPARATION (STEEL SURFACES):

A. HAND TOOLS: All hand tools used for grinding and sanding on or near lead containing paint shall be equipped with High Efficiency Particulate Air (HEPA) filters designed to contain paint chips.

B. SURFACE PREPARATION SHALL BE AS FOLLOWS:

1. Remove all existing debris, dirt, and deteriorated coating by Low Pressure Water Cleaning per SSPC SP 12/NACE No. 5. The minimum pressure of the Water Cleaning shall be 5,000 psi.

2. The Contractor shall test the surfaces for soluble salts with the use of Chlor*Test as manufactured by Chlor*Rid International or approved equivalent. The steel surfaces within the tank shall have a concentration of 0 micrograms per square centimeter ($\mu g/cm^2$). A test shall be conducted for every 500 square feet (ft^2) of steel surface area to be coated at locations determined by the Inspector.

3. If the soluble salt test indicates chloride concentrations greater than those outlined in these Specifications, the Contractor shall use Chlor*Rid, as manufactured by Chlor*Rid International, in the water source during water cleaning to remove the salts from the steel surfaces. A substrate's surface preparation will be accepted once the soluble salt concentration is as outlined in these Specifications.

4. All oil, grease, welding fluxes and other surface contaminants shall be removed by solvent cleaning per SSPC SP1 prior to abrasive blasting.

5. The Contractor shall abrasive blast the surfaces to be coated according to SSPC SP10 and these Specifications.

C. ABRASIVE BLAST CLEANING: For abrasive blast cleaning, the type and size of abrasive shall be selected to produce a surface profile that meets the coating manufacturer's recommendation for the particular coating and service conditions. Abrasives for submerged and severe service coating systems shall be clean, hard, sharp cutting crushed slag.

1. The abrasive shall not be reused unless otherwise approved by the Inspector. For automated shop blasting systems, clean oil-free abrasives shall be maintained.

2. The Contractor shall comply with the applicable federal, state, and regional air pollution control regulations for abrasive blast cleaning.

3. Compressed air for air blast cleaning shall be supplied at adequate pressure from well-maintained compressors equipped with oil/moisture separators which remove at least 95% of the contaminants.

4. Abrasive blasted cleaned surfaces shall match the standard samples shown in SSPC VIS 1 or VIS 3 for each product's recommended profile.

3.06 MIXING AND THINNING OF MATERIALS: Unless otherwise specified herein, the coating manufacturer's printed recommendations and instructions for thinning, mixing, and handling coating materials shall be strictly observed. Prepare multiple component coatings using all of the contents of the container for each component packaged by the manufacturer. Do not use partial batches. Do not use multiple component products that have exceeded their shelf life. Provide 4 touch-up kits for small area work. Mix only the components specified and furnished by the manufacturer. Do not add additional components for color.

3.07 APPLICATION (CONCRETE AND STEEL):

A. COATING APPLICATIONS: All coating applications shall conform to applicable standards of the OSHA, SSPC, NACE, ASTM, and the manufacturer's printed instructions. Material applied prior to approval of the surface preparation by the Inspector shall be removed and reapplied to the satisfaction of the Inspector at the expense of the Contractor.

B. COATING EQUIPMENT: The Contractor's coating equipment shall be designated for application of the materials specified and shall be maintained in first class working condition. Compressors shall have suitable traps and filters to remove water and oils from the air. The Contractor's equipment shall be subject to approval of the Inspector. All gasoline or diesel-powered equipment shall be parked over a lined containment area to minimize environmental impacts due to leaks or spills.

C. Coating application shall be as follows:

1. Remove dust, blast particles, and other debris from blast cleaned or previously coated surfaces by dusting, sweeping, washing, or vacuuming. Allow ventilator fans to clean airborne dust to provide good visibility of working area prior to coating applications.

2. Apply the first coating application within 24 hours after blast cleaning and before any water, dirt, or foreign matter has accumulated on the surface.

3. Keep coating materials at a uniform consistency during application (stir and drain as necessary). Apply each coating evenly, at the specified film thickness, to achieve a finish free of pinholes, drops, brush marks, ridges, waves, sags, runs, and other evidence of poor workmanship. Edges, corners, crevices, and joints shall receive special attention to ensure thorough surface preparation and adequate thickness of coating material are provided.

4. Stripe coat all steel edges, corners, joints and other protrusions. Finished surfaces shall be free from defects, pinholes, holidays or blemishes. Care shall be exercised to prevent coatings from being spattered onto surfaces that are not to be coated.

5. The coating thickness shall be measured at the time of application using a wet film thickness gauge approved and in accordance with ASTM D4414.

6. If minimum/maximum recoat times are not stated in the coating manufacturer's standard product literature, then the Contractor must supply such information to the Inspector for approval, prior to the start of the coating application; or supply a written statement from the coating manufacturer that limitations for recoat times do not apply to the coating specified on the project.

7. When overlapping transitions between sections of coating applied on different days, abrasive blast or mechanically abrade an 18-inch-wide strip of the previously applied coating, measured from the leading edge, to remove all gloss. Vacuum prior to application of fresh topcoat material feathered at least 12 inches into the abraded area. Avoid application onto glossy or untreated areas of the previously installed coating.

8. The finished coating application shall be protected from damage during curing and shall be cured as recommended by the manufacturer, prior to returning the reservoir to service.

9. All concrete coating edges, adjacent to pipe penetrations, vents, access hatches and other coating termination locations shall be terminated by keying into the concrete with a 1/8-inch-wide by 3/8-inch deep saw cut. Prior to coating application, the saw cut shall be dried and vacuumed to remove all dust and residue. During coating application, a liberal amount of material shall be applied to the saw cut area, then pressed with a trowel or putty knife into the saw cut cavity and smoothed level to the adjacent surfaces.

D. The coating manufacturer's standard details, submitted by the Contractor to the DHHL, shall be used for coating applications over construction and expansion joints.

3.08 CURING OF COATING: The Contractor shall provide curing conditions in accordance with the conditions recommended by the coating material manufacturer or by this Section, whichever is the highest requirement, prior to placing the completed coating system into service.

Dehumidification and temperature control in enclosed areas may be required during abrasive blasting and curing of coatings.

3.09 TESTING AND INSPECTIONS

A. SURFACES: Surfaces prepared as described in this Specification and per the manufacturer's recommendations shall be observed by the Inspector prior to applications of coatings to verify compliance.

B. SCAFFOLDING OR LADDERS: Scaffolding or ladders to facilitate inspection shall be erected and moved to locations where requested by the Inspector.

C. ADDITIONAL ILLUMINATION AND VENTILATION: Whenever required by the Inspector, the Contractor shall provide additional illumination and ventilation required for inspections. Adequate illumination shall consist of explosion-proof lights and electrical equipment required to meet safety standards. The Inspector shall determine the level of illumination for inspection purposes.

D. INSPECTION DEVICES: The inspection devices listed below, or approved equivalents, shall be provided by the Contractor to the Inspector as required in good working condition and with calibration data prior to beginning any Work. These items shall remain available until final acceptance of the coating applications per the parameters listed below:

1. Film Thickness Testing: The dry film coating thickness shall be measured in accordance with the SSPC "Paint Application Specification No. 2".

   (1) Wet film gauge: approved by ASTM D4414 (concrete)

   (2) Dry film gauge: PosiTector 100C or other approved by ASTM D6132 (steel)

2. Psychrometer: Sling, mechanized or digital.

3. Surface Temperature: Infrared surface temperature gauge.

4. Coating Adhesion Testing: Adhesion tests shall be performed according to ASTM D4541 for Type II instruments. The DHHL believes the following manufacturers are capable of producing equipment and/or products that will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular manufacturer's products, nor shall it be construed that named manufacturers' standard equipment or products will comply with the requirements of this section. Candidate manufacturers include Elcometer Model 106, or equal.

5. Coating Thickness Testing: During installation, all coating applications shall be inspected prior to each succeeding application. The procedure for collecting representative thickness data shall be as follows:

   (1) No measurements shall be made until at least 8 hours after application of the coating or as otherwise approved by the Inspector.

   (2) On concrete, the coating thicknesses shall be measured at the time of application using a wet film gauge.

   (3) Inspector shall determine where and how often to test for film thicknesses, and as a minimum, the requirements of SSPC PA 2 will be followed.

   (4) Discard any unusually high or low gauge reading that cannot be repeated consistently. Take the average (mean) of the three gauge readings as the spot measurement. The average spot measurement shall meet or exceed the specified dry film thickness for each application.

6. Adhesion Testing on Concrete:

   a) Adhesion tests shall be performed according to ASTM D4541 for Type II instruments for every 500 sq. ft. of coating material applied.

   b) A minimum of three 20mm diameter dollies shall be affixed to the coated surface. Each testing location shall be identified and recorded by the Inspector. The adhesive used to attach the dollies to the liner shall be rapid setting with a tensile strength in excess of the liner material and permitted to cure in accordance with the manufacturer recommendations.

   c) The lining material and dollies shall be adequately prepared to receive the adhesive. Failure of the dolly adhesive shall require retesting.

   d) Two of the three adhesion pulls shall exceed 200 psi or concrete failure with more than 50% of the subsurface adhered to the coating, unless otherwise specified in the Special Provisions.

   e) If one of the three dollies fails, an additional location shall be tested in the same structure. If two of the four dollies tested fail, the liner shall be removed and replaced at the Contractor's expense.

   f) The Inspector shall record the type of adhesive used, the length of time allowed to cure, and the type of failure observed on the dolly.

7. Final Inspection:

   a) At the completion of all coating work, a final inspection shall be conducted. The Contractor, a coating manufacturer representative, the Inspector, and the

DHHL shall jointly conduct a final inspection to establish that all work is complete per the Contract Documents.

b) Any deficiencies found shall be documented and corrected before granting final work acceptance.

c) The Contractor shall use video and still photography to thoroughly document each work area condition during the final inspection. A copy of all photographs and video shall be provided to the DHHL, and the Contractor shall keep the originals on file. The photographs and video shall be the basis for condition evaluation of the coating systems at the warranty inspection.

d) Inspection costs in excess of one re-inspection or cancellation of the coating work shall be borne by the Contractor.

3.10 WARRANTY INSPECTION: Warranty inspections shall be conducted within the last warranty year following work acceptance. All coating applications found deficient or defective during the warranty period shall be repaired or replaced by the Contractor, to the satisfaction of the DHHL. These repairs or replacements shall be in accordance with this Specification and the material manufacturer's recommendations at no cost to the DHHL.

Deficient or defective areas in the coatings include blisters, peeling, disbondment or cracking. The final inspection shall be used to assist in determining deficient or defective areas in the coating systems.

The DHHL shall establish a date for the inspection and provide 30 days' advance notification to the Contractor, so the Contractor and a coating manufacturer representative can be present during the inspection.

The cost of the warranty inspection shall be borne by each party. The Contractor shall arrange for the presence of the coating manufacturer and bear all associated costs. Inspection costs in excess of one re-inspection or cancellation not attributed to the DHHL shall be borne by the Contractor. The Contractor shall arrange for the cover all costs for repair work under the warranty.

If the warranty inspection is not held during, or before, 1 month prior to the end of the warranty period, the Contractor is not relieved of its warranty responsibilities under the contract documents. If the contractor fails to conduct the last-warranty-year inspection for reasons not attributed to the DHHL, the warranty period shall be extended until the inspection is conducted and defective work is repaired.

3.11 REPAIRS: Coating damage due to adhesion testing or if areas found to have an improper finish, insufficient film thickness or other deficiencies; then the Contractor shall clean, prepare and topcoat the coating surface per the manufacturer's recommendations to obtain the specified finish and coverage. Work shall be free of runs, bridges, shiners, laps, or other imperfections.

Damaged or defective coating shall be removed by the Contractor and the surface prepared in accordance with these Specifications before recoating.

3.12 CLEANUP: Upon completion of the work, all staging, scaffolding, containers and work-related material or debris shall be removed from the site to the satisfaction of the Inspector and DHHL.

Coating overspray and oil spots or stains on all surrounding surfaces shall be removed and the job site cleaned.

All Damage to surfaces resulting from the Contractor's work shall be cleaned, repaired or refinished, to the satisfaction of the Inspector at no cost to the DHHL.

Disposal of spent solvents, thinners, coating components and other related materials shall be the Contractor's responsibility and shall meet all federal, state, and regional regulations for safe disposal.

3.13 MEASUREMENT AND PAYMENT: Protective Coatings shall not be measured for payment. Payment for the application and furnishing of the Protective Coatings in this section will not be made directly but shall be included in the payment items of which they are a part. Such payment shall represent full compensation for furnishing all materials, labor, tools, equipment and incidentals to complete the work.

END OF SECTION

SECTION 11218

TANK LEVEL TRANSMITTER

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and installing of tank level transmitters for the temporary steel and new concrete reservoirs.

1.02 SUBMITTALS

Submit manufacturer's product data for proposed tank level transmitter for approval by the Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS

Tank level transmitter shall be a static water pressure transmitter for liquid level, IGP10 series with silicon strain gauge microsensor by Foxboro, or approved equal. The transmitter shall have electronic solid-state circuitry, 4-20 milliampere output, maximum working pressure 30 psi, power source from remote loop-type current power supply, 22 milliampere minimum. Furnish with weatherproof enclosure complete with mounting bracket for 2-inch pipe mounting.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Tank level transmitter shall be installed at location shown on the plans in accordance with the manufacturer’s guidelines. See Section 03310 – CONCRETE, PADS, FOOTINGS, AND THRUST/REACTION BLOCKS.

B. The data shall be relayed and integrated into the water system SCADA controls.

C. For the temporary tank, the tank level transmitter shall have a high water setpoint of 0.5’ below the overflow elevation, and a low water setpoint of 362’ MSL.

D. For the permanent concrete tank, the tank level transmitter shall have a high water setpoint of 389.5’ MSL and a low water setpoint of 380’ MSL.

3.02 MEASUREMENT AND PAYMENT

Payment for TANK LEVEL TRANSMITTER will be made by Each. Payment shall represent full compensation for furnishing all materials, labor, tools, equipment and incidentals, including excavation, backfill, grading, concrete, piping, fittings, valves and other incidentals required to complete the work, in place complete.

END OF SECTION

SECTION 11219

PORTABLE SYSTEM INTERCONNECT PUMP

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and delivery of one variable speed, portable packaged pump system for domestic water applications. The pump package shall be supplied trailer mounted and delivered to site for storage.

1.02 REFERENCES

A.	ETL	Intertek Laboratory
B.	ASTM	American Standards for Testing Materials
C.	ASME	American Society of Mechanical Engineers
D.	NSF	National Sanitary Foundation
E.	NEC	National Electrical Code aka NFPA 70
F.	NFPA	National Fire Protection Association
G.	HI	Hydraulic Institute
H.	NEMA	National Electrical Manufacturers Association
I.	ANSI	American National Standards Institute
J.	UL	Underwriting Laboratory

1.03 SUBMITTALS

A. Pumps curves with condition point and pump operating capacities shall be supplied.
B. Drawings
   a. System outline drawing(s) including elevation, plan and detail views shall be provided.
   b. Drawings shall include system connection and bolt-down sizes and locations as well as recommended NEC clearances.
   c. System drawings/models CAD files in AutoCAD (.dwg), ACIS (sat) or Revit compatible (.adsk) formats shall be supplied upon request.
   d. Wiring diagrams in .pdf format shall be provided.
   e. An electronic copy of Installation, Operation and Maintenance manuals (IO&M's) shall be provided for the pump system.
   f. A copy of the manufacturer's certificate of insurance showing as a minimum, general liability coverage of $1,000,000.

1.04 QUALITY ASSURANCE

A. Manufacturers seeking authorization to furnish their product shall provide an inhouse

quality assurance program.

B. The pump system shall be listed ETL/c-ETL for Packaged Pump systems.
C. The manufacturer shall be listed under UL508 for the manufacturer of control panels.
D. The manufacturer's personnel shall have a minimum of 30 years' experience in the fabrication of packaged pump system.
E. The system shall be certified under NSF/ANSI Standard 372, Drinking Water System and Lead Content Compliance.
F. The pump system shall be hydrostatically tested to maximum working pressure (MWP) the system is rated at for a minimum of 1 hour.
G. The pump system shall be factory run tested to insure condition point is maintained at the expected power draw.
H. The pump system test facility instrumentation shall be NIST traceable and have current calibration certificates.
I. Piping shall be built in compliance with ASME B31.1. Piping shall be fabricated by ASME Section IX certified welders.
J. Structural steel weldments shall we fabricated by AWS D1.1 certified welders.
K. Welder's certifications shall be available upon request.

PART 2 - PRODUCTS

2.01 MATERIALS

A. PREMIERflow, LLC is an approved manufacturer.
B. System
   a. The system shall provide varying water flow rate at a constant pressure or ASHRAE 90.1 compliant pressure profile through the use of a PID PLC controller and variable speed drives.
   b. The packaged pump system shall consist of:
      i. One pump
      ii. Check valve located on the discharge branch of pump
      iii. Ball valve or lug or grooved butterfly isolation valves for each set of pumps and check valves
      iv. Common suction and discharge manifolds.
      v. 4-20 mA transducer(s) located on the system discharge manifold
      vi. A 4-20 mA transducer shall be provided on the suction manifold.
      vii. Controls consisting of a PREMIERflow VB series controller, or approved equal, and dedicated variable frequency drive for pump
      viii. A common base or frame for components listed above.
C. Components
   a. Pump shall be ANSI / NSF Standard 61 and ANSI / NSF 372 approved.
      i. System condition point: 300 GPM @ 65 psi, 460/3/60.
      ii. System Model PFVs-20-4 Simplex; (1) Pumps/Motors Model Ebara 3U-65-200, 20HP, 3600 RPM, or approved equal.
      iii. Pump condition point: 300 GPM @ 150' TDH

b. Valve, check, wafer type.
    i. The Check Valve shall be of the silent operating type that begins to close as the forward flow diminishes and fully closes at zero velocity preventing flow reversal and resultant water hammer.
    ii. The valves used in potable water service shall be certified to NSF/ANSI 61, Drinking Water System Components – Health Effects, and certified to be Lead-Free in accordance with NSF/ANSI 372.
c. Valve, butterfly, lug-type
    i. Body shall be lug type
    ii. Disc shall be for domestic water
    iii. Valve shall be certified to NSF/ANSI-372
    iv. Valve shall have a maximum working pressure of 250 psig. Valve shall be tested to 110% of the rated pressure.
d. Valve, ball
    i. Ball valves shall be 2-piece full port design constructed of forged copper silicon alloy brass body and end adapter.
    ii. Seats and stem packing shall be virgin PTFE. Stem shall be bottom loaded, blowout proof design with fluorocarbon elastomer O-ring to prevent stem leaks.
    iii. Ball valve shall have chrome plated brass ball and adjustable packing gland.
    iv. Valve shall be rated to 600psig (41 bar) WOG non-shock. Valves shall be certified to NSF/ ANSI standard 372.
e. Piping
    i. Manifolds shall be constructed of either 304 stainless steel. Manifolds shall have a maximum working pressure of 150 psig.
    ii. Manifolds shall be grooved at both ends to allow change of suction and discharge connection geometry in the field.
    iii. Main and branch piping shall be sized for a maximum velocity of 10 ft/s.
f. Controls
    i. The control panel shall be a PREMIERflow series VB, or approved equal. The control panel shall consist of:
        1. Single point power connection
        2. Through door control power disconnect with safety interlock to prevent door from being opened while in ON position
        3. A Eaton solid-state programmable logic controller (PLC) with non-volatile memory (battery backup not required)
        4. Fused 120 V AC control voltage transformer
        5. Fused 24 V DC power supply, 1 Watt
        6. Operator interface: 7-inch color scale touch screen Human Machine Interface (HMII) including but not limited to the following:
            a. Main Screen with the following features:
                i. Individual pump HOA (Hand – Off – Auto) virtual switches

ii. Pump run indication, including current % speed
iii. Pump Failure indication
iv. Current pressures readings in psig (suction and system)
v. Current flow in GPM
vi. Adjustable manual (hand) speed setting
vii. Direct access to menu screen

b. Menu screen providing direct access to all system settings and status screens
    i. Pump settings screen displays current settings and allows user changes
c. Alarm settings screen displays current settings for all alarms and allows user changes.
    i. Low suction alarm settings
        1. Low suction pressure, psig
        2. ON and OFF delays, seconds
        3. Manual or automatic reset
    ii. Low system alarm settings
        1. Low system pressure, psig
        2. ON and OFF delays, seconds
        3. Manual or automatic reset
    iii. High system alarm settings
        1. High system pressure, psig
        2. ON and OFF delays, seconds
        3. Manual or automatic reset
    iv. High suction economy mode
        1. Economy mode suction pressure, psig
        2. Economy mode enable / disable
        3. ON and OFF delays, seconds
d. Separate Alarm Silence and Alarm Reset buttons
e. Current system status screen displays:
    i. Pump(s) currently running
    ii. Active alarms and warning messages
f. System event history screen displays a minimum of the last 100 system events, including pump start /stops, alarm conditions and alarm acknowledgements.
g. Pump run time screen displays the total operating time for pump. Provide individual resets for pump run time
h. Multi-Level Security
    i. Password protected security levels (field changeable passwords)

7. A common alarm relay provides dry contacts for customer monitoring.
8. An alarm horn with a minimum sound level of 85 db, annunciating all alarm conditions

ii. The control panel shall be listed under UL/C-UL 508 and meet NEC (NFPA 70) requirements.
iii. PREMIERflow Visilogic software: PV-VB Self Tuning control algorithm shall allow for varying discharge pressure with varying flow rates in order to compensate for varying friction losses in the system as described in ASHRAE 90.1. The control algorithm shall meet the requirements of ASHRAE 90.1.
iv. The system control algorithm shall use a speed adjust curve calculation proportional response. Step response algorithms shall not be considered equal.
v. The VB series shall provide Building Automation System communication through Modbus. Communication shall be provided via an RS-485 ethernet port.
vi. The following event reporting shall be provided via BAS communication:
    1. Individual VFD status
    2. Remote System Disable
    3. Phase Loss Alarm
    4. Flow Switch or Level Switch option enabled
    5. Individual Pump Run
    6. Individual Pump Fault
    7. Individual Pump Hand/Auto status
    8. Low System Alarm
    9. Low Suction alarm
    10. High System Alarm
    11. General Alarm
    12. Alarm Horn Silenced
    13. System Sensor Failure
    14. Suction Sensor Failure
    15. Economy Mode engaged
    16. Fatal alarm
vii. The following events initiation shall be available via BAS communication:
    1. BAS System Disable
    2. Enable BAS Set Point
    3. BAS Set Point (psi)
viii. IF VFD's are mounted inside the control panel, drive keypads shall be door mounted and accessible without opening the control panel or disengaging power.
ix. The control panel shall have a minimum short circuit current rating of 1200 kVa.
x. The Eaton controller shall communicate with the variable frequency drives using Modbus protocol via RS-485 cables.
xi. Controls shall include remote start/stop contact to enable automatic turn on and shut off of pump and generator based on water level in the Anahola water tank reservoir.

g. Variable Frequency Drives (VFD)

i. Each drive will have individual disconnects and short circuit protection. Drive manufacturer must provide a two year minimum warranty.
ii. Drives will be configured to provide the following operating features:
1. Drive keypad will have manual, off and automatic mode selection and will accessible to operators without opening an enclosure.
2. When in automatic, drive will run upon closure of the respective run permissive contact
3. When in automatic and with a run permissive signal, drive speed will responded to a 0-10 V DC speed reference signal from pump controller.
4. Drive will provide a limited number of automatic resets for fault conditions and will maintain a history of faults.

h. Suction and system pressure transducers
i. Transducer wetted parts shall be a 300series stainless steel.
ii. Transducer shall output a 4-20 mA signal with a minimum accuracy of +1%.

i. An appropriate flow meter and pressure gauge shall be provided to attach to the discharge manifold per KDOW requirements;
j. Package shall include all necessary hose or pipe adaptors to connect to the 4.5" HFD stand hose thread suction and double 2.5" KFD standard hose thread discharge manifolds of the system interconnection standpipes;
k. Generator
i. GENERAC Model SD/AD 60kw Diesel Genset 4.5L Engine, or approved equal.
ii. Generator shall be mounted on trailer with the pump.
l. Enclosed Trailer
i. USA Cargo Trailer 7' x 16' enclosed trailer dual axel tongue pull complete with interior lights, or appoved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation of the system shall be per the manufacturer's recommendations and shall meet applicable federal, state and local codes.
B. Coordination of building trades and subcontractors and compliance with federal, state, and local codes shall be performed by the contractor with unit responsibility.
C. Unless otherwise negotiated, remote mounted instrumentation, control wiring and mapping of BAS communication points shall be the responsibility of the controls engineer/contractor.
D. Unless otherwise negotiated, interfacing of the V-60 HMI to the building's network to allow for web-enabled access shall be coordinated of the contractor having unit responsibility and the buildings IT professionals.
E. Contractor shall furnish the portable pump at the project site within 120 days of receiving the NTP.

F. The portable pump shall be placed at a location as directed by the engineer.

3.02 START-UP

A. Four (4) hours of start-up service and field training will be provided by the manufacturer's representative unless otherwise negotiated.
B. Prior to start-up, the system will be installed per manufacturer's instruction with power and water connected, communication lines connected, data point mapped and electrical inspection performed and approved. Sufficient water flow supply and demand shall be available to emulate full system designed performance.
C. The manufacturer's representative shall be given a minimum two (2) weeks of notice for start-up.
D. During start-up, the system shall be tested for start and stop conditions, pump condition point and full system flow.
E. Pump package system shall be warranted for a period of (24) months from date of shipment or (18) months from date of startup, whichever occurs first.

3.02 MEASUREMENT AND PAYMENT

Payment for PORTABLE SYSTEM INTERCONNECT PUMP will be made by Lump Sum. Payment shall represent full compensation for furnishing all materials, labor, tools, equipment and incidentals required to complete the work.

END OF SECTION

SECTION 11220

TANK CHLORINE RESIDUAL ANALYZER

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and installing of one potable water chlorine residual analyzer unit. The chlorine residual analyzer unit shall be supplied with the necessary piping to connect to the product feed line and drain line.

1.02 SUBMITTALS

A. Before construction, submit six (6) sets of shop drawings include system connection and bolt-down sizes and locations as well as recommended NEC clearances.

PART 2 - PRODUCTS

2.01 MATERIALS

A. One Chlorine Residual Analyzers shall continuously measure free chlorine residual from the Anahola Tank effluent line. The unit shall consist of a direct measuring chlorine flow cell, sensor interconnect cable with quick disconnect plug, and an electronic controller housed in a NEMA 4 enclosure. NEMA 4 enclosure shall be the Hoffman A6OH4818 SSL PQT, or approved equal. The chlorine flow cell shall be an amperometric membrane capable of direct measurement of free chlorine residual in clean water without the use of liquid reagents. The sensor cell assembly shall be constructed of clear material allowing the condition of the sensor to be inspected without removal of the sensor casing. The controller shall provide a display of residual chlorine concentration directly in PPM on a backlit LCD display. The overall display range shall be 0.00-10.00 PPM. An isolated 4-20 mA output shall be provided, capable of driving loop loads up to 1000 ohms. Accuracy shall be 0.5% of the range. Power input shall be 115 Vac, single phase. The unit shall be provided with a user accessible power switch. The unit shall provide two isolated 4-20 mA outputs configurable for chlorine, pH, temperature, or PID control. Analog outputs shall be both ground isolated and isolated from each other. Unit shall also contain two SPDT alarm relays. Provide unit with flow rotameter, sample taps, and adjustable pressure regulator. The complete chlorine monitor shall be supplied with spare parts and accessories for up to 2 years of operation. The Chlorine Residual Analyzer shall be Dulcometer as manufactured by Prominent, or an approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The water tank effluent line chlorine residual analyzer shall be installed according to the manufacturer's recommendations.

B. The 3/4" supply line to the chlorine residual analyzer shall be connected to the 8" effluent line of the water tank. The data shall be relayed and integrated into the water system SCADA controls. See Section 03310 – CONCRETE, PADS, FOOTINGS, AND THRUST/REACTION BLOCKS for control mounting pad specifications.

3.03 MEASUREMENT AND PAYMENT

Payment for TANK CHLORINE RESIDUAL ANALYZER will be made by Each. Payment shall represent full compensation for furnishing all materials, labor, tools, equipment and incidentals, including excavation, backfill, grading, concrete pad, enclosure, piping, valves and other incidentals required to complete the work, in place complete.

END OF SECTION

SECTION 11222

CYBERLOCK SYSTEM

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and installation of a Cyberlock system for DHHL at the Anahola tank site with the hub located at an office to be selected by DHHL.

1.02 SUBMITTALS

Submit manufacturer's product data for Cyberlock system for approval by the Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All materials shall be Cyberlock, or approved equal. Contractor shall verify that specified equipment is compatible with existing equipment in the field.

B. Cyberlock system components provided shall be as indicated in below table. Contractor shall confirm with supplier that the listed below equipment includes everything required for a functioning Cyberlock Electronic Access Control system. The indicated Cyberlock Standard Cylinder is dependent on the lock set installed at the door. Contractor shall confirm that the indicated Standard Cylinder will work on the doors that will be retrofitted with the Cyberlock Cylinders and with the new doors. If the existing lockset will not accept an interchangeable core, then additional hardware will be required.

ITEM DESCRIPTION	PART NO	QTY
Cyber Audit Server, including SE-100 Server, Software License for up to 50 users (SWL-CAB-50), and 1-year support for system (SPT-CAW-50)	SE-100 Bundle	1
USB Station with Cable	CKS-020	1
CyberKey Authorizer Hub, Web, 120V, 60Hz	AH-W1	1
Cyberkey Authorizer Keyport Indoor/outdoor, 1x8 display, keypad	AK-01	1
Control Key	CK-IR7C	1

Grand Master Programming Key for Locks and Cylinders	CK-GM	1
CyberKey User key, IR, Replaceable Battery and Tip	CK-IR7	5
CyberLock Padlock Brass, 2" x 3/8" dia stainless steel shackle	PL-02	7
CyberLock Standard Cylinder SFIC, Best Format, 7-pin	CL-SF03	4

PART 3 - EXECUTION

3.01 INSTALLATION

A. The Cyberlock Padlocks and Cyberlock Standard Cylinders shall be located as indicated on the Construction Plans.

B. The Cyberlock Server, Hub and all associated equipment shall be installed off-site at an office to be selected by DHHL.

C. The Contractor shall be required to set up a functioning Cyberlock system and provide introductory training to DHHL staff on the use of the Cyberlock system.

D. Keying for all cylinders and padlocks shall be the same for the entire project.

3.02 MEASUREMENT AND PAYMENT

Payment for furnishing and installing the CYBERLOCK SYSTEM, or approved equal, will be made by Lump Sum. Payment shall represent full compensation for furnishing all materials, labor, tools, equipment and incidentals required to complete the work, in place complete. The Lump Sum Payment shall include compensation for introductory training of DHHL staff on use of the system.

END OF SECTION

SECTION 13201

TEMPORARY STEEL WATER TANK

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and installing a temporary steel reservoir, including tank structure, lining, piping and appurtenances.

A. Scope of Work

Furnish and erect a polymer lined, corrugated bolted steel storage tank, including the design and construction of the foundation, tank structure, and tank appurtenances as shown on the contract drawings and specified herein.

All required labor, materials and equipment shall be included.

1.02 SUBMITTALS

Before fabrication, submit:

A. Six (6) sets of shop drawings and structural design calculations for the tank and foundation, stamped by a Hawaii Licensed Professional Engineer for review and acceptance. This approval will not relieve the Supplier or Manufacturer from supplying a tank in strict accordance with the Contract Specifications.

B. Supplier qualifications and contact information including number of years in business, number of tanks supplied in the last ten years, and number of tanks installed in the last ten years.

C. List of materials and technical data sheets for tank liner and other appurtenances.

1.03 DESIGN CRITERIA

A. The tank shall be G115 Galvanized SteelCore model SCT-3006-LVR corrugated steel with nominal diameter 30.94’ and nominal sidewall height 21.31’ or approved equal.

B. The design of the tank and its foundation shall be the responsibility of the tank supplier and shall comply with the general dimensions indicated on the plans and as specified below:

Ring foundation shall be designed by contractor’s structural engineer. Ring foundation

shown on contract drawings are schematic in nature. Contractor shall hire a structural engineer registered in the state of Hawaii to design and provide stamped drawings for the foundation. Stamped drawings and calculations shall be submitted for record. Contractor's structural engineer shall follow recommendations in the geotechnical report by Geolabs, Inc. dated October 25, 2017, for design parameters and subgrade preparation. A copy is available with the procurement officer. Design shall be based on the wind, seismic, and structural parameters on Sheet S-1 of the contract drawings. Design code and standards shall be as stated on the contract drawings.

C. The tank liner shall conform solely to NSF/ANSI 61: Drinking Water System Components- Health Effects.

D. The steel tank shall have a minimum capacity of 115,000 gallons.

1.04 WARRANTY

The tank shall be maintained operable for the duration of the contract. The contractor shall be responsible for providing a continuous supply of water to the system throughout the duration of the contract.

The tank manufacturer shall warranty parts for a minimum period of one year from date of completion. If the water storage tank, or any part thereof, shall prove to be defective in material or workmanship upon examination by the Engineer, the manufacturer will supply an identical or substantially similar replacement part f.o.b. the manufacturer's factory, or the manufacturer, at its option, will repair or allow credit for such part.

Upon completion of the project, warranty shall be included with the O & M manual.

PART 2 - PRODUCTS

2.01 BOLTED CORRUGATED STEEL TANK

The water tank specifications are based on a SteelCore Model SCT-3006-LVR tank supplied by M&M Tanks with standard 10-degree low v rib roof and nominal capacity 117,607 gallons. Other manufacturers or suppliers will be considered if the substituted product complies with this Technical Specification.

A. Plates and Sheets

All sheets and plates shall be formed from steel that has been smelted and produced in the United States of America. Steel Mill Certificates shall be included with the tank

submittals to substantiate conformance with this requirement if required.

Plates, structural shapes, and sheet shall be rolled to the necessary diameter to minimize stress during and after assembly.

Sheets used in the construction of the tank shell and roof shall conform to the "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process" ASTM A653/A653M-17. Coating weight shall be G115.

B. Bolts

Bolts shall be heat treated to grade SAE 8 and electro-galvanized with JS-500 clear coating.

All bolts, nuts and washers shall conform to AWWA D103.

Roof bolts shall have factory installed, cone washers with Grade 8 Serrated nuts for greater grab on steel panels.

Wall bolts shall have Button Allen heads for insertion from inside the tank toward outside.

All bolts on the vertical tank wall shall be installed such that the head portion is located inside the tank, and the washer and nut are on the exterior.

Bolt lengths shall be sized as to achieve a neat and uniform appearance.

C. Liner

An NSF-61 certified liner shall be installed within the steel tank structure. The liner shall conform to the following:

1. The liner shall be of reinforced polypropylene, certified as NSF-61 compliant.

2. After liner installation, the tank shall be tested for liquid-tightness by filling the tank to its overflow elevation.

3. Water containment system shall consist of liner hanger hardware, an 8 oz geo-textile pre-liner installed on the foundation and the interior of the walls and factory welded seam, flexible membrane main liner, and liner materials can meet NSF61, NFPA22, AWWA standards.

D. Sealants

1. Flange to Liner Sealant

   The sealant shall be SIKA 1A. It shall be used to seal all flanges to liner on the inside of the tank. It shall be suitable for contact with potable water and shall be certified to meet ANSI/NSF Additives Standard 61 for indirect additives.

   Sikaflex-1a is a premium-grade, high-performance, moisture-cured, 1-component, polyurethane-based, non-sag elastomeric sealant. Meets Federal specification TT-S-00230C, Type II, Class A. Meets ASTM C-920, Type S, Grade NS, Class 35, use T, NT, O, M, G, I; Canadian standard CAN/CGSB 19.13-M87.

   Fast tack-free and final cure times. High elasticity - cures to a tough, durable, flexible consistency with exceptional cut and tear-resistance

   Sealant curing rate at 40-100 degrees F
   Tack-free time: 3 to 6 hours.
   Final cure time: 4 to 7 days.
   Neoprene gaskets and tape type sealer shall not be used

2. Silicone Sealant

   The sealant shall be Dow Corning 795 Building Sealant- Grey or equal. It shall be used on exterior of tank only, applied around flange holes and bolts. It is a one-part, cold-applied, non-sagging silicone material that cures to a medium modulus silicone rubber upon exposure to atmospheric moisture.

E. Appurtenances

The Contractor shall furnish and install the appurtenances as indicated:

1. All small parts and appurtenances shall be hot dip galvanized in accordance with ASTM A386.

2. All primary tank fittings shall be SCH 80 PVC or Galvanized Steel, Stainless Steel or equal. Pipe connections shall be as recommended by the tank manufacturer.

3. Inlet and Outlet Connection: Inlet and outlet connection shall conform to the size and location specified on the detail sheets. The tank shall be equipped with an overflow of the type and size specified on the detailed drawings.

4. Roof Vent: A properly sized vent assembly in accordance with AWWA D103 shall be furnished and installed above the maximum water level of sufficient capacity so that at maximum possible rate of water fill or withdrawal, there will

be no resulting interior pressure or vacuum in excess of 0.5” water column. The overflow pipe shall not be considered to be a tank vent. The vent shall be constructed of aluminum.

5. Drain: A female threaded wall flange shall be furnished at the bottom wall of the tank such that the tank may be completely drained. Drain shall conform to the size and location specified in the plans.

6. Outside Tank Ladder: An aluminum or galvanized steel exterior ladder package with safety cage, step-off platform and lockable security cover shall be provided at the location shown on the plans. Outside ladder and cage shall meet OSHA requirements.

7. Liquid Level Indicator to be provided.

2.02 SAND

Sand shall be Ameron HC&D concrete sand, nominal size range #4 to #100, ASTM C-33, or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Sidewall Structure

Field erection of the corrugated bolted steel tank shall be in strict accordance with the procedures outlined in the manufacturer's erection manual, and performed by an authorized dealer of the tank manufacturer, regularly engaged in erection of these tanks using factory trained and certified erectors.

Specialized erection jacks and building equipment developed and manufactured by the tank manufacturer shall be used to erect the tanks.

Particular care shall be taken in handling and bolting of the tank panels. Prior to a liquid test, all surface areas shall be visually inspected by factory installers.

No backfill shall be placed against the tank sidewall without prior written approval and design review of the tank manufacturer. Any backfill shall be placed according to the strict instructions of the tank manufacturer.

B. Roof and Access Hatch– Galvanized Steel

The roof shall be a G115 Galvanized, flat panel galvanized steel roof panels, standard roof cap. Steel clear-span and self supporting. Both live and dead loads shall be carried by the tank walls. The roof shall be of a 10 degree low v rib design.

The manufacturer shall furnish a roof opening access hatch which shall be placed near the outside tank ladder and which shall be provided with a hinged cover and a hasp for locking. The opening shall have a clear dimension of at least twenty-four (24) inches.

C. Roof Vent

The vent shall be designed and constructed such that it will prevent the entrance of birds and/or animals by including an expanded aluminum screen (1/2 inch) opening. An insect screen of 23 to 25 mesh polyester monofilament shall also be provided and designed to open should the screen become plugged by ice formation.

D. Pipe Connections

Where pipe connections are shown to pass through tank panels, they shall be field located, saw or torch cut, and utilize an interior and exterior flange assembly and the tank shell reinforcing shall comply with AWWA D103 latest edition. SIKA 1A or equal shall be applied on any cut panel edges or bolt connections.

Overflow piping shall be 8 inches diameter.

An NFPA vortex breaker shall be provided.

E. Access Doors

One bottom access door shall be provided as shown on the contract drawings in accordance with AWWA D103. Such door shall be a minimum of 24 inches in diameter. The access door (shell manhole) and the tank shell reinforcing shall comply with AWWA D103 latest edition, Sec. 5.1. Cover plate shall be supported by a davit.

Field erection of polymer lined, bolted steel tank shall be in strict accordance with the procedures outlined in the manufacturer's erection manual. Particular care shall be exercised in handling and installation of the tank liner to avoid abrasion or scratching. Prior to liquid test, all surface areas shall be inspected by the Engineer.

Leveling of base ring shall be required, and the differential elevation shall not exceed one-eighth inch (1/8") in ten feet (10').

3.02 TANK FOUNDATION

The tank foundation shall be designed by the Manufacturer and constructed in accordance with the approved shop drawings, stamped by a State of Hawaii registered

Professional Engineer.

3.03 TESTING

A. Testing of the reservoir shall be in accordance with Section 303.10 of the Water System Standards and Section 11.12 of AWWA D100.

B. Following completion of erection and cleaning of the tank, the tank shall be tested for liquid-tightness by filling the tank to its overflow elevation. Any leaks disclosed by this test shall be corrected by the erector in accordance with the manufacturer's recommendations.

Water required for testing will be furnished at the time of erection and plumbing completion by the State without charge to the Contractor.

3.04 DISINFECTION

Tank shall be disinfected according to Section 303.10 of the Water System Standards.

Tank shall be disinfected by chlorination in accordance with AWWA C 652 or hypochlorites conforming to AWWA B300 before it is placed in service.

3.05 MEASUREMENT AND PAYMENT

A. Payment for construction of the TEMPORARY 0.1 MG TANK will be made by Lump Sum. Payment shall represent full compensation for furnishing all materials, labor, tools, equipment and incidentals, including steel tank, liner, foundation design, foundation construction, pipe penetrations, connections, sealants, access ladder, testing and other incidentals required to complete the work.

B. Payment for the item to Remove Temporary 0.1 MG Steel Tank shall not be paid for under this section. Payment for this item shall be made under the Demolition section.

END OF SECTION

SECTION 13202 – TANK ACCESSORIES

SPECIAL PROVISIONS

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and construction of the new concrete reservoir. The Water System Standards, 2002, for State of Hawaii, including any amendments, shall be followed unless specified otherwise in this specification.

A. The following are amendments to Section 303 Structures of the Water System Standards, 2002.

B. The terms TANK and RESERVOIR shall be used interchangeably.

1.02 AMENDMENT TO WATER SYSTEM STANDARD

A. SECTION 303.03 – CONCRETE WORK.

See Section 03310 Reinforced Concrete for concrete amendments to the Water System Standards, 2002.

B. SECTION 303.06 – REINFORCED CONCRETE RESERVOIR

1. Amend "1. Construction and Expansion Joints" of the "C. Concrete Work" subsection by adding the following:

Waterstops

A. Waterstops shall be of an approved type, supplied by an approved manufacturer and shall be plastic made of virgin polyvinylchloride compound, shall be ribbed, uniform in dimensions, dense, homogeneous, free from porosity, and as detailed on Drawings.

B. No reclaimed PVC shall be used in the compound.

C. Waterstop shall be held in place in the forms by use of split forms or other approved method that will positively hold the waterstop in the correct position and to the correct alignment. All horizontal and vertical waterstops, which are not accessible during the pouring, shall be tied off in two directions every 12 inches in such a manner that bending over one way or another is prevented. All waterstops shall be properly spliced and joints shall be checked for strength and pinholes after splicing. Splices shall be strong enough to develop a pulling force of 75 percent of the strength of the waterstop, and shall be watertight. Connect the ends of the radial waterstop in the wall footing joints to the circumferential

waterstop in the wall to wall footing joint and to the circumferential waterstops in the floor to wall footing joints if they should exist.

D. The finished waterstop material shall meet the following minimum requirements:

1.	Tensile strength	2,000 psi	ASTM D-412
2.	Ultimate elongation	350%	ASTM D-412
3.	Shore Hardness	70-80	ASTM D-2240
4.	Specific Gravity	1.3	ASTM D-792
5.	Stiffness in Flexure	600 psi	ASTM D-747
6.	Cold Brittleness	-35 degrees F	ASTM D-746
7.	Water Absorption	48 hours 0.32% max	ASTM D-570
8.	Tear Resistance	290 lb./in.	ASTM D-624

VINYLEX CORPORATION, 2636 Byington-Solway Road, Knoxville, TN 37921 (Phone 615-690-2211) and GREENSTREAK PLASTIC PRODUCTS, Box 7139, St. Louis, MO 63177 (Phone 314-225-9400) are two of several suppliers who can furnish waterstops meeting these requirements. Approved equal material may also be used.

2. Add the following to paragraph "4. Interior Perimeter Seal" of the "C. Concrete Work" subsection

A. The interior surface of horizontal construction joint in the wall of the reservoir shall be sealed with CIM 1000 Trowel Grade, by C.I.M. Industries Inc., 23 Elm St., Peterborough, NH 03458 (Phone 800-543-3458) (Website www.cimindustries.com). The surface of the concrete shall be prepared and the compound applied per manufacturer's recommendation.

B. Add the following paragraph to paragraph "4. Interior Perimeter Seal" of the "C. Concrete Work" subsection:

The sealing compound shall be CIM 1000, by C.I.M. Industries Inc., 23 Elm St., Peterborough, NH 03458 (Phone 800-543-3458) (Website www.cimindustries.com). The surface of the concrete shall be prepared and the compound applied per manufacturer's recommendation.

3. Amend the entire paragraph "5. Roof Sliding Joint" of the "C. Concrete Work" subsection to read:

A. The roof sliding joint at the top of the reservoir wall shall be constructed as detailed on the plans. The Neoprene Bearing Pad shall be of the dimension and hardness shown on the Drawings and shall be made by an approved manufacturer. The material for 40 durometer neoprene pads shall conform to ASTM D-2000 M2BC414A14C12F17 and the material for 30 durometer pads

shall conform to ASTM D-2000 M2BC310A14C12F17. Unless otherwise specified on the Drawings, neoprene pads shall be of 40 durometer. KIRKHILL RUBBER CO., 300 E. Cypress St., CA 92621 (Phone: 714-529-4901) and WEST AMERICAN RUBBER COMPANY, INC. (Phone 213-628-7271) are two of several suppliers who can furnish neoprene pads meeting these requirements. Approved equal materials may be used.

B. Cellular Closed Cell Neoprene Pads shall be used as a filler material in flexible joints, in areas not taken up by the solid neoprene bearing pads. The material shall be medium grade closed cell neoprene conforming to 2A3 of ASTM D 1056-85 and as further specified herein and on the Drawings.

1. Compressive Deflection	9 – 13 psi
2. Shore 00 Durometer	60 – 80 PCF
3. Density	12 – 28 PCF
4. Water Absorption by Weight	5%
5. Temperature Range:	
Low (Flex without cracking)	-30 degrees F
High Continuous	150 degrees F
High Intermittent	200 degrees F
6. Heat Aging (7 days at 150oF)	
Lineal Shrinkage (max.)	5%
7. Tensile Strength	115 psi min.
8. Elongation	180% min.
9. Resilience (bayshore % rebound average	
½" thickness @ 72 degrees F)	20 – 40%

"MONARCH" by ARMACELL, CYPRESS SPONGE 431N or 432N, or approved equal are acceptable material.

C. All Neoprene Bearing Pads and Cellular Closed Cell Neoprene Pads shall be glued to the concrete with an approved rubber cement material to prevent uplift of the pads during concrete pour.

4. Amend the entire paragraph "6. Surface Finish" of the "C. Concrete Work" subsection to read:

A. The exterior and interior wall and column surfaces shall be finished to show no unsightly defects, fins, and irregularities. All form tie holes shall be repaired flush with surface. On all interior surfaces shall be made smooth by applying Sikaguard 75 to cover and patch air holes and other imperfections. All exterior surfaces shall have an architectural finish.

5. Revise the title of the "G. Payment" subsection to "J. Payment."

6. Add subsection "G. Earthquake Cables" as follows:

A. Earthquake cables used to connect the wall to wall footing/grade beam shall consist of 7 wire galvanized strands, meeting the minimum ultimate strength for 3/8-inch and ½-inch strands (as required on the Drawings) of 21,000 pounds and 38,200 pounds respectively. The strands shall be hot-dipped galvanized before stranding with a minimum zinc coating of 0.85 oz./square foot.

B. The Closed Cell Neoprene sleeves for the seismic cables shall conform to the minimum dimensions shown on the Drawings to permit unrestrained flexing of the strands inside the sleeves under the maximum projected radial wall movement. The Closed Cell Neoprene sleeves shall have the following properties:

1. Material shall be medium grade conforming to 2A3 of ASTM D 1056-85.
2. Compressive Deflection: 9 – 13 psi
3. Shore 00 Durometer: 60 – 80 PCF
4. Density: 12 – 28 PCF
5. Water Absorption by Weight: 5%
6. Temperature Range:
   Low (flex without cracking): -30 degrees F
   High continuous: 150 degrees F
   High intermittent: 200 degrees F
7. Heat aging (7 days at 150°F)
   Lineal Shrinkage (max.): 5%
8. Tensile Strength: 115 psi min.
9. Elongation: 180% min.
10. Resilience (bayshore % rebound average ½" thickness @ 72 degrees F): 20 – 40%

"MONARCH" by ARMACELL, CYPRESS SPONGE 431N or 432N, or approved equal are acceptable material.

7. Add subsection "H. Lateral Restraints, Roof to Wall" as follows:

A. Extra Strong pipe shall conform to ASTM A53 Grade B or ASTM A500 Grade A. Rod shall conform to ASTM A307. Hot-dipped galvanizing shall conform to ASTM A123-78.

8. Add subsection "I. Bottom of Wall Joint Detail" as follows:

A. The bottom of wall shall be constructed as detailed on the plans. The Neoprene Bearing Pad shall be of the dimension and hardness shown on the Drawings and shall be made by an approved manufacturer. The material for 50 durometer neoprene pads shall conform to ASTM D-2000 M2BC514A14C12F17.

B. KIRKHILL RUBBER CO., 300 E. Cypress St., CA 92621 (Phone: 714-529-4901) and WEST AMERICAN RUBBER COMPANY, INC. (Phone 213-628-7271) are two of several suppliers who can furnish neoprene pads meeting these

requirements. Approved equal materials may be used.

C. The filler pad shall be **RUBATEX R423N, or CYPRESS SPONGE 423N,** or approved equal, are acceptable materials. Rubatex company is no longer in existence, however other companies have equivalent product using the same designation or equivalent filler pad to the previous Rubatex R423N.

D. Bearing and filler pads shall be glued to the concrete with an approved rubber cement material to prevent uplift of the pads during concrete pouring.

C. SECTION 303.22 – MISCELLANEOUS IRON AND METAL WORK

A. Add the flowing to E. Aluminum:

Aluminum frame and insect screen shall be custom designed and fabricated by contractor. The insect screen shall SWG (standard wire gage) 32 with mesh spacing at 14x14.

B. Exterior Ladder:

Ladders, landing, bracing, intermediate platforms, platform railing, and appurtenances shall be fabricated in accordance to latest OSHA standards out of aluminum. Ladders shall be equipped with safety climbing system. Fasteners and parts which are of a different type of metal shall be isolated electronically from ladder to prevent galvanic action.

If anything is not in conformance with OSHA standards, it shall be revised to be in conformance and noted on shop drawings

Four harnesses and appurtenances required for the use with the selected safety climbing system of each ladder shall be provided to the user.

C. Interior Ladder:

Ladders, bracing, intermediate platforms (if required), platform railing (if required) , and appurtenances shall be fabricated in accordance to latest OSHA standards out of 316L Stainless Steel. Ladders shall be equipped with safety climbing systems for which all parts shall be out of 316L Stainless Steel. Fasteners and parts which are of a different type of metal shall be isolated electronically from ladder to prevent galvanic action.

If anything is not in conformance with OSHA standards, it shall be revised to be in conformance and noted on shop drawings.

Four harnesses and appurtenances required for the use with the selected safety climbing system of each ladder shall be provided to the user.

D. SECTION 303.33 – CHAIN LINK FENCE AND GATE

A. Amend the last paragraph of "C. Installation" to read:

For Kauai Only: The contractor shall furnish padlocks for all gates, hatches, ladder guards and hasps. Contractor shall inquire with the DHHL officer in charge (project manager) as to the type and make of padlocks desired. Duplicate keys for each lock shall be provided if requested by the DHHL officer in charge.

B. Padlock Quantities- As required for each lockable item on the plans.

E. SECTION 303.22 – PADLOCKS

A. All padlocks shall be "Cyberlock PL-2". All keying shall be the same for entire project. A total of 5 keys for the project shall be provided to the owner.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 13220 – CONTROL BUILDING

SPECIAL PROVISIONS

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and construction of the CMU control building expansion. The Water System Standards, 2002, for State of Hawaii, including any amendments, shall be followed unless specified otherwise in this specification.

A. The following are amendments to Section 303 Structures of the Water System Standards, 2002.

1.02 AMENDMENT TO WATER SYSTEM STANDARD

A. SECTION 303.34 – ROOFING

1. Amend Section 303 by adding "303.34 Asphalt Roofing"

a. Roofing for new extension of Control Building shall be Asphalt Shingle matching the existing shingle, in brand, color and quality. The water proofing membrane beneath the asphalt shingles shall match the existing.

b. Flashing and Trims, shall match the existing (if it occurs), in type, material, and dimensions.

c. Existing roofing and water proofing membrane for Control Building shall be removed and also replaced by new Asphalt Shingle matching the existing shingle, in brand, color and quality.

B. SECTION 303.27 - PAINTING

1. Amend Section 303.27 to amend item "C. Samples", by adding the following paragraph.

The color of the new paint over the new extension of the Control Building shall match the existing building, both interior and exterior.

1.03 WOOD FRAMING

A. All wood framing shall be Douglas Fir Larch:

B. 2x framing shall be Grade No.2

C. 4x framing shall be Grade No.2

D. Plywood shall be Douglas Fir, CDX, Structural 1 conforming to Commercial Standard PS 1-74.

E. All wood shall be treated against rot and insect damage. All wood shall be pressure treated.

1.03 REPLACING OF ALL EXISTING MECHANICAL LOCK CYLINDERS OF DOORS

A. Replace the lock cylinders of all existing doors with "Cyberlock". Keying for entire project shall be the same.

PART 2 – MISCELLENEOUS ITEMS TO BE PROVIDED:

2.01 Miscelleneous Items to be provided in Control Building:

A. Gloves: Four pair (left and right hand) of gloves which are Nitri-Solve chemical resistant glove in S, M, L & XL.

B. Goggles: Four goggles, V-Maxx Safety Goggles, Indirect Vent, Neoprene Headband, Clear Body, Clear Polycarbonate Lens, Fog Ban Anti-Fog Coating.

C. Spill Response Kit: One set by SpillTech SPKU-20 Universal Spill Response Kit.

D. Fire Extinguisher: Furnish and install wall-mounted dry chemical fire extinguisher, U. L. approved for A, B, C fires equal to UL-20A-80-BC or approved equal. Casing to be enameled steel. Furnish complete with wall bracket and fasteners for attachment to masonry. Fire extinguisher shall be located as indicated in the plans.

PART 3 – EXECUTION

3.01 MEASUREMENT AND PAYMENT

CMU CONTROL BUILDING EXPANSION shall be paid for by lump sum as provided for and indicated in the Bid Proposal Form to include the control building expansion, sidewalks, and any necessary testing for existing lead and asbestos.

Payment for the CMU CONTROL BUILDING EXPANSION shall be made at the lump sum price and shall be full compensation for all equipment, tools, materials, labor and other required items and incidentals required to complete the work in-place complete.

Cyberlocks shall not be paid for under this section, but shall be paid for under SECTION 11222 – CYBERLOCK SYSTEM.

END OF SECTION

SECTION 13282

LEAD-CONTAINING PAINT CONTROL MEASURES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies the Contractor's responsibilities for controlling lead hazards associated with the Anahola Farm Lots Water Project, Phase II – Water Tank Replacement and Facility Improvements. Lead containing paints (LCP), ranging from 110 milligrams per kilogram (mg/kg) to 50,000 mg/kg, were identified in the project area. For the purpose of this Section, LCP is defined as any paint containing a measurable level of lead. Lead-based paint (LBP) is defined as 5,000 mg/kg or 0.5% by weight lead or higher.

1. Contractor is required to complete all lead paint-related work in accordance with applicable federal, state, and local regulations.

2. Contractor may conduct further surveys at his/her own expense, if previously unforeseen LCP is suspected in the project area.

B. Contractor must implement appropriate engineering controls and safety measures to prevent the site workers, facility users, the public, and environmental exposures to lead hazards, potentially generated from the rehabilitation project activities.

C. Contractor shall ensure that all employees and subcontractors involved in disturbing or removing hazardous materials have access to relevant information, and understand and control the lead hazards. Refer to Section 01715 - EXISTING CONDITIONS for hazardous material survey findings and Section 13288 - TESTING/AIR MONITORING for Contractor responsibilities for compliance.

D. Costs incurred due to the Contractor's negligence in controlling hazards shall be borne by the Contractor, including but are not limited to, medical, legal, public and regulatory relations, investigation, clean-up, monitoring, and reporting.

1.02 PRELIMINARY

A. In conducting renovation or demolition of surfaces with LCP, utilize safeguards, precautions, and protective measures to prevent exposure of any individuals to lead.

B. Disturbance of lead-containing paints and coatings may cause lead-containing dust and debris to be released into the atmosphere, thereby creating a potential health hazard to workers and other personnel within and outside the project area. Inform all workers, supervisory personnel, subcontractors, and consultants of the potential health hazards and of proper work procedures which must be followed when working with LCP.

C. Contractor and his/her subcontractors shall review the plans and specifications and ensure that all site workers, including subcontractors, fully understand its contents, including hazard identification and control.

D. Contractor shall take appropriate and continuous measures and methods to provide all necessary information and devices, to protect all workers from the potential hazards of lead exposure. Such measures must comply with applicable federal, state, and local regulations.

E. Assure only workers, who have been trained in accordance with the U.S. Occupational Safety and Health Administration (OSHA) Lead in Construction Standard [29 Code of Federal Regulations (CFR) 1926.62] and Hawaii Occupational Safety and Health Division (HIOSH) 12-148.1, are allowed to conduct the work specified in this Section.

F. Complete work under this Section in strict accordance with applicable federal, state, and local regulations, standards, and codes governing the preparation, treatments, handling, storage, transport, and disposal of lead-containing paints and coatings. The most recent edition of the aforementioned shall govern the execution of this project.

G. Requirements of EPA's Lead Renovation, Repair and Painting Rule (RRP Rule) and National Emission Standards of Hazardous Air Pollutants (NESHAP) apply to this project. All lead paint disturbance activities shall be controlled and monitored.

1.03 WORK SPECIFIED IN THIS SECTION

A. Control lead hazards during the project related work in accordance with laws, regulations, and current best work practices. It is the responsibility of the Contractor to understand and control the potential lead hazards.

B. Work covered by this Section includes the incidental procedures and equipment required to protect the workers, the public, and the environment from lead exposures.

C. Conduct work in accordance with 29 CFR 1910.1025, 29 CFR 1926.62, HIOSH 12-148.1, and the requirements specified herein.

1.04 COORDINATION WITH OTHER SECTIONS

A. Prior to commencement of work, an annotated description of existing damage shall be identified and submitted to the Contracting Officer. It will be the Contractor's responsibility to repair damage to the Contracting Officer's satisfaction that cannot be proven to have been in this condition prior to the commencement of this project.

B. Related Sections are:

1. Section 01715 - EXISTING CONDITIONS for general requirements and a hazardous material survey report.

2. Section 13283 – Lead Based Paint Removal and Disposal

3. Section 13288 - TESTING/AIR MONITORING for requirements for compliance

1.05 SUBMITTALS

A. Before start of work, submit in accordance with SECTION 01330 - SUBMITTAL PROCEDURES. Do not begin work until these submittals are returned, indicating that the information contained in the submittal is concurred by the Contracting Officer.

1. Statements
   a. Lead Hazard Control Plan: Submit a detailed job-specific plan of the work procedures to be used during LCP-related work.

   b. The Plan shall include, but are not limited to:
      (1) Clear scope of work

      (2) Clear description of methods to control lead hazards

      (3) Written Hazard Communication (HAZCOM) including training records

      (4) Written Respiratory Protection Plan

      (5) Name, contact information, and qualification of the Contractor's Competent Person.

      (6) Manufacturer's Safety Data Sheets: Submit for any chemicals and chemical products brought onsite.

   c. Occupant Protection Plan: As required by 40 CFR 765 Subpart L.

   d. Training Certificates: Submit a copy of workers and the Competent Person's OSHA/HIOSH required "Lead in Construction" and EPA's RRP Rule training records.

   e. Testing Laboratory Qualifications: Submit the name, address, and telephone number of the testing laboratory selected to perform the air, wipe, or soil lead analysis, and reporting. This laboratory shall be accredited under the EPA National Lead Laboratory Accreditation Program (NLLAP) by the American Association for Laboratory Accreditation (A2LA) or the American Industrial Hygiene Association (AIHA) and must be successfully participating in the Environmental Lead Proficiency Analytical Testing (ELPAT) program to perform lead sample analysis.

f. Closure Report: Upon completion of the lead paint-related work, the Competent Person shall submit a closure report in accordance with 40 CFR 745 Subpart L. Closure report shall include, but not limited to:

(1) Start and completion dates of lead-paint related work

(2) Name and address of each certified firm conducting the lead abatement or lead paint controls and the name of each supervisor

(3) Workers, the public, and the environment protection plan implemented

(4) Name, address, and signature of Competent Person conducting inspections and the date of inspection

(5) Laboratory report, if sampling and analysis is conducted

(6) Detailed written description of the abatement or lead paint controls, including methods used, locations and/or components where work was carried out, reason for selecting particular abatement methods for each component, and any suggested monitoring or control of encapsulants or enclosures.

(7) Waste disposal documents

2. Records

a. Laboratory Analytical Results: Submit a copy of laboratory analytical results, if any, to the Contracting Officer within 12-hours of receipt from the laboratory.

b. Uniform Hazardous Waste Manifest Form: Submit completed waste manifests, as applicable within 10 days of disposal. Before any disposal documentation is drafted, the quantities and types of hazardous waste generated shall be reported to the Contracting Officer

c. EPA Waste Generator Identification Number for the site if hazardous waste is generated.

1.06 PRODUCT HANDLING: Dispose of materials that become contaminated with lead in accordance with applicable regulations.

1.07 REFERENCES

A. The publications listed below form a part of this specification. Publications are referred to in the text by the basic designation only.

1. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z88.2 (1992) Practice for Respiratory Protection

2. CODE OF FEDERAL REGULATIONS (CFR)

a. 29 CFR 1910.134 Safety and Health Standards (Respiratory Protection)

b. 29 CFR 1910.1025 Safety and Health Standards (Lead)

c. 40 CFR 260 Hazardous Waste Management System: General

d. 40 CFR 261 Identification and Listing of Hazardous Waste

e. 40 CFR 262 Standards for Generators of Hazardous Waste

f. 40 CFR 263 Standards for Transport of Hazardous Waste

g. 40 CFR 264 Standard for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

h. 40 CFR 265 Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

3. U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing

4. Hawaii Occupational Safety and Health Division (HIOSH)

HIOSH 12-148.1 Lead in Construction Standards

5. UNDERWRITERS LABORATORIES, INC. (UL)

UL-586 (2004) High-Efficiency, Particulate, Air Filtration Units

1.08 GENERAL REQUIREMENTS

A. Title to Materials: Waste material resulting from this work shall become the property of the Contractor and shall be disposed of as specified herein. In an event hazardous waste is generated, the EPA ID number shall be obtained from the Contracting Officer.

B. Medical Surveillance: Before exposure to lead-containing dust, Contractor shall provide workers with a comprehensive medical examination as required by 29 CFR 1910.1025. Examination is not required if records show the employee has been examined as required by 29 CFR 1910.1025 within the past 12 months. Maintain complete and accurate

records of employees' medical records and certificates of workers' acknowledgement for 50 years.

C. Training: Within 12 months prior to assignment to lead work, each employee shall receive training with regard to the hazards of lead, safety and health precautions, the use and requirements for protective clothing, equipment, and respirators, and the additional requirements of 29 CFR 1910.1025. Furnish each employee with a respirator fit test as required by 29 CFR 1910.1025. Training shall include engineering and other hazard control techniques and procedures.

D. Respiratory Protection Program: Establish and implement a respiratory protection program as required by ANSI A88.2, 29 CFR 1910.134 and 29 CFR 1910.1025.

E. Health and Safety Compliance: In addition to detailed requirements of this Section, comply with laws, ordinances, rules, and regulations of federal, state, and local authorities regarding handling, storing, transporting, and disposing of lead waste materials.

1. Where specification requirements and referenced documents vary, the most stringent requirement shall apply.

2. Submit matters of interpretation of standards and of specification requirements to the Contracting Officer for resolution before bidding.

F. Competent Person: Lead paint related work shall be performed under supervision of the Contractor's Competent Person. Competent Person shall complete the following tasks:

1. Certify employee training in accordance with all federal, state, and local requirements.

2. Review and approve the lead hazard control work plan and ensure applicable standards are met and appropriate engineering and administrative controls are in place.

3. Provide proper and timely (10-day) notification to the Contracting Officer and relevant state agencies prior to the start of work.

4. Conduct regular inspections of work performance for compliance with the approved project work plan and specifications, and prepare a daily log of work performed.

5. Implement engineering controls to prevent lead exposure to the site workers, the public, and the environment.

6. Prepare and submit the Closure Report (Paragraph 1.05A 1 f).

7. Specify the locations, extents, and conditions of lead-containing paint removed or disturbed.

1.09 DEFINITIONS

A. Air Monitoring: Sampling and assessment of lead concentrations at the project area, project vicinity, or workers' breathing zone.

B. Competent Person: Contractor personnel who is capable of identifying existing and suspect lead paint hazards in the work area and project site, selecting the appropriate control strategy for lead exposure, and who has the authority to take prompt corrective measures to manage exposure.

C. Lead: Metallic lead, all inorganic lead compounds, and inorganic lead soaps.

D. Lead Control Area: An area where lead removal operations are completed which is isolated by physical boundaries to prevent unauthorized entry of personnel and to prevent the spread of lead-containing dust, paint chips, or debris.

E. Lead Permissible Exposure Limit (PEL): The limit is 50 micrograms per cubic meter ($\mu g/m^3$) of air as an 8-hour time-weighted average (TWA) as determined by Appendix A of 29 CFR 1910.25.

F. Action Level (AL): The AL for an 8-hour TWA exposure to airborne lead is 30 $\mu g/m^3$.

G. High Efficiency Particulate Air (HEPA) Filter Equipment: HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead-containing dust.

H. Personal Monitoring: Sampling of air for lead concentrations within the breathing zone of an employee to determine the 8-hour TWA in accordance with 29 CFR 1910.1025. The samples shall be representative of the employee's work tasks. The breathing zone is considered the area within 12 inches of the nose or mouth of an employee.

I. Time-Weighted Average (TWA): The TWA is an 8-hour time-weighted average of airborne lead per cubic meter of air, which represents the employee's 8-hour workday as determined by 29 CFR 1910.1025.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PREPARATION PRIOR TO DISTURBANCE OF LEAD-CONTAINING PAINT

A. Document existing paint chips or debris prior to any work (indoors and outdoors), as applicable.

1. If there are any paint chips or debris in the project area, Contractor shall pre-clean prior to disturbing existing LCP.

2. Contractor shall treat paint chips or debris collected during pre-cleaning and during project related activities as lead-containing waste.

B. Minimize lead-containing dust during work performance using wet methods and equipment with HEPA collection devices. If visual inspection, air monitoring, or clearance by the Competent Person or the Contracting Officer indicates that control measures are inadequate, Contractor shall stop work, clean up the affected area, and implement enhanced engineering controls at no additional cost to DHHL.

C. Establish a lead control area. Isolate using 6-mil polyethylene sheeting and protect the portions of the building or area not within the scope of work.

D. Demarcate the exterior lead control area using lead warning tape. Lead warning tape shall be at least 20 feet away from the closest painted surface being disturbed.

1. Contractor shall place 6-mil polyethylene drop sheets around exterior surfaces.

2. Contractor shall secure drop sheets so that wind or other forces will not dislodge the sheets.

3. Drop sheets shall extend horizontally from the base of the building a distance equal to at least one-half the height of the painted surface being disturbed, but at least 6-feet in depth, or as conditions allow.

4. Drop sheets shall be frequently cleaned and kept free of debris. Any water captured by the drop sheet shall be treated as lead-contaminated

E. Pre-work visual inspection: Inspect the immediate project and adjacent areas for the presence of paint chips or debris and document the physical conditions with photographs and narratives. This documentation will serve as baseline conditions to which final visual clearance will be compared.

3.02 ACTIVITIES DISTURBING LEAD-CONTAINING PAINT

A. Complete LCP removal or demolition as required for this project, and minimize lead-containing dust using wet methods and HEPA equipment.

1. If visual inspection indicates control measures are inadequate, Contractor must stop work, notify the Contracting Officer, conduct clean up, and implement enhanced engineering controls immediately, at no additional cost to DHHL.

2. HEPA vacuum shall be maintained for effectiveness.

B. Do not execute dry removal or dry sweeping.

1. Waste or paint debris generated during removal shall be promptly staged or packaged, and shall not be allowed to accumulate uncontrolled at any time.

2. Lead-containing waste shall be properly marked and stored in secure containers appropriate for storing lead-containing waste.

3. Contractor shall not allow lead-containing waste to be (1) stored outside the lead control area, (2) in a high traffic unsecured area, or (3) where the waste could interact with rainfall or wind and create a secondary hazard or contamination.

3.03 LEAD CONCENTRATIONS IN THE WORK AREA

A. The maximum permissible exposure to airborne concentrations of lead within the project area shall be 30 $\mu g/m^3$. Stop work whenever this limit exceeded, and the Competent Person shall remedy the condition prior to commencing work.

B. Instruct and train each worker in proper respiratory use. Require that each worker always wears a respirator, properly fitted on the face, in the work area from the start of any operations which may cause airborne lead-containing dust until the work area passed the clearance. Use respiratory protection appropriate for the lead-containing dust levels encountered in the work place or as required for other toxic or oxygen-deficient situations encountered.

1. Air Purifying Respirators: Provide half-face or full-face type respirators.

2. Filter Cartridges: Provide, at a minimum, HEPA type filters labeled with the National Institute for Occupational Safety and Health (NIOSH) Certification for "Radionuclides, Radon Daughters, Dust, Fumes, Mists including Asbestos-Containing Dusts and Mists" and color coded in accordance with ANSI Z88.2. As needed, a chemical cartridge section may be added.

3. Non-Permitted Respirators: Do not use single use, disposable or quarter-face respirators.

4. Require that respiratory protection be used whenever there is any possibility of LCP disturbance, intentional or accidental.

5. Require that a respirator be worn by anyone in a lead control area at all times when LCP is disturbed.

6. Regardless of Lead-Containing Dust Levels: Require that the minimum level of respiratory protection used be half-face air-purifying respirators with HEPA filters.

C. Fit Testing

1. Initial Fitting: Provide initial fitting of respirators during a respiratory protection course of training. Fit types of respirator to be actually worn by each individual. Allow an individual to use only those respirators for which training and fit testing have been provided.

2. On an-Annual Basis: Check the fit of each worker's respirator by having irritant smoke blown onto the respirator from a smoke tube. Valid fit test certificates shall be included in the Lead Hazard Control Plan.

3. Upon Each Wearing: Require that each time an air-purifying respirator is donned, it will be checked for proper fitting with a positive and negative pressure fit test in accordance with the manufacturer's instructions or ANSI Z88.2 (1992).

D. Type of Respiratory Protection Required

1. Provide respiratory protection as indicated in paragraph below. Higher levels of protection may be provided as desired by the Competent Person or the workers. Where the paragraph below does not apply, determine the proper level of protection by dividing the expected or actual airborne lead-containing dust levels in the work area by the "protection factors" given below.

2. Use the following unless air monitoring results indicate greater protection is necessary. Refer to the Protection Factors table for choice of respirators.

    a. Loose equipment cleaning prior to removal in uncontaminated area: Half-face dual cartridge-type respirator.

    b. Plastic installation which does not disturb LCP: Half-face dual cartridge-type respirator.

    c. Removing or cleaning items or plastic installation when such operation may disturb LCP or dust: Dual Cartridge, Half-face Air Purifying Respirators.

    d. Lead-containing material removal: Dual Cartridge, Half-face Air Purifying Respirators.

    e. Gross cleaning of removal area(s): Dual Cartridge, Half-face Air Purifying Respirators.

    f. Loading and unloading drums on truck (outside work area): Dual Cartridge, Half-face Air Purifying Respirators.

g. Lead-Containing Paint removal: Dual Cartridge, Half-face Air Purifying Respirators.

3.04 PROTECTIVE CLOTHING: Furnish personnel exposed to lead-containing dust with disposable protective whole body clothing, head covering, gloves, and foot coverings. Furnish disposable plastic or rubber gloves to protect hands from lead.

PROTECTION FACTORS

RESPIRATOR TYPE	PROTECTION FACTOR
Air purifying: Negative pressure respirator HEPA filter Half facepiece	Up to 500 $\mu g/m^3$
Powered-air purifying respirator (PAPR): Negative pressure respirator HEPA filter Full facepiece	Up to 2,500 $\mu g/m^3$
PAPR Positive pressure respirator HEPA filter Half or full facepiece or Type C supplied air: Positive pressure respirator Continuous-flow half or full facepiece	Up to 5,000 $\mu g/m^3$

3.05 WARNING SIGNS AND LABELS

A. Provide warning signs at approaches to the lead control areas, if lead-containing paint is disturbed.

B. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area.

C. Provide and affix labels to impermeable bags, lead waste drums, and other containers containing lead materials, scrap, waste, or debris.

D. Signs and labels shall comply with the requirements of 29 CFR 1910.1025.

3.06 TOOLS: Filters on vacuums and exhaust equipment shall be absolute HEPA filters and UL 586 labeled.

3.07 AIR MONITORING

A. Employee Monitoring: Contractor's Competent Person shall monitor employees' exposure to lead in accordance with OSHA requirements. Contractor shall collect air samples from employees' breathing zones during each shift, for the duration of the LCP-disturbing work. Samples shall be collected from at least 25% of workers conducting LCP-disturbing tasks, and not fewer than two workers.

B. Environmental Sampling During Paint Removal Work. A third party Industrial Hygienist retained by DHHL shall conduct area air sampling daily, on each shift in which lead-containing paint removal operations are performed, in areas potentially affected by the removal work. Sufficient area monitoring shall be conducted to ensure unprotected personnel are not exposed at or above the action level, 30 $\mu g/m^3$. If an action level is reached, stop work and correct conditions causing the high levels. Resume only after approval of the Competent Person and the Contracting Officer.

1. For outdoor operations, the Industrial Hygienist shall determine the location and number of samples to be taken.

2. Cost of retesting shall be borne by the Contractor and subtracted from the final payment.

C. Work area and Adjacent Areas: Contractor shall visually inspect the controlled area and outside of the controlled areas. Contractor activities shall not adversely impact the reservoir interior or outdoor air quality and the ground surface at the project site.

3.08 STOP ACTION LEVELS

A. Inside Work Area: Maintain airborne levels in the work area of less than the Stop Action Level given below for the type of respiratory protection in use. If the lead-containing dust levels rise above this figure for any sample taken, revise work procedures to lower ambient dust levels. If lead-containing dust levels for any work shift or 8-hour period exceeds the Stop Action Level, stop all work except corrective actions, and the Competent Person shall notify the Contracting Officer. After correcting the cause of lead-containing dust levels, do not recommence work for 24 hours unless otherwise authorized, in writing, by the Competent Person.

LEAD

STOP ACTION LEVEL (µg/m^3)	RESPIRATOR REQUIRED	PROTECTION FACTOR
50	Half-face APR	10
5,000	PAPR or Type C, Continuous flow	100
50,000	Type C, Pressure demand	1,000

B. If the high lead air concentrations were the result of Contractor's failure of work area isolation measures, initiate the following actions:
   1. Decontaminate the affected area(s).

   2. Require that respiratory protection be worn in affected area until the area is cleared for use by other trades.

   3. Conduct a visual inspection of the work area. Refer to Section 13288 - TESTING/AIR MONITORING for requirements and clearance criteria.

C. If the high reading was the result of other causes, initiate corrective action as determined by the Competent Person.

D. Effect on Contract Sum. Complete corrective work with no change in the Contract Sum if lead-containing dust levels exceeding 30 µg/m^3 were caused by Contractor's activities. Costs involving delay, additional lead air monitoring and quality control, investigation, and reporting shall be borne by the Contractor.

3.09 ANALYTICAL METHODS

A. NIOSH 7082 method shall be used in analyzing air samples. Filters used shall be in accordance with the referenced method.

B. NIOSH 9100 method shall be used in analyzing lead wipe samples.

C. EPA 6010/7471 method shall be used in analyzing soil samples.

3.10 LEAD AIR SAMPLE MEDIA: Air samples will be collected on 37 millimeter (mm) cassettes with 50 mm extension cowl with 0.8 micrometer cellulose ester membrane.

3.11 LABORATORY TESTING

A. Services of a testing laboratory shall be employed by the IH. Lead air sample results shall be made available to the Contracting Officer within 12 hours upon receipt of laboratory analytical results.

B. Contracting Officer will have access to all air monitoring tests and results.

3.12 CLEAN UP

A. Maintain surfaces of the lead control area free of accumulations of paint chips and dust. Contain the lead dust and debris; keep waste from being distributed over the general project area. Do not dry sweep the area. When the paint removal, demolition, renovation, or preparation is completed, clean all visible lead paint contamination by vacuuming with a HEPA vacuum followed by wet mopping and wiping.

B. Contractor shall certify that the work was completed in accordance with 29 CFR 1910.1025 and that there are no visible accumulations of lead-containing paint and dust in the project areas. Competent Person and the IH shall visually inspect and photo-document the affected surfaces for residual lead paint chips and accumulated lead-containing dust after the work is completed. Contractor shall re-clean areas showing lead-containing dust or residual lead paint chips to the Competent Person and IH's satisfaction.

C. Contractor is responsible for the restoration and cleaning of any areas outside the work area impacted by or contaminated by lead-containing dust or debris generated by the Contractor's work, such as removal, handling, or storage of lead-containing waste. Contractor shall perform remedial cleaning and restoration of these areas, if any, at no additional cost to DHHL.

3.13 CLEARANCE

A. Contractor shall visually inspect the affected surfaces for residual lead paint chips and accumulated dust. Before the removal of the lead control area, the Competent Person and the Contracting Officer representative shall jointly inspect the project area.

B. Contractor and the Contracting Officer representative shall visually inspect exterior areas, adjacent to the work area for lead paint chips or debris and ensure zero visible emissions. Soil samples shall be collected by the IH for clearance purposes. Contractor shall restore any areas impacted by lead-containing dust or debris to their original condition or better.

3.14 DISPOSAL

A. Representative sample of the waste generated during the removal work shall be collected and analyzed by an approved and qualified laboratory for Toxicity Characteristic Leaching Procedure (TCLP) analysis. If analytical result indicates the TCLP level is below the EPA guideline or within the landfill acceptance criteria, the waste generated from the project can be disposed of as general construction and demolition (C&D) debris. If the TCLP test fails or the result exceeds the landfill acceptance criteria, the waste shall be treated as hazardous waste and be disposed of in a Resource Conservation Recovery Act (RCRA) permitted landfill. Contractor shall contact the Contracting Officer for EPA ID number. Waste manifest must be signed by the Contracting Officer.

B. Contracting Officer will review for equitable adjustment of contract amount upon evaluation and acceptance of the TCLP results to determine the hazard characteristics. If the waste is determined to be RCRA hazardous waste, the waste shall be disposed of at an off-island EPA-approved facility.

C. Contractor shall submit a copy of the required TCLP analytical results and a completed Hazardous Waste Manifest to the Contracting Officer within 5 business days upon disposal.

3.15 GENERAL

A. Waste is to be hauled by a waste hauler with all required licenses from all state and local authority with jurisdiction.

B. Protect interior of truck or dumpster with Critical and Primary Barriers.

C. Carefully load containerized or bagged waste in fully enclosed dumpsters, trucks or other appropriate vehicles for transport. Exercise care before and during transport, to ensure that no unauthorized persons have access to the material. Vehicles should be placarded with Department of Transportation labels, as appropriate.

D. Do not store containerized or bagged waste outside of the work area. Take containers from the work area directly to a sealed truck or dumpster.

E. Do not transport lead waste materials on open trucks. If waste material is to be transported in drums, label drums with the same warning labels as the bags.

F. Advise the hazardous waste storage facility in advance of transport and of the quantity of material to be delivered.

G. Retain and submit a copy of receipts from waste storage facility or landfill for materials disposed of.

H. After completion of hauling and disposal of each load, submit a copy of waste manifest, chain of custody form (if applicable), and landfill receipt to the Contracting Officer. Final contract payment shall not be made until all documents are submitted.

3.16 MEASUREMENT AND PAYMENT

Measurement and payment for Lead Containing Paint Control Measures shall not be paid for separately, but shall be included in the lump sum payments for Demolish, Remove and Dispose of 0.5 MG Steel Tank and CMU Control Building Expansion.

END OF SECTION

APPENDIX A

HAZARDOUS WASTE DISPOSAL LOG (Sample)

Name of project _____

Street address _____

City, State, Zip code _____

Year 20___	**Description of Hazardous Waste**	**Approximate Weight Kg Pound**	**Special Handling**
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			

_____

By Signature

_____

Print Name

APPENDIX B

PROJECT HAZARDOUS WASTE LOG (Sample)

Project: _____

Job number: _____

Start date: _____ Completion date: _____

General contractor: _____

Address: _____

_____

Telephone/fax no.: _____

Name of superintendent for this project: _____

Name of generator: _____

Address: _____

_____

Telephone/fax no.: _____

Description of hazardous waste: _____

_____

Approximate weight (kg or pounds):

Monthly disposal log:

Month: Weight:

_____

_____

Disposal site: _____

Contractor disposing of hazardous waste: _____

Address: _____

_____

Telephone/fax no.: _____

Disposal contractor is a (check one):

Conditionally Exempt Small Quantity Generator	
Small Generator	
Large Generator	

APPROVAL:

Competent Person: _____

Company: _____

Address: _____

_____

Telephone no. _____

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SECTION 13283

LEAD-BASED PAINT REMOVAL AND DISPOSAL

PART 1 – GENERAL

1.01 DESCRIPTION

This section specifies abatement and disposal of lead-based paint (LBP) and controls needed to limit occupational and environmental exposure to lead hazards.

1.02 RELATED WORK

A. Section 02050 DEMOLITION.

1.03 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. Code of Federal Regulations (CFR):

CFR 29 Part 1910.....Occupational Safety and Health Standards
CFR 29 Part 1926.....Safety and Health Regulations for Construction
CFR 40 Part 148.....Hazardous Waste Injection Restrictions
CFR 40 Part 260.....Hazardous Waste Management System: General
CFR 40 Part 261.....Identification and Listing of Hazardous Waste
CFR 40 Part 262.....Standards Applicable to Generators of Hazardous Waste
CRF 40 Part 263.....Standards Applicable to Transporters of Hazardous Waste
CFR 40 Part 264.....Standards for Owners and Operations of Hazardous Waste Treatment, Storage, and Disposal Facilities
CFR 40 Part 265.....Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
CFR 40 Part 268.....Land Disposal Restrictions
CFR 49 Part 172.....Hazardous Material Table, Special Provisions, Hazardous Material Communications, Emergency Response Information, and Training Requirements
CFR 49 Part 178.....Specifications for Packaging

C. National Fire Protection Association (NFPA):
NFPA 701-2004.....Methods of Fire Test for Flame-Resistant Textiles and Films

D. National Institute for Occupational Safety and Health (NIOSH)
NIOSH OSHA Booklet 3142……...Lead in Construction

E. Underwriters Laboratories (UL)
UL 586-1996 (Rev 2009).....High-Efficiency, Particulate, Air Filter Units

F. American National Standards Institute
Z9.2-2006.....Fundamentals Governing the Design and Operation of Local Exhaust Systems
Z88.6-2006.....Respiratory Protection

1.04 DEFINITIONS

A. Action Level: Employee exposure, without regard to use of respirations, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8-hour period. As used in this section,”30 micrograms per cubic meter of air" refers to the action level.

B. Area Monitoring: Sampling of lead concentrations within the lead control area and inside the physical boundaries which is representative of the airborne lead concentrations which may reach the breathing zone of personnel potentially exposed to lead.

C. Physical Boundary: Area physically roped or partitioned off around an enclosed lead control area to limit unauthorized entry of personnel. As used in this section, "inside boundary" shall mean the same as "outside lead control area."

D. Certified Industrial Hygienist (CIH): As used in this section, refers to an Industrial Hygienist employed by the Contractor and is certified by the American Board of Industrial Hygiene in comprehensive practice.

E. Change Rooms and Shower Facilities: Rooms within the designated physical boundary around the lead control area equipped with separate storage facilities for clean protective work clothing and equipment and for street clothes which prevent cross-contamination.

F. Competent Person: A person capable of identifying lead hazards in the work area and is authorized by the contractor to take corrective action.

G. Decontamination Room: Room for removal of contaminated personal protective equipment (PPE).

H. Eight-Hour Time Weighted Average (TWA): Airborne concentration of lead averaged over an 8-hour workday to which an employee is exposed.

I. High Efficiency Particulate Air (HEPA) Filter Equipment: HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead-contaminated paint dust. A high efficiency particulate filter means 99.97 percent efficient against 0.3 micron size particles.

J. Lead: Metallic lead, inorganic lead compounds, and organic lead soaps. Excluded from this definition are other organic lead compounds.

K. Lead Control Area: An enclosed area or structure with full containment to prevent the spread of lead dust, paint chips, or debris of lead-containing paint removal operations. The lead control area is isolated by physical boundaries to prevent unauthorized entry of personnel.

L. Lead Permissible Exposure Limit (PEL): Fifty micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR 1910.1025. If an employee is exposed for more than 8 hours in a work day, the PEL shall be determined by the following formula. PEL (micrograms/cubic meter of air) = 400/No. of hrs. worked per day.

M. Personnel Monitoring: Sampling of lead concentrations within the breathing zone of an employee to determine the 8-hour time weighted average concentration in accordance with 29 CFR 1910.1025. Samples shall be representative of the employee's work tasks. Breathing zone shall be considered an area within a hemisphere, forward of the shoulders, with a radius of 150 mm to 225 mm (6 to 9 inches) and the center at the nose or mouth of an employee.

1.05 QUALITY ASSURANCE

A. Before exposure to lead-contaminated dust, provide workers with a comprehensive medical examination as required by 29 CFR 1926.62 (I) (1) (i) & (ii). The examination shall not be required if adequate records show that employees have been examined as required by 29 CFR 1926.62(I) without the last year.

B. Medical Records: Maintain complete and accurate medical records of employees in accordance with 29 CFR 1910.20.

C. CIH Responsibilities: The Contractor shall employ a certified Industrial Hygienist who will be responsible for the following:

1. Certify Training.
2. Review and approve lead-containing paint removal plan for conformance to the applicable referenced standards.
3. Inspect lead-containing paint removal work for conformance with the approved plan.
4. Direct monitoring.
5. Ensure work is performed in strict accordance with specifications at all times.
6. Ensure hazardous exposure to personnel and to the environment are adequately controlled at all times.

D. Training: Train each employee performing paint removal, disposal, and air sampling operations prior to the time of initial job assignment, in accordance with 29 CFR 1926.62.

E. Training Certification: Submit certificates signed and dated by the CIH and by each employee stating that the employee has received training.

F. Respiratory Protection Program:

1. Furnish each employee required to wear a negative pressure respirator or other appropriate type with a respirator fit test at the time of initial fitting and at least every 6 months thereafter as required by 29 CFR 1926.62.
2. Establish and implement a respiratory protection program as required by 29 CFR 1910.134, 29 CFR 1910.1025, and 29 CFR 1926.62.

G. Hazard Communication Program: Establish and implement a Hazard Communication Program as required by 29 CFR 1910.1200.

H. Hazardous Waste Management: The Hazardous Waste Management plan shall comply with applicable requirements of Federal, State, and local hazardous waste regulations and address:

1. Identification of hazardous wastes associated with the work.

2. Estimated quantities of wastes to be generated and disposed of.

3. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and a 24-hour point of contact. Furnish two copies of state and local hazardous waste permit applications.

4. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.

5. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.

6. Spill prevention, containment, and cleanup contingency measures to be implemented.

7. Work plan and schedule for waste containment, removal and disposal. Wastes shall be cleaned up and containerized daily.

8. Cost for hazardous waste disposal according to this plan.

I. Safety and Health Compliance:

1. In addition to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of federal, state, and local authorities regarding removing, handling, storing, transporting, and disposing of lead waste materials. Comply with the applicable requirements of the current issue of 29 CFR 1910.1025.

Submit matters regarding interpretation of standards to the Engineer for resolution before starting work.

2. Where specification requirements and the referenced documents vary, the most stringent requirements shall apply.

J. Pre-Construction Conference: Along with the CIH, meet with the Engineer to discuss in detail the lead-containing paint removal work plan, including work procedures and precautions for the work plan.

1.05 SUBMITTALS

A. Submit the following in accordance with Section 01300 SUBMITTAL

B. Manufacturer's Catalog Data:

1. Vacuum filters
2. Respirators

C. Instructions: Paint removal materials. Include applicable material safety data sheets.

D. Statements Certifications and Statements:

1. Qualifications of CIH: Submit name, address, and telephone number of the CIH selected to perform responsibilities in paragraph entitled "CIH Responsibilities." Provide previous experience of the CIH. Submit proper documentation that the Industrial Hygienist is certified by the American Board of Industrial Hygiene in comprehensive practice, including certification number and date of certification/recertification.

2. Testing Laboratory: Submit the name, address, and telephone number of the testing laboratory selected to perform the monitoring, testing, and reporting of airborne concentrations of lead. Provide proper documentation that persons performing the analysis have been judged proficient by successful participation within the last year in the National Institute for Occupational Safety and Health (NIOSH) Proficiency Analytical Testing (PAT) Program. The laboratory shall be accredited by the American Industrial Hygiene Association (AIHA). Provide AIHA documentation along with date of accreditation/reaccreditation.

3. Lead-Containing Paint Removal Plan:

a. Submit a detailed job-specific plan of the work procedures to be used in the removal of lead-containing paint. The plan shall include a sketch showing the location, size, and details of lead control areas, location and details of decontamination rooms, change rooms, shower facilities, and mechanical ventilation system.

b. Include in the plan, eating, drinking, smoking and restroom procedures, interface of trades, sequencing of lead related work, collected wastewater and paint debris disposal plan, air sampling plan, respirators, protective equipment, and a detailed description of the method of containment of the operation to ensure that airborne lead concentrations of 30 micrograms per cubic meter of air are not exceeded outside of the lead control area.

c. Include air sampling, training and strategy, sampling methodology, frequency, duration of sampling, and qualifications of air monitoring personnel in the air sampling portion on the plan.

4. Field Test Reports: Monitoring Results: Submit monitoring results to the Engineer within 3 working days, signed by the testing laboratory employee performing the air monitoring, the employee that analyzed the sample, and the CIH.

5. Records:
   a. Completed and signed hazardous waste manifest from treatment or disposal facility.
   b. Certification of Medical Examinations.
   c. Employee training certification.

PART 2 - PRODUCTS

2.01 PAINT REMOVAL PRODUCTS

Submit applicable Material Safety Data Sheets for paint removal products used in paint removal work. Use the least toxic product, suitable for the job and acceptable to the Industrial Hygienist.

PART 3 - EXECUTION

3.01 PROTECTION

A. Notification: Notify the Engineer 20 days prior to the start of any paint removal work.

B. Lead Control Area Requirements.

1. Establish a lead control area by completely enclosing with containment screens the structure where lead-containing paint removal operations will be performed.

2. Contain removal operations by the use of a negative pressure full containment system with at least one change room and with HEPA filtered exhaust.

C. Protection of Existing Work to Remain: Perform paint removal work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition.

D. Boundary Requirements: Provide physical boundaries around the lead control area by roping off the area [designated on the drawings] or providing curtains, portable partitions or other enclosures to ensure that airborne concentrations of lead will not reach 30 micrograms per cubic meter of air outside of the lead control area.

E. Heating, Ventilating and Air Conditioning (HVAC) Systems: Shut down, lock out, and isolate HVAC systems that supply, exhaust, or pass through the lead control areas. Seal intake and exhaust vents in the lead control area with 6-mil plastic sheet and tape. Seal seams in HVAC components that pass through the lead control area.

F. Change Room and Shower Facilities: Provide clean change rooms and shower facilities within the physical boundary around the designated lead control area in accordance with requirements of 29 CFR 1926.62.

G. Mechanical Ventilation System:

1. Use adequate ventilation to control personnel exposure to lead in accordance with 29 CFR 1926.57.

2. To the extent feasible, use fixed local exhaust ventilation connected to HEPA filters or other collection systems, approved by the industrial hygienist. Local exhaust ventilation systems shall be designed, constructed, installed, and maintained in accordance with ANSI Z9.2.

3. If air from exhaust ventilation is recirculated into the work place, the system shall have a high efficiency filter with reliable back-up filter and controls to monitor the concentration of lead in the return air and to bypass the recirculation system automatically if it fails. Air may be recirculated only where exhaust to the outside is not feasible.

H. Personnel Protection: Personnel shall wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking is not permitted in the lead control area. No one will be permitted in the lead control area unless they have been given appropriate training and protective equipment.

I. Warning Signs: Provide warning signs at approaches to lead control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs shall comply with the requirements of 29 CFR 1926.62.

3.02 WORK PROCEDURES

A. Perform removal of lead-containing paint in accordance with approved lead-containing paint removal plan. Use procedures and equipment required to limit occupational and environmental exposure to lead when lead- containing paint is removed in accordance with 29 CFR 1926.62, except as specified herein. Dispose of removed paint chips and associated waste in compliance with Environmental Protection Agency (EPA), federal, state, and local requirements.

B. Personnel Exiting Procedures:

Whenever personnel exist the lead-controlled area, they shall perform the following procedures and shall not leave the work place wearing any clothing or equipment worn during the work day:

a. Vacuum themselves off.
b. Remove protective clothing in the decontamination room, and place them in an approved impermeable disposal bag.
c. Shower.
d. Change to clean clothes prior to leaving the physical boundary designated around the lead-contaminated job site.

C. Monitoring:

Monitoring of airborne concentrations of lead shall be in accordance with 29 CFR 1910.1025 and as specified herein. Air monitoring, testing, and reporting shall be performed by a CIH or an Industrial Hygiene (IH) Technician who is under the direction of the CIH:

1. The CIH or the IH Technician under the direction of the CIH shall be on the job site directing the monitoring, and inspecting the lead-containing paint removal work to ensure that the requirements of the Contract have been satisfied during the entire lead-containing paint removal operation.

2. Take personal air monitoring samples on employees who are anticipated to have the greatest risk of exposure as determined by the CIH. In addition, take air monitoring samples on at least 25 percent of the work crew or a minimum of two employees, whichever is greater, during each work shift.

3. Submit results of air monitoring samples, signed by the CIH, within 24 hours after the air samples are taken. Notify the Engineer immediately of exposure to lead at or in excess of the action level of 30 micrograms per cubic meter of air outside of the lead control area.

D. Monitoring During Paint Removal Work:

1. Perform personal and area monitoring during the entire paint removal operation. Sufficient area monitoring shall be conducted at the physical boundary to ensure unprotected personnel are not exposed above 30 micrograms per cubic meter of air at all times. If the outside boundary lead levels are at or exceed 30 micrograms per cubic meter of air, work shall be stopped and the CIH shall immediately correct the condition(s) causing the increased levels and notify the Engineer immediately.

2. The CIH shall review the sampling data collected on that day to determine if condition(s) requires any further change in work methods. Removal work shall resume when approval is given by the CIH. The Contractor shall control the lead level outside of the work boundary to less than 30 micrograms per cubic meter of air at all times. As a minimum, conduct area monitoring daily on each shift in which lead paint removal operations are performed in areas immediately adjacent to the lead control area.

3. For outdoor operations, at least one sample on each shift shall be taken on the downwind side of the lead control area. If adjacent areas are contaminated, clean and visually inspect contaminated areas. The CIH shall certify that the area has been cleaned of lead contamination.

3.03 LEAD-CONTAINING PAINT REMOVAL

A. Remove paint within the areas designated on the drawings in order to completely expose the substrate. Take whatever precautions are necessary to minimize damage to the underlying substrate.

B. Mechanical Paint Removal and Blast Cleaning: Perform mechanical paint removal and blast cleaning in lead control areas using negative pressure full containments with HEPA filtered exhaust. Collect paint residue and spent grit (used abrasive) from blasting operations for disposal in accordance with EPA, state and local requirements.

C. Outside Lead Paint Removal: Select removal processes to minimize contamination of work areas with lead-contaminated dust or other lead-contaminated debris/waste. This paint removal process should be described in the lead-containing paint removal plan. Perform manual sanding and scraping to the maximum extent feasible.

3.04 SURFACE PREPARATIONS

Avoid flash rusting or other deterioration of the substrate.

3.05 CLEANUP AND DISPOSAL

A. Cleanup: Maintain surfaces of the lead control area free of accumulations of paint chips and dust. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use compressed air to clean up the area. At the end of each shift and when the paint removal operation has been completed, clean the area of visible lead paint contamination by vacuuming with a HEPA filtered vacuum cleaner and wet mopping the area.

B. Certification: The CIH shall certify in writing that the inside and outside the lead control area air monitoring samples are less than 30 micrograms per cubic meter of air, the respiratory protection for the employees was adequate, the work procedures were performed in accordance with 29 CFR 1926.62, and that there were no visible accumulations of lead-contaminated paint and dust on the worksite. Do not remove the lead control area or roped-off boundary and warning signs prior to the Engineer's receipt of the CIH's certification. Reclean areas showing dust or residual paint chips.

C. Testing of Lead-Containing Paint Residue and Used Abrasive Where indicated or when directed by the Engineer, test lead containing paint residue and used abrasive in accordance with 40 CFR 261 for hazardous waste.

D. Disposal:

1. Collect lead-contaminated waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing, which may produce airborne concentrations of lead particles.

2. Store removed paint, lead-contaminated clothing and equipment, and lead-contaminated dust and cleaning debris into U.S. Department of Transportation (49 CFR 178) approved 55-gallon drums. Properly labels each drum to identify the type of waste (49 CFR 172) and the date lead-contaminated wastes were first put into the drum.

3. Collect lead-contaminated waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing which may produce airborne concentrations of lead particles. Label the containers in accordance with 29 CFR 1926.62. Dispose of lead-contaminated waste material at a state or county approved hazardous waste treatment, storage, or disposal facility.

4. Store waste materials in U.S. Department of Transportation (49 CFR 178) approved 55-gallon drums. Properly label each drum to identify the type of waste (49 CFR 172) and the date the drum was filled. The Engineer or an authorized representative will assign an area for interim storage of waste-containing drums. Do not store hazardous waste drums in interim storage longer than 90 calendar days from the date affixed to each drum.

5. Handle, store, transport, and dispose lead or lead-contaminated waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by 40 CFR 268.

E. Disposal Documentation Submit written evidence that the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead disposal by the state or local regulatory agencies. Submit one copy of the completed manifest, signed and dated by the initial transporter in accordance with 40 CFR 262.

3.06 MEASUREMENT AND PAYMENT

Measurement and payment for Lead Based Paint Removal and Disposal shall not be paid for separately, but shall be included in the lump sum payments for Demolish, Remove and Dispose of 0.5 MG Steel Tank and CMU Control Building Expansion.

END OF SECTION

SECTION 13288

TESTING / AIR MONITORING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section defines the Contractor's responsibility for air monitoring, inspection, and testing while conducting work which disturbs materials that have potential to generate airborne hazards, such as lead-containing paint (LCP).

B. Testing and air monitoring shall be performed for the purpose of:

1. Verifying compliance with the applicable codes, regulations, and laws regarding working with LCP.

2. Ensuring that the legally required documentation is collected.

3. Providing engineering controls during project to prevent exposures.

C. Contractor must implement appropriate engineering controls and safety measures to prevent the site workers, the public, and the environment from exposure to hazardous materials.

D. Costs incurred due to the Contractor's negligence or failure to control hazards shall be borne by the Contractor, including but are not limited to: investigations, medical, legal, regulatory and public relations, cleanup, monitoring, and reporting.

E. An independent industrial hygiene firm retained by The Department of Hawaiian Home Lands (DHHL) will perform project/air monitoring during the Contractor's work which disturbs LCP. The Industrial Hygienist (IH) shall have no affiliation with the Abatement Contractor.

1.02 DEFINITIONS

A. Abatement Contractor: The firm engaged to remove, encapsulate and/or dispose of lead or other waste.

B. Contractor: General Contractor engaged in the miscellaneous repairs and maintenance of the facility.

C. Contracting Officer: The DHHL officer is responsible for ensuring that the work of the Contractor is conducted according to the contract documents and in compliance with applicable laws, regulations, and ordinances.

D. HUD: United States Department of Housing and Urban Development

E. Industrial Hygienist (IH): A qualified industrial hygienist who will direct project/air monitoring. The IH shall be a State of Hawaii certified Lead Risk Assessor or Lead Project Designer and shall have at minimum five years of experience in industrial hygiene and relevant hazard abatement projects.

F. Industrial Hygienist Technician (IHT): A qualified technician who supports the project under the supervision of the IH and executes the daily monitoring of contractor activities. IHT shall have at minimum two years of experience in lead project monitoring under a direct supervision of an IH.

1.03 COORDINATION: The testing/air monitoring requirements included in the scope of work shall be coordinated with Section 13282 – LEAD-CONTAINING PAINT CONTROL MEASURES.

1.04 PRE-CONSTRUCTION MEETING

A. A pre-construction meeting shall be held prior to site work and shall be documented by the Contractor.

B. Attendance: Contractor, Contracting Officer's representative, IH, and Competent Person shall attend.

C. Agenda

1. Review final schedule for project.

2. Review legal requirements and special and sensitive conditions and constraints.

3. Verify compliance with pre-construction requirements, and present a copy of, but are not limited to, all notifications and approved work plan, including worker and supervisor qualifications and medical surveillance documents.

4. Review engineering controls, personal protective equipment, abatement equipment, and hazard control measures.

5. Review work procedures and responsibilities of site personnel.

6. Clarify the scope of work and its impact on other trades, the building users, and the surroundings.

1.05 TESTING/AIR MONITORING/INDUSTRIAL HYGIENE SUPERVISION AND AIR MONITORING

A. Industrial hygiene supervision and air monitoring shall be performed by an independent

IH firm retained by the Contracting Officer. IH firm shall not be affiliated with the Abatement Contractor.

B. The laboratory used for sample analysis shall be proficient in the National Institute for Occupational Safety and Health (NIOSH) Proficiency Analytical Testing (PAT) program and the environmental lead laboratory accreditation program (ELLPAT).

C. Air monitoring and project supervision shall be performed under the direction of an IH. Qualifications and certifications of the IH and IHT shall be submitted to the Contracting Officer for review and approval prior to the beginning of the work. On-site air monitoring and project supervision may be performed by a qualified IHT, provided all activities are performed under the supervision of the IH.

1.06 DESCRIPTION OF WORK: Furnish labor, materials, and equipment necessary to carry out the Contractor's personnel monitoring, record keeping, and proper removal and disposal in compliance with all applicable federal, state and local laws and regulations during the performance of the project.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 DHHL RESPONSIBILITIES

A. Contracting Officer will review the Contractor's Lead Hazard Control Plan. Requirements are included in Section 13282 Part 1.05 A.

B. Contracting Officer will review the Toxicity Characteristic Leaching Procedure (TCLP) results and waste documents. In the event that the waste is determined to be hazardous, the Contracting Officer may consider equitable adjustment to the contract.

3.02 CONTRACTOR RESPONSIBILITIES

A. Contractor is responsible for submitting a complete Lead Hazard Control Plan for review and approval. Refer to Section 13282 LEAD-CONTAINING PAINT CONTROL MEASURES for requirements of the work plan.

B. Contractor is responsible for worker monitoring and necessary records for the Contractor's employees as required by OSHA (29 CFR 1926.58), Hawaii Administrative Rule (12-145), and all other applicable laws.

C. Contractor shall obtain the legally required documentation for air monitoring and respiratory protection program as part of the contract.

D. Costs involving investigations, air monitoring, and testing due to the Contractor's failure to control hazards shall be borne solely by the Contractor, and shall be deducted from the

final contract payment.

E. Additional testing performed by the Contracting Officer shall be accommodated by the Contractor but shall not remove the Contractor's responsibility of monitoring required by law and the contract specifications.

F. For final cleanup and decontamination following gross removal, remove the final polyethylene sheeting but leave the coverings for critical barriers, such as doors, windows, air ducts, etc., until successful clearance is obtained.

G. Lead Clearance: The Contractor's Competent Person and the IH shall conduct a visual inspection. Upon successful visual inspection, the IH retained by the DHHL shall collect and analyze the surface soil for lead.

H. Additional area air monitoring and/or testing necessary as a result of insufficient cleanup efforts by the Contractor will be conducted by the IH. However, the full cost of such additional monitoring, testing, and reporting shall be borne by the Contractor and shall be deducted from the final contract payment.

3.03 MONITORING AND INSPECTIONS BY COMPETENT PERSON

A. Duties of the Competent Person

1. Photographic Record of Project: Record the LCP related work with representative photos. Photos shall become the property of the Contracting Officer and shall be accompanied by a detailed log.

2. Project Log: Maintain daily field reports documenting all key activities during LCP related work, and submit a summary of project activities to the Contracting Officer. Incorporate the daily field reports with other project data into a final closeout report.

3. Visual Inspection of Controlled Areas: Perform regular inspection of controlled areas. Conduct inspections during the actual work performance of the Contractor to document the work practices employed by the Contractor. Verify that scheduled LCP related work is completed, and the area was properly and promptly cleaned.

4. Change Order: If changes are necessary once construction begins, Competent Person shall make a request for change orders pending approval by the Contracting Officer. Per Section 13282 Part 3.16, LCP-related activities and disposal of wastes will not be measured or paid separately, except for the hazardous waste determined by the TCLP testing (13282 Part 3.14B). The TCLP testing shall be included in the base bid.

B. Site Monitoring

1. On-site personnel air monitoring as required by EPA, OSHA, and the project specifications.

2. Monitoring of decontamination procedures at control area entry/exit.

3. Monitoring of controlled area maintenance by visual inspection.

4. Interface with the IH, Contracting Officer, and/or representatives of regulatory agencies.

5. Ensure that proper respiratory protection is utilized by all persons at the project site.

3.04 TESTING/AIR MONITORING

A. IH will have the authority to stop work or to exercise engineering controls during the project.

B. IH may conduct testing and air monitoring at his/her discretion.

3.05 MEASUREMENT AND PAYMENT

Work under this Section shall not be measured or paid for separately but shall be considered incidental to the lump sum price bid for the item of which it is a part in the Bid Schedule.

END OF SECTION

DIVISION 16 - ELECTRICAL

SECTION 16000

ELECTRICAL WORK

PART 1 – GENERAL

1.01 GENERAL CONDITIONS

A. General Conditions and Special Provisions preceding specification shall govern this section.

B. Specification and Drawings are prepared in abbreviated form and includes 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.

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

D. Before bidding, visit project site, carefully review such section of the Specification and all Drawings of this Contract, and obtain and review the standards, specifications and drawings of the local utility companies.

E. Report any error, conflicts or omissions to the Owner's representative (hereafter referred to as Engineer) at least one week 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 Owner to properly complete intent of Specification and Drawings.

1.02 WORK INCLUDED: This section covers the work necessary for the complete power, lighting, and control systems at the Anahola Farm Lots site, including but not limited to the following:

A. Complete electrical service and utility metering equipment.

B. Complete electrical system for emergency generator and automatic transfer switch system.

C. Complete Motor Control Center, consisting of motor controllers, including motor control components and accessories.

D. Complete SCADA cabinet, including remote telemetry unit components and accessories.

E. Complete electrical conduit and wire system for connection to the various pumps, valves, instruments, and controls.

F. Complete well pump control systems.

G. Complete chlorination system power and control circuits.

H. Coordination with utility companies for electric and telephone service.

I. Complete grounding system.

J. Complete interior lighting, general use receptacles and equipment connection systems.

K. Complete metering equipment according to Kauai Island Utility Cooperative requirements.

L. Complete instrumentation circuits for tank level transmitter.

M. Final adjustment and testing of pumps and associated controls.

N. All incidental work where not specifically shown or specified, but is necessary and required to complete the work to an acceptable and operational stage.

1.03 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. For Supervisory and Data Acquisition (SCADA) System, refer to specification section 16100.

B. For Emergency Generator and Accessories, refer to specifications section 16300.

C. Materials Connected But Furnished & Installed Under Other Sections: This list is for the convenience of the Contractor, and materials connected are not necessarily limited by this list.

1. Motors

2. Flow switches

3. Well flow and tank level transmitters

4. Pressure switches

5. Chemical metering pumps

6. Booster pumps

1.04 QUALITY ASSURANCE: Comply with the latest applicable rules, regulations, requirements, and specifications of the following:

Local laws & ordinances
State & Federal laws
National Electrical Code
County of Kauai electrical code
State Fire Marshal
Underwriter's Laboratory
National Electrical Safety Code

Any conflicts that may exist between the above items will be resolved by the Engineer. Wherever the requirements of the Specifications or Drawings exceed those of the items above, the requirements of the Specifications or Drawings shall govern.

A. Prior to start of the rough-in work, verify all dimensions and equipment sizes with the approved shop drawings including 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 Owner and indicated on the “As-built” Drawings.

B. Specifications are accompanied by architectural, civil, mechanical, landscape, and audio-visual 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 Owner, relocate any device, equipment, feeder, or circuit within 10’-0” of the location presently shown without added cost to the Owner.

C. Materials and Equipment: Material and equipment shall conform to requirements of applicable technical specifications 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 duplicated 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.

D. Substitutions:

1. Where items are specified by manufacturer's name or catalog number, substitutions require written permission by the Owner prior to bidding. Brand names, manufacturer's names and catalog numbers indicate the standard of design and quality required. List of substitute materials together with qualifying data shall be submitted for review at least twelve (12) working days before bid date. Failure to submit for review substitute materials prior to bidding shall mean that materials, as specified, will be provided. Substitute materials submitted and rejected shall not be resubmitted in any modified form.

2. Samples of proposed substitute items may be required and shall be submitted by the Contractor at his expense as soon as practicable after they are required.

3. Burden of proof of equality of proposed substitutions will be the responsibility of the contractor. Submittals shall be sufficiently

4. All prospective bidders must submit descriptive information on proposed material for pre-bidding acceptance where an item is detailed but no manufacturer is named.

5. Costs to review any contractor submitted value engineering change proposals shall be paid by Contractor.

1.05 SUBMITTALS:

A. Departures from Drawings: Submit to the Engineer, in writing for review, details of any necessary proposed departures from these Contract Documents, and the reasons therefore, as soon as practicable and within 30 days after the award of the Contract. Make no such departures without the prior written approval of the Engineer.

1. Departures resulting from substitutions of materials of 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 decreased 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 Owner. 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 followed.

Example:

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

2. The General Contractor shall be responsible to coordinate, approve and select systems that do not impose unaccounted for impacts on the electrical works. 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.

B. Pre-bid Equipment & Material Submittals: Manufacturer's trade names and catalog numbers stated herein are intended to indicate the type and quality of equipment or materials desired. Unless substitution is specifically forbidden, proposed alternates may be submitted for approval.

1. Manufacturers not listed require approval fourteen calendar days prior to bid opening. Make requests for approval in writing to the Engineer. Provide sufficient material or data to allow determination of compliance with these Contract Documents. List any proposed deviations from these Contract Documents, including equipment dimensions.

C. Post-Contract Award Equipment & Material Submittals: Within 30 days after the award of the Contract, provide Manufacturer's complete descriptive information for the items of material, equipment, and systems listed hereinafter. Submit all data at one time in ring binder.

1. Provide shop drawings, literature, and requested samples showing item proposed for use, size, dimensions, capacity, special features required, schematic (elementary) control diagrams, equipment schedules, rough-in, etc., as required by the Engineer for complete check and for installation. Use NEMA device designations and symbols for all electric circuit diagrams submitted. Make content of schematic (elementary) connection or interconnection diagrams in accordance with the latest edition of NEMA IC 1.

2. The Contractor shall check submittals for number of copies, adequate identification, correctness, and compliance with Drawings and Specifications, and initial all copies. Revise, change, and/or resubmit all submittal information until acceptable to the Engineer. Obtain Engineer's acceptance, and respective utility company approvals, before commencement of fabrication or installation of any materials or equipment.

3. Review of submittal information by the Engineer shall not relieve the Contractor from responsibility for deviations from Drawings and Specifications, unless he has in writing at time of submission requested and received written approval from the Engineer for specific deviations. Review of submittal information shall not relieve the Contractor from responsibility for errors and omissions in shop drawings or literature.

4. Provide seven copies minimum of submittal information to the Engineer for distribution after review.

5. Furnish submittal information on the following items:

   a. Motor Control Center (MCC) equipment -- outline & schematic (elementary drawings, descriptive information, and component schedule).
   b. MCC -- outline & one-line drawings, descriptive information, and component schedule.
   c. Service equipment and utility metering system
   d. Panelboards
   e. Disconnect switches
   f. Special pull boxes & junction boxes
   g. Lighting fixtures
   h. Electrical equipment enclosure
   i. Security switches
   j. Automatic transfer switch
   k. Transformers

D. Instructions Books: Provide six sets of hard-backed ring binders containing:

1. Operation, maintenance, and renewal parts information for all equipment furnished under this section.

2. Set of complete as-approved information herein required to be submitted for review following contract award.

3. As-built electric circuit and equipment drawings.

4. List of all equipment suppliers or current names, addresses, and telephone numbers of those who should be contacted for service, information, and assistance.

5. Record Drawings marked with red indelible pencil to show all departures from the original Drawings, underground cable, conduit, or duct runs dimensioned from established building lines, and all electrical work revisions.

6. All test results.

7. All material to be clean and filed under dividers with heading in accordance with specification item title.

8. Submit material to Engineer for approval prior to delivery. Make additions or changes as required by the Engineer.

E. Factory Tests and Inspections:

1. The equipment furnished shall be inspected mechanically and electrically, and all manufacturer's 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.

1.06 PRODUCT HANDLING:

A. Provide protection for materials and equipment against loss or damage. Protect everything from the effects of weather. Prior to installation, store items to be installed in indoor locations, items subject to corrosion under damp conditions, and items containing insulation such as transformers, motors, and control, in indoor, heated, dry locations.

B. Following installation, protect materials and equipment from corrosion, physical damage, and the effects of moisture on insulation. Cap conduit runs during construction with manufactured seals. Keep openings in boxes or equipment closed during construction.

C. In the event of damage, immediately make all repairs and replacements necessary at no additional cost to the Owner.

1.07 SITE INSPECTION: Prior to submitting a bid, visit the project, ascertain conditions affecting the proposed work, and make allowance as to the cost thereof.

1.08 RESPONSIBILITY: Be responsible for:

A. Complete systems in accordance with the intent of these Contract Documents.

B. Referring to all of the Drawings and Specifications, and shop drawings for other trades for details of facility equipment and construction which affect the work covered under this section.

C. Coordinating electrical work with Engineer, Kauai Island Utility Cooperative (KIUC), Hawaiian Telcom (HTCO) and work of other trades to avoid conflicts, errors delays, and unnecessary interference with operation of the plant during construction.

D. Checking the approximate locations of light fixtures, electrical outlets, equipment, and other electrical system components shown on plans for conflicts with openings, structural members, and components of other systems and equipment having fixed locations. In the event of conflicts, consult the Engineer. The Engineer's decision shall govern. Make necessary changes at no additional cost to the Owner.

E. Installing materials and equipment in a workmanlike manner.

F. Installing materials and equipment in strict accordance with manufacturer's recommendations, unless otherwise specified or directed by the Engineer.

G. Furnishing and installing all incidental items not specifically shown or specified which are required by good practice to provide the complete systems specified herein.

1.09 INTENT OF DRAWINGS:

A. Drawings are partly diagrammatic and are intended to show circuiting and switching details which shall be exactly as shown.

B. Exact conduit locations are not shown unless so indicated or specifically dimensioned.

C. One-line diagrams are schematic and do not show physical arrangement of equipment.

D. 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 advice the owner who will issue any necessary clarifications within a time period within a time period which does not disrupt the progress of the work.

2. All interpretations 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 Owner, the higher quality of item shall prevail. Owner 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 to the Contractor, shall be immediately brought to the attention of the Owner for a decision before proceeding with the particular work involved. Work carried out disregarding these instructions will be subjected to removal and replacement at the Contractor's expense.

1.10 PERMITS AND INSPECTION:

A. All materials and workmanship are subject to inspection at any time by the Engineer or his representatives. Correct any work or materials not in accordance with these Contract Documents or found to be deficient or defective in a manner satisfactory to the Engineer at no additional cost to the Owner.

B. Obtain and pay for electrical permits and arrange for all necessary electrical inspections by the County and all other agencies having jurisdiction.

1.11 ELECTRICAL AND TELEPHONE SERVICES:

A. Arrange with utility companies and pay for all monthly service charges until final acceptance as made by the Owner. All nonrecurring utility costs shall be paid by the Owner. Contractor shall coordinate for timely installation of electrical and telephone services to the project by KIUC and Hawaiian Telcom.

B. Perform all work to meet the standards and requirements of KIUC and Hawaiian Telcom where such work is under their jurisdiction.

C. Coordinate with KIUC and Hawaiian Telcom to rectify any malfunction in the electrical or telephone services respectively to provide fully operational services to the project.

PART 2 - PRODUCTS

2.01 GENERAL: Unless otherwise indicated, provide all first quality, new materials, free from any defects, in first class condition, and suitable for the space provided. Provide materials approved by UL wherever standards have been established by that agency. Where two or more units of the same class of material or equipment are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer. All electrical equipment enclosures and equipment mounting hardware for outdoor installations shall be Type 316 Stainless Steel, unless otherwise noted.

2.02 STANDARD PRODUCTS: Unless otherwise indicated, provide materials and equipment which are the standard products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturer's latest standard design which conforms to these specifications.

2.03 EQUIPMENT FINISH: Electrical equipment may be installed with manufacturer's standard finish and color, except where specific color, finish, or choice is indicated. If the manufacturer has no standard color, equipment shall be painted ANSI G1, Light Gray.

2.04 CONDUIT: Conduit, Rigid Steel, Zinc-Coated: Rigid steel conduit, including couplings, elbows, and nipples shall be galvanized by hot-dipping, electroplating, sherardizing, or metallizing process, and shall meet the requirements of ANSI C80.1, UL, and the NEC.

A. Conduit, Rigid PVC: Rigid polyvinyl chloride (PVC) conduit shall be Schedule 40 UL listed for concrete encased, direct burial underground, and exposed use. Rigid PVC conduit, including couplings, elbows, and nipples, shall conform with the requirements of the latest edition of NEMA TC-2, NEC, Federal Specification W-C-1094, and shall meet applicable ASTM test requirements for the intended use.

B. Conduit, Flexible: Liquid-tight flexible steel, zinc-coated, jacketed with high density polyethylene and with factory approved fittings. Liquid-tight with factory fittings for wet or moist areas.

C. Conduit Fittings, Metallic: Metallic conduit fittings shall be of the type indicated or required for the anticipated purpose, and shall meet applicable requirements of ANSI C80.4, UL, NEC, and NEMA FB 1.

D. Conduit Fittings, PVC: PVC conduit fittings shall be of the type indicated or required for the anticipated purpose and shall meet the requirements of NEMA TC-3, Federal Specification W-C-1094, UL, and NEC.

2.05 CONDUCTORS:

A. Conductors 600 Volts and Less: Conductors in raceways, ducts, and cables shall be

copper with the type of insulation specified. Conductors, including insulation, cabling, jacket, filler, shielding, covering, and testing, shall meet all applicable requirements of IPCFA S-19-81 and S-61-402, the NEC, and UL. Conductor sizes shall not be less than those shown.

1. Conductors shall be copper No. 12 AWG minimum. Conductors No. 10 and smaller, solid and round **except for control type conductors which shall be stranded**. Conductors No. 8 and larger, 7 or 19 strands, concentric. All conductors No. 6 and smaller shall be NEC type THW insulated. All conductors No. 4 and larger shall be NEC type THWN insulated. Wiring in lighting fixtures shall be NEC Type AF, TF, and TFF insulated. Manufacture and install according to NEC Articles 310 and 402. Wiring for all controls shall be extra flexible machine tool, color coded, THWN, #12 AWG machine wire.

2. All conductors and cables for underground use shall carry the UL labeling "Type USE", and shall have RHW insulation and heavy-duty, black, neoprene sheath meeting the physical requirements and minimum thickness requirements of IPCEA S-19-81.

B. Identification Tags: Each set of cables in handholes and manholes shall be identified by a non-corrosive metal tag. Letters shall be minimum 1/4 inch high identifying the cable as to use and/or voltage. Tags shall be wrapped around the cables and taped. Power tags shall be red.

C. 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.

D. Equipment Grounding Conductors: Conductors for equipment grounding shall be stranded copper. Conductors shall have green Type TW insulation with a minimum thickness of 2/64-inch.

2.06 OUTLETS:

A. Each outlet in the wiring or raceway system shall be provided with an outlet box to suit the conditions encountered and shall be of the same material as the conduit to which it is connected unless otherwise indicated or approved.

B. Boxes shall be gasketed cast metal or stainless steel type having threaded hubs in the following locations:

1. Outdoors, including flush or surface mounting on exterior surface of exterior walls.
2. Exposed on interior walls.

2.07 JUNCTION BOXES: Junction boxes of the required type and size shall be provided where indicated. The junction boxes shall be provided with terminal strips or terminal blocks with a separate connection point for each conductor entering or leaving the box. These terminal strips or blocks shall have a minimum of 25 percent spare terminal points. Weatherproof boxes shall be gasketed Type 316 Stainless Steel type with conduit hubs.

2.08 ENCLOSURES AND CABINETS: Enclosures and cabinets for panelboards, breakers, and switches shall be NEMA type, fabricated from galvanized steel, or as indicated, prime painted and enamel finished according to NEMA specifications. For dry interior locations, enclosures shall be NEMA 1. For areas exposed to the elements, damp and wet locations, enclosures shall be NEMA 4X stainless steel (316) with stainless steel (316) fasteners and hardware. For breakers and switches located in damp, wet or high humidity areas provide NEMA 4X stainless steel (316) enclosures. Field painting shall be as specified hereinafter.

2.09 DEVICES AND COVER PLATES:

A. Plates for interior flush construction shall be smooth reinforced plastic, with suitable hole, and color to match device.

B. Plates for areas exposed to the elements, damp, or wet installations shall be weatherproof with lockable stainless steel (316) covers. Covers shall permit plugs to be connected without compromising the integrity of the protective nature of the cover.

C. Light switch plates for areas exposed to the elements, damp, or wet installations shall be neoprene gasketed cast aluminum, gray powder coat finish, with spring loaded neoprene gasketed flip-open lids.

D. Plates for receptacles on emergency circuits shall be red.

E. Plates for receptacles shall be labeled with the name of the panelboard and circuit number serving the receptacle.

2.10 RECEPTACLES:

A. Single Convenience Receptacle: Receptacle shall be specification grade and rated 20 amperes at 125 volts. Receptacle shall have a grounding pole. Contact arrangement

shall be such that contact is made on two sides of an inserted blade. Base shall be of gray phenolic composition with side-mounted terminals. Receptacles shall be capable of receiving two-wire parallel-blade caps or three pole caps. All receptacles shall be UL listed.

B. Duplex Convenience Receptacles: Each receptacle shall be specification grade and rated 15 amperes at 125 volts. Each receptacle shall have a grounding pole. Contact arrangement shall be such that contact is made on two sides of an inserted blade. Bases shall be of gray phenolic composition with side-mounted terminals. Receptacles shall be capable of receiving two-wire parallel-blade caps or three pole caps. All receptacles shall be UL listed.

C. Weatherproof Receptacles: Each shall consist of a duplex receptacle as specified mounted in a cast metal box with gasketed, weatherproof, cover plate, as indicated on drawings.

D. Special Purpose or Heavy-Duty Receptacles: Special purpose or heavy-duty receptacles shall be of the type and of ratings and number of poles indicated or required for the anticipated purpose. Contact surfaces may be either round or rectangular. All such receptacles shall have the capacity to carry the rated load continuously without damage, shall be UL listed, and shall be furnished with a suitable straight or angle type cord grip cap. Locking facilities, where required, shall be accomplished by the rotation of the cap.

2.11 WALL SWITCHES: Wall switches shall be of the specification grade, totally enclosed, tumbler type. Operating handles shall be of phenolic composition and be gray. Switches shall be rated 20 amperes at 120/277 volts. All switches shall be A-C type, suitable for the control of tungsten filament lamp loads, and approved by UL.

2.12 LAMPS & LIGHTING FIXTURES: Lamps and lighting fixtures of the types and sizes as indicated shall be furnished and installed complete. Lamps shall be of the proper type, wattage, and voltage rating shall be furnished and installed in each fixture. Illustrations and references on the plans are indicative of the general type of fixture desired. Fixtures of similar designs, light distribution, brightness characteristics, finish, and quality will be acceptable if approved by the Engineer prior to bid opening.

2.13 LIGHTING TIME SWITCH: Automatic electric motor driven time switch shall have 2-circuit, simultaneous "on" and separate "off" operations and shall be surface mounted in the a NEMA 1 enclosure or in the motor control center, as indicated.

A. The mechanism shall be readily removable from the enclosure. The timer motor shall be self-starting, heavy-duty with lifetime lubrication for operation on 120 volts, 60 Hertz supply. The contact shall be heavy-duty 40 amperes at 250 volts. Switch shall have an 8-hour minimum spring-driven reserve power supply which shall

automatically rewind upon restoration of the normal power supply. Tork, Sangamo, Paragon, or approved equal.

2.14 PROTECTIVE EQUIPMENT:

A. Panelboard: Copper busses with bolted molded plastic case circuit breaker complement. Assembly shall be mounted in a NEMA 1 surface mount type or mounted in the motor control center, as indicated. Provide circuit directory in metal frame. Manufacture and install according to NEC Articles 240 and 384.

1. Surge Protective Device (SPD)

a. Provide a SPD in panelboards where indicated on the drawings. Each SPD shall be bus connected for parallel operation, rated for 208Y/120V, 3-phase, 4-wire systems; and have a minimum surge rating of 120kA per phase. The SPD shall be designed, manufactured and tested in accordance with the latest applicable UL Listed standards (UL 1449, 3rd Edition), UL 1283 and CSA certified per CSA 22.2. Each SPD shall have an audible alarm with silence switch, an alarm indicator light, and indicator lights for line-to-neutral, line-to-ground, and neutral-to-ground monitoring. Ground per NEC and manufacturer's instructions.

B. Individual circuit breaker shall consist of 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. Breakers shall have 10,000 ampere minimum interrupting capacity unless indicated otherwise.

C. Equipment disconnect switch: Heavy-duty horsepower rated, lever-operated contacts, spring-loaded.

2.15 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.

2.16 MISCELLANEOUS EQUIPMENT: Utility Company Meter Socket shall be in accordance with NEMA, EUSERC, and KIUC standards, enclosed in stainless steel enclosure, raintight construction with gray enamel finish.

2.17 SURGE PROTECTIVE DEVICE (SPD):

A. Main Electrical Service Surge Protective Device (mounted in the Motor Control

Center).

1. General Features:

    a. Peak Surge Current Capacity: 300kA per phase, 150kA per mode.
    b. Suitable for use in ANSI/IEEE Category A, B & C locations.
    c. UL Listings:

        1) UL1449 3rd Edition
        2) cUL
        3) UL 1283

    d. Manufacturer Qualifications: ISO 9110 and ISO 12000 certified manufacturer.

2. Mechanical and Electrical Features:

    a. 200kAIC short circuit rating with 60A RK5 fuse (fuse to be provided).
    b. Input Power Frequency: 47Hz to 420Hz
    c. Operating Temperature: -40^{o} F (-40o C) to +185^{o} F (+85^{o} C)
    d. Response Time: $\leq$ 1 ns.
    e. Mode protected: L-L, L-G.
    f. Each MOV protected from over-current, thermal overload and monitored individually.
    g. Diagnostics: 1 green indicator per phase, normally on. Form C Volt Free (dry) relay contacts, rated 60W or 125VA / 125VAC and 0.5A / 30VDC and 1.0A, internal weatherproof mounting.
    h. Capacitance: up to 15nF per mode.
    i. Surge Life per UL Life Cycle Testing (20kV, 10kA impulse): >20,000 impulses.
    j. S.M.A.R.T. diagnostics: audible alarm, surge counter, phase loss monitoring with reset ability for surge counter.
    k. Integral fused disconnect.
    l. ARM-3 remote alarm module.
    m. ANSI/IEEE C62.41-1991 Measured Limiting Voltage

3. Manufacturer or approved equal: EATON SPD Series.

B. Branch Feeder Circuit Surge Protective Device (mounted in the Motor Control Center or SCADA Cabinet):

1. General Specifications:

a. Provide solid-state surge protection unit.
b. The unit shall be latest UL 1449 listed.
c. Units shall have integral, replaceable fusing per phase, with status indicators (except for pin base mounted 120V surge suppressor, which shall have internal fusing).
d. Unit enclosure shall be resistant to oil, moisture, and dust, and other industrial airborne contaminants.
e. Each unit shall include installation instructions, and be warranted for a minimum of five (5) years.
f. Lead lengths must be supplied by manufacturer, and be no longer than 30 inches.

2. General Construction:

a. Enclosure shall be nonconductive, corrosion resistant, and shall withstand temperatures of -40^{o} to 200^{o} F.
b. Electrical components are manufactured specifically for surge suppression.
c. Units are fast acting externally or internally fused per phase, thereby eliminating code requirement for adding circuit breaker or fused switches at panel.
d. Units shall have blown fuse indicator lights, one for each phase (except for pin base mounted 120V surge suppressor).
e. Units shall use #14 AWG 64 Strand Nickel Cadmium wire, 105^{o}C.

3. General Electrical Characteristics:

a. Response time/component response time shall be sub-nanosecond.
b. Enclosure shall be rated for NEMA 1, 2, 3, 3R, 4, 4X, 12 and 13 (except for pin base mounted 120V surge suppressor, which shall be rated for NEMA 1 only).
c. Frequency range: 50-400Hz
d. EMI-RFI noise attenuation: to 40dB
e. Operating Temperature: -40^{o} to 85^{o}C.
f. Operating Humidity: 1% to 95%
g. Maximum peak transient power line voltage @ 120V - 2.4 megawatts
h. Capacitance: 1 to 1.5 - microfarad per line
i. Rated power dissipation: 1 watt per line
j. Latest U.L. 1449 Listed

4. Specific Technical Specifications:

a. System: 480V, 3 phase, 3 wire (delta).

1) Max. continuous line voltage (RMS): 528
2) Nominal clamping voltage (peak): 558
3) Max. peak current (8 x 20) sum: 90,000
4) Transient energy (joules): 3,50
5) Fuses: 5 Amp, 600V (Buss KTK-5)
6) Manufacturer: MVC Model MV400P or approved equal.

b. System: 120/208V, 3 phase, 4 wire (wye).

1) Max. continuous line voltage (RMS): 130
2) Nominal clamping voltage (peak): 198
3) Max. peak current (8 x 20) sum: 90,000
4) Transient energy (joules): 1345
5) Fuses: 5 Amp, 250V (AGC or equal)
6) Manufacturer: MVC Model MV200 or approved equal.

c. System: 120V, 1 phase, 2 wire.

1) Max. continuous line voltage (RMS): 130
2) Nominal clamping voltage (peak): 180
3) Max. peak current (8 x 20) sum: 6,500
4) Transient energy (joules): 155
5) Fuses: internal
6) Failure indicators
7) Alarm (120V) allows user to be notified, or various other features such as shutdown can be performed.
8) Pin base mounted with eight pin base socket and spring retainer.
9) Manufacturer: MVC Model ICP-110 or approved equal.

2.18 AUTOMATIC TELEPHONE DIALER SYSTEM:

A. Description and Phone Number Dialing: The dialer shall be a solid state component capable of dialing up to 16 telephone numbers, each up to 60 digits in length. Phone numbers and Standard pulse dialing or Touch Tone DTMF dialing are user programmable via the system's keyboard or remotely via Touch Tone telephone. In addition, the dialer shall:

1. Group Alarm Calls - On alarm, system shall selectively call the correct phone number according to the specific alarms(s).
2. Detect Telephone Line Fault and indicate condition with Front Panel LED.
3. Automatically select Tone versus Pulse Dialing.
4. Monitor Call Progress - Detect Busy and Ringing Signals, Abandon Call if Busy, Wait until phone is answered to Annunciate Voice Reports.

5. Provide Numeric Pager Support.
6. Provide PBX Support.

B. Solid State Voice Message Recording & Playback: The unit shall have two different categories of speech message capability, all implemented with permanent non-volatile solid state circuitry with no mechanical mechanisms. The unit shall allow for message recording from a remote telephone as well as from the front panel.

1. User Field Recorded Messages: The user may record and re-record his own voice messages for each input channel for the Station ID.

   a. There shall be no limit on the length of any particular message within the overall available message recording time, which shall vary from 26 to 635 seconds, depending upon the number of input channels selected, and the recording rate used.
   b. The unit shall allow selective recording of both Normal and Alarm advisory messages for each input channel.
   c. The unit shall provide for automatic setting of the optimum speech recording rate for the total set of messages recorder, in order to achieve optimum recording sound quality.
   d. Circuit board switches or jumper straps shall not be an acceptable means of manipulating message length or recording rates.

2. Permanent Resident Non-Recorded Messages: Permanent built-in messages shall be included to support user programming operations, to provide supplemental warning messages such as advising that the alarms have been disabled, and to allow the unit to be fully functional even when the installer has not recorded any messages of his own.

C. Input Monitoring Function: The basic unit shall continuously monitor the presence of AC power and the status of eight (16) contact closure inputs. AC power failure, or violation of the alarm criteria at any input shall cause the unit to go into alarm status and begin dial-outs. The unit shall, upon a single program entry, automatically accept all input states as the normal non-alarm state, eliminating possible confusion about Normal Open versus Normally Closed inputs. Further, as a diagnostic aid, unit shall have the capability of directly announcing the state of any given input as currently "Closed Circuit" or "Open Circuit" without disturbing any message programming. Each input channel shall also be independently programmable, without the need to manipulate circuit board switches or jumpers, to any of the following:

1. Normally Open, Normally Closed, or for No Alarm (Status Only).
2. Run Time Meter - to accumulate and report the number of hours a particular input circuit has been closed. Any channel so configured will never cause an

alarm call, rather, on inquiry will recite its message according to the status of the input and then report the closed circuit time to the tenth of an hour. The input will accumulate and report in tenths of hours up to a total accumulated running time of 99,999.9 hours. The initial value of the Run Time Meter shall be programmable in order to agree with existing electro-mechanical Run Time Meters. Up to a total of 8 Run Time Meters may be programmed.

3. Pulse Totalizer - to count the accumulated number of pulses (momentary contact closures) occurring at the input so programmed. Any input channel may be programmed for a Totalizer Function, up to a maximum of 8. Maximum Input pulse rate is 100 HZ, with a 50% Duty Cycle. The spoken scaled value will not "roll-over" to zero until a value of 4,294,967,294 has been exceeded.

D. Input/Output Expansion Capability: The standard unit shall be modular in design, permitting it, therefore, to accept "plug-in" expansion circuit boards to incorporate any of the following:

1. Contact Closure Expansion Capability to a total of 16, 24, or 32 total dry contact inputs.
2. Analog Input Capability to a total of 1, 4, 8, or 16 total analog inputs.
3. Remote Supervisory Control Outputs to manipulate 4 or 8 output relays.

E. Modbus Communications: The unit shall accept an expansion card which enables it to communicate directly with devices utilizing Modbus RTU Protocol. A unit so configured shall be capable of "reading" and "writing" to 32, 64, or 96 data registers via Touch Tone Telephone. No modem or host computer shall be required. Interface shall consist of a single RS-232 Serial Cable.

F. Printer/Computer Communications: The unit shall be equipped with a centronics parallel printer port, enabling the user to print alarm reports, download programming data, and generate scheduled status reports as required. Alternatively, the unit shall be able to accept an optional modular, plug-in asynchronous communications card to permit any of the following:

1. Local Data Logging - Permits a single dialer to communicate with a local Serial printer to log routine status reports, alarm reports, and programming data.
2. Central Data Logging - Permits one or more dialers to communicate with a single centrally located Serial printer equipped with a suitable modem to log routine status reports, alarm reports, and programming data.
3. Data Acquisition and Control - Permits one or more dialers to communicate with a centrally located Computer/Printer System equipped with a SCADA software package, thereby functioning as a stand alone SCADA system.

G. Alarm and Inquiry Messages: Upon initiating an alarm call, the system is to "speak" only those channels which are currently in "alarm status". Inquiry phone calls can be made directly to the unit at any time, for a complete status report.

H. Acknowledgment: Alarms are acknowledged either by pressing a Touch Tone "9" as the call is being received, or by calling the unit back after having received an alarm call.

I. Nonvolatile Program Memory Retention: User-entered programming and voice messages shall be kept intact, even during power failures or when all power has been removed, for up to ten (10) years. This shall be accomplished through inclusion in the system of a lithium battery separate from the unit's backup rechargeable cell battery.

J. Local and Remote Programming Capabilities: The user may optionally elect to alter the following parameters from their standard normal default values via keyboard entry or remotely from any Touch Tone telephone.

1. Alarm Response Delay: 0.1 to 999.9 seconds, with different delays being assignable to different alarms.
2. Delay Between Alarm Call Outs: 0.1 to 99.9 minutes.
3. Alarm Reset Time: 0.1 to 99 hours, or "No Reset".
4. Incoming Ring Response (Answer) Delay: 1 to Rings.
5. Number of Message Repetitions: 1 to 20 Repetitions.
6. Auto call Test: When enabled, the unit shall place a single round of test calls both at the time this function is enabled, and also at regular subsequent intervals until this function is disabled.
7. Remote System Microphone Activation.
8. Remote Arming and Disarming of System.

K. Phone Line: The dialer is to use a standard "dial-up" telephone line (direct leased line <u>is not</u> required), and is to be F.C.C. approved. Connection to the telephone is through a 4-pin modular jack (RJ 11).

L. Speakerphone: The unit shall be capable of dialing any phone number on command and functioning as a speakerphone.

M. Real Time Clock: The unit shall be equipped with a real time clock thereby making it possible to:

1. Alarm Ready Schedule - The dialer shall be user programmable to follow a specific schedule of operations. This shall include the flexibility to set a weekday, weekend and holiday schedule. With this feature the dialer shall arm and disarm itself according to the schedule programmed.

2. In the event any of the printer configurations outlined in Section 6 are utilized, all alarm reports will be time and date stamped. Routine scheduled status reports can also be programmed.

N. Power/Battery Backup: Normal power shall be 105-135 VAC, 15 watts nominal. The product is to contain its own gel cell rechargeable battery which is automatically kept charged when AC power is present. The system shall operate on battery power for a minimum of 20 continuous hours in the event of AC power failure. A shorter backup time shall not be acceptable. The built-in charger shall be precision voltage controlled, not a "trickle charger", in order to minimize recharge time and to maximize battery life available.

O. Integral Surge Protection: All power, phone line, dry contact, and analog signal inputs shall be protected at the circuit board to IEEE Standard 587, category B (6,000 volts open circuit/3000 amps closed circuit). Gas tubes followed by solid state protectors shall be integral to the circuit board for each line.

P. Technical/Customer Support: All users shall be provided and/or shall have access to the following support resources.

1. Each auto dialer shall be shipped with a CD-ROM which details all features of the product and provides an in-depth step-by-by programming guide. A superficial marketing overview will not be acceptable.
2. Free Live Chat support on RACO's website staffed with trained technicians shall be available during manufacturer's normal working day.
3. Free comprehensive web-based support center with over 550 FAQs shall be available for customers to retrieve copies of all available technical information directly into his own computer. The support center shall have an optimized user interface for smartphones at http://www.racomobilesupport.com, allowing users to quickly navigate to the desired support topics. This service shall be available on a 24 hour basis.
4. A toll free 800 number shall be available during manufacturer's normal working day to permit users to talk directly with technical service personnel and resolve problems not solved by the RACO web-based Support Center.

Q. Warranty: The dialer shall be covered by a FIVE (5) YEAR warranty covering parts and labor performed at the Factory.

R. Additional Features: Sealed Switches, LED Indicators, Alarm Disable Warning, Talkthrough: All keyboard and front panel switches shall be sealed to prevent contamination. Front panel LED's shall indicate: Normal Operation, Program Mode, Call in Progress, Status for each Channel, AC Power present, AC Power failure, and Low, Discharging, or Recharging Battery. On any inquiry telephone call, or On-Site status check, the voice shall provide specific warning if no dial out phone numbers

are entered, or if the unit is in "alarm disabled" mode, or if AC power is off or has been off since last reset. A built-in microphone shall allow anyone at a remote site to listen to Local sounds and to have a two-way conversation with personnel at the dialer.

S. Manufacturer and model shall be RACO Verbatim Modular Series VSS or approved equivalent.

2.19 MOTOR CONTROL CENTER (MCC):

A. The Motor Control Center and SCADA cabinet (hereinafter noted as MCC) shall be manufactured by Square D, General Electric, EATON, Siemens, Allen Bradley, or approved equal.

B. <u>THE ELECTRICAL CONTROL CENTER SHALL BE FACTORY ASSEMBLED, WIRED, AND TESTED</u>.

1. The MCC shall be constructed in accordance with the latest UL 845 standards, with necessary steel plates, angle iron supports and bolts, and shall be of the cubicle type as shown on the drawings. MCC shall be rated NEMA Class II, Type C. All wires shall be identified by wire number wherever terminated with an approved type slip-thru wire marker. (Submit sample for review by the Engineer). The wire number, terminal block number and terminal block arrangement within the MCC shall be indicated on the shop drawings.
2. Terminal blocks shall be control type, one piece, 600 volt, 30 amperes, phenolic marking strip, screw with wire saddle-type clamps on both sides, total number of points as required.
3. Wire markers shall be slip-thru type, white bands with black numbers, compression type of heat shrink, identification numbers to match shop drawings.
4. The SCADA section shall consist of fully enclosed panels as shown on the plans. Four (4) duplex receptacle outlets shall be installed as noted on the plans.
5. Nameplates shall be installed as shown on the drawings.
6. All necessary sides, top, and back sheets and doors for totally enclosing the switching apparatus, and for forming the steel cabinets shall be included as part of the SCADA section.
7. No changes may be made in the overall dimensions of the electrical control and SCADA section without the written approval of the Engineer or Owner.
8. The Contractor shall be responsible for securing all dimensions and hole spacing for mounting the required appurtenances on the SCADA section.
9. The MCC shall be arranged in one and/or two continuous assemblies, as indicated on plans, and shall include, but not be limited to, the following:

a. SCADA Cabinet: For housing SCADA equipment and automatic telephone dialer.
b. Motor Control Center Panels: Number of panels as shown on plans.

10. For housing motor starter, molded case circuit breaker, control circuit relays, wiring, and appurtenances. These compartments shall be fully enclosed and shall have a door in the front on which shall be mounted the following:

    a. Selector Switches
    b. Trouble Reset Push Button
    c. Emergency Stop Button, Pull to Reset
    d. Running Time Meter
    e. Indicating Lights
    f. Test/Normal Switch

11. For flush mounting the digital multi-function power monitor.
12. For mounting circuit breakers and selector switches and lighting panel, as shown on drawings. This compartment shall be fully enclosed with a door in the front of the compartment.
13. For mounting main power breaker. This compartment shall be fully enclosed with a door in front of the compartment.

C. The following is a list of the major component parts of the electrical control center.

1. Solid state reduced-voltage motor controller.

    a. Introduction. This specification describes the performance, functional specifications and fabrication details for a digital reduced voltage, stepless, solid state motor starter that shall provide a selectable voltage ramp, current limit or current ramp (all standard) method of soft starting 3-phase AC induction motors.

        1) The motor starter shall be self-contained and house the solid-state controller, motor overload protection (Class 10 through Class 30 selectable) and a disconnect means as required on the drawings, in one enclosure.

    b. Codes and Standards

        1) Unit(s) must be manufactured to the codes listed below:
            a) National Electrical Code
        2) Unit(s) must be approved and/or certified by, and carry the label(s) of one or more of the following organizations:

a) Underwriters Laboratories (UL), Canada Standards Association (CSA) or cUL is acceptable

3) Units shall be Combination Starters with circuit breakers, shall be UL listed for use in combination with the specific associated circuit breaker, and shall have passed a 3 cycle withstand test per UL standards.

c. Product Features. Solid state reduced voltage motor starters shall be Square D, General Electric, EATON, Siemens, Allen Bradley, or approved equal to meet the requirements of this specification. The starter shall be complete with the following standard features and adjustments.

1) Motor and Load Protection shall be integral to the starter assembly. Motor protection shall be based upon modeling of the thermal characteristics of the motor as programmed by the user and measured by the starter. All current referenced protection features shall be calculated from the motor nameplate FLA, and automatically adjusted for the Service Factor, NEMA Design, Insulation Class, Line Voltage and Line Frequency as entered by the user. All time based protection features shall be based on a Real Time Clock, remaining active through any power loss. Starter shall provide the following functions:

a) Thermal Overload shall be provided by the on-board microprocessor control. Basic protection shall be inverse time-current trip curves as defined by NEMA trip curve Classes. The trip curve classes shall be programmable from between Class 5 and Class 30 and the starter shall be UL listed to provide each individual class. As the most important protection feature of a starter, the overload protection shall be based on a Dynamic Thermal Register retained in memory and provide the following features:

(1) Retentive Thermal Memory shall be used to ensure that the Dynamic Thermal Register does not loose track of motor temperature after the power is lost or shut down. Upon reapplication of power, the microprocessor shall be automatically updated as to the motor temperature and adjusted for real time cooling while the power was off.

(2) Dynamic Reset Capacity shall retain a snapshot of the thermal capacity necessary to

restart the motor. The starter shall determine these requirements by recording and averaging the previous 3 successful start-ups. After an overload trip has occurred the protection shall prevent resetting until enough cooling time has passed and sufficient motor thermal capacity is available.

(3) True Thermal Modeling shall be a feature of the overload and reset calculations. Once established at setup, the Dynamic Thermal Register shall be biased according to the following input information when available: Cold Stall Time, Hot Stall Time, Stopped Cool Down Time, Running Cool Down Time, and all of the real time information from the RTD Option if ordered.

(4) Separate Trip Curves shall be provided for Start and Run, allowing a higher level curve to avoid nuisance tripping during acceleration, but dropping to another level for accurate motor protection while at full speed. To maximize flexibility, each trip curve shall be programmable as follows:

(a) Basic, using the NEMA Class ranges described above.

(b) Locked Rotor programmable between 400 – 800% of FLA, and a trip time from 1 – 30 seconds.

(c) Measured Start Capacity (I*I*T curve area) taken from the previous successful start (only applicable to the Start Curve).

(5) Overload Alarm shall be provided to warn users of an impending overload trip. The Alarm level shall be programmable between 40 – 95% of the Dynamic Thermal Register value. It shall provide an adjustable delay of 1 – 20 seconds.

(6) Manual or Automatic Reset shall be selectable in programming to provide for automatic reset in unattended remote applications.

b) Phase Monitoring shall be standard and based on motor current. In order to protect against disconnected motor leads, this feature will function even if the line

voltage remains normal. All features shall be as follows and capable of being disabled if not needed:

(1) Phase Loss shall shut down the starter if current through any leg drops to 20% of unit FLA or less. This protection shall be implemented by hardware and non-adjustable. It shall provide an adjustable trip delay of 1 – 20 seconds.

(2) Phase Imbalance Protection shall be provided with programmable sensitivity to provide both an Alarm and Trip points. The sensitivity shall be adjustable for phase-to-phase imbalances of between 5% and 30%. Each point shall provide an adjustable delay of 1 – 20 seconds.

(3) Phase Rotation protection shall be self-learning and field programmable. If phase rotation varies from the initial set pattern, the starter shall trip immediately. If phase rotation is correct, the starter can be re-taught to recognize the new rotation.

c) Short Circuit Detection with dual mode protection for starting and running operation shall be standard. This circuit MUST be provided to protect the starter from load failures. This protection shall be implemented by hardware and non-adjustable.

(1) In the starting mode the starter shall employ a ¼ second pre-check routine to determine if the load circuit has a fault condition and disable the ramping prior to reaching the Initial Voltage setting. This is to avoid additional equipment damage after a fault that may have occurred while the starter was off.

(2) In the running mode, this feature will shut down the starter if current through any leg exceeds 10 times unit FLA for 12.5 milliseconds.

d) Over Current Protection shall be provided separate from the above. This Shear Pin trip shall be adjustable at lower levels for the purpose of protecting mechanical components from undue shock when rapid unexpected load changes occur.

(1) Adjustment level shall be from 100% to 300% of the programmed motor FLA.

(2) A time delay of up to 20 seconds shall avoid

nuisance tripping from short duration transients.

e) Under Current Protection shall alarm the starter on an adjustable condition. This Load Loss sensor shall be programmable from 10% to 90% of the programmed motor FLA, and, with a time delay of up to 20 seconds shall avoid nuisance tripping from short duration transients.

f) Ground Fault protection shall be provided to protect the motor from damage using the Residual Current method. An Alarm and 2 trip levels, each adjustable from 5 – 90% shall be available with separate trip times as follows:

(1) ALARM level preset at 5% with a 0.5 – 20 second delay.

(2) LOSET level preset at 7% with a 1 – 20 second delay.

(3) HISET level preset at 10% with an 8 – 250 millisecond delay.

g) Line Frequency Window shall be programmable from a 1 – 6Hz variance from the nominal line frequency as entered by the user. It shall provide an adjustable trip delay of 1 – 20 seconds.

h) Coast Down Lockout shall be provided to prevent restarting of the motor during backspin or other dangerous mechanical conditions after shutting off. The coast down lockout time shall be programmable between 0 and 60 minutes following a Stop command.

i) Starts-per-Hour Lockout shall be provided to prevent damage to the motor from rapid cycling of start commands for any reason. The maximum starts-per-hour shall be programmable between 1 and 10 starts.

(1) Time Between Starts Lockout shall also be programmable to work with the above. A minimum time of between 0 and 60 minutes between start attempts shall prevent restarting too rapidly for the motor and load conditions as determined by the user.

2) Acceleration Control shall be fully adjustable in programming to match any application. As a minimum, starter shall come complete with the following settings:

a) Ramp Type: To ensure maximum flexibility in matching the load conditions in the field, the starter shall provide all of the following methods of closed

loop acceleration ramp control: Voltage Ramp, Voltage Ramp with Current Limit, Current Limit Only (Current Step), Current Ramp (Torque Ramp) or up to 3 Custom Ramp profiles that can be programmed by the user.

b) Starting Torque: Initial torque output shall be programmable as either Current or Voltage output, and adjustable between 0-100% of maximum Locked Rotor Torque (600% current) available from the motor.

c) Maximum Current Limit: To ensure reliability of starting under any circumstance that the motor can function in, Current Limit shall be adjustable between 200 and 600% of the unit rating. This will allow locked rotor current to be delivered to the motor if necessary. Lighter duty starters with lower current limit settings will not be acceptable.

d) Ramp Time: The time between Initial Torque and Full Output shall be adjustable between 1 and 120 seconds.

e) Dual Ramps: To accommodate changing load conditions, the starter shall provide 2 separately adjustable ramp profiles, selectable via a dry contact closure. Each ramp will provide all of the above features.

f) Custom Ramp Curves shall be available that can be configured by the user to match any load or starting condition. Each of the 3 available custom curves can be profiled by entering 8 torque and time points. The starter shall create a smooth acceleration curve from these plotted axis points.

g) Kick Start: To provide for starting difficult loads, the starter shall include a Kick Start feature that will apply a high output for a short time on initial start command. The Kick Start voltage level shall be adjustable from 10 – 100% voltage, for 0.1-2 seconds max.

h) Jog: For checking rotation at start-up or other testing procedures, the starter shall provide a programmable Jog feature, adjustable from 5 – 75% of line voltage.

3) Deceleration Control (Ramp Down) shall be completely independent of any Accel Ramp settings and provide a fully adjustable Decel profile in order to avoid possible motor damage. Pre-programmed “Closed Loop” decel routines that

do not allow contouring to match load conditions are not acceptable.

a) Step Down Voltage: adjustable from 100 to 0% of line voltage, allowing the motor torque to drop off immediately to a level that affects output without waiting for a linear ramp.

b) Deceleration Ramp Time: adjustable from 0 – 30 seconds to allow gentle controlled deceleration in excess of the natural coast-to-stop time of the load.

c) Stop Voltage Level: adjustable from 100 – 0% of line voltage to automatically turn off the starter when the output torque has reached a desired level. Programming shall not allow the Stop level to be set higher than the Step Down Level.

d) Selectable Operation During Overload: to allows the user to decide if the motor shall turn off or continue to Decel when an overload condition is detected.

4) Starter Protection shall be provided to maintain reliability of both the equipment and the circuit components, with the following features:

a) Shorted SCR Detection shall be standard. This function must automatically prevent a "start" sequence when at least one SCR is shorted. A means of having qualified service personnel defeat the lockout of this circuit MUST be provided to allow for "Must Run" situations.

b) Shunt Trip Circuit shall be standard. This feature will instantly energize a dry relay contact that can be wired to a "Shunt Trip" coil of the circuit breaker in order to protect the motor from damage. This protection shall only operate if there is current flowing through any phase of the starter when in the "Off" condition, such as when there are multiple shorted SCRs or a bypass contactor is stuck in the on mode. This feature shall be independent of the above Shorted SCR protection so that it cannot be defeated.

c) Starter Overtemp Trip shall be built-in and protect the SCRs from excessive heat build-up in the enclosure or heat sinks. Thermal sensors on the heat sinks shall be pre-wired to one of the programmable inputs that has been factory preset as the Over Temp input.

5) Inputs shall be provided for the control and option selection of the starter as follows.

a) Digital Inputs All input and control devices shall be

rated for 120VAC control or shall require dry contact closures without the need for external power supplies or interposing relays.

(1) On-Off Control shall be 120VAC to avoid potential problems with voltage drop in long control wire runs. The starter shall provide for 2 wire or 3 wire control schemes. Seal-In relay contact for the 3 wire control scheme shall be internal, dedicated to that use and not counted as an output contact. Terminals shall be provided for use in interlocking with programmable output relays or external devices.

(2) User Inputs: 4 programmable digital inputs shall be provided. Each input shall accept dry contact closures from external user supplied devices, and can be named for display on the DCU when energized. 2 of these inputs shall be preset as Temperature and Dual Ramp Select, but can be changed by the user. Inputs can be programmed as N.O. or N.C., and programmed with a de-bounce timer of 0 – 60 seconds. Each input can be assigned to operate any of the Programmable Outputs.

(3) Analog Input shall be provided for optional Tach Feedback Starting. This input shall accept 4-20ma with adjustable offset and gain.

6) Outputs shall be provided for the following functions in addition to the seal-in relay used in 3 wire control schemes as mentioned above.

a) Digital Outputs shall be four (4) Form "C" contact relay outputs, rated for 240VAC, 5AMPS, 1200VA max., with each relay being programmable for any one of the following functions;

(1) Indicator Relay programmable to change state on any of the following conditions: Run / Stop, Start / End of Decel, Timed Output, At Speed / Stop, At Speed / End of Decel, Dual Ramp Selected, Self Test Fail.

(2) Fault Trip Relay programmable for each of the following fault conditions: Overload, Phase Imbalance / Loss / Reversal, Lock Out Inhibits, External Inputs, Short Circuit, Over Current / Shear Pin, Ground Fault HISET /

LOSET, Over / Under Frequency, I2T Start Curve, Shorted SCR, Shunt Trip, Over Temp, Under Current / Load Loss.

(3) Alarm Relay including the following conditions: Overload Warning, Overcurrent Warning, Ground Fault Warning, Under Current Warning, Imbalance Warning, Thermal Register Warning.

b) Analog Outputs (2) shall be provided and shall be programmable as RMS current or percentage of motor FLA for providing information to external controls.

7) Operator Interface Panel that provides simple to use adjustment and status indication on a dead-front shroud of the starter shall be provided.

a) Adjustments shall be made by keypad with tactile feedback keys for high noise environments. To prevent confusion, no binary coded dipswitches shall be used for programming. Pass code protection shall be available to prevent unauthorized changes to the programming.

b) Alpha-Numeric Display shall be Backlit LCD with 2 lines by 20 characters.

c) Indicators using long life LED devices shall provide additional quick annunciation of Power, Run Alarm and Trip operation, as well as the status of the four output relays.

d) Password Protection shall be provided, allowing 3 levels of access to program information, 2 of these levels requiring separate Passwords.

8) Metering functions shall be provided through the Alpha-Numeric Display for indicating the following:

a) Output Current for each individual phase or average of all 3. Indicating range to be 0.0 – 9999.9 amps.

b) Ground Fault Current

c) Motor Load % of FLA

d) Line Frequency

e) Phase Order

f) Remaining Thermal Capacity to indicate heating effect and cooling rate of the motor. Range shall be 0 – 100% of the remaining capacity and count up towards 100% while cooling.

g) Thermal Capacity to Start indicating the required value that will be added to the thermal register as averaged from the previous 3 successful starts.

h) Average Start Time based on previous 3 successful starts

i) Average Start Current based on previous 3 successful starts

j) I*I*T to Start measured from the previous start.

k) Last Start Time measured from Start Command to At-Speed.

l) Starter Status including Ready, Starting, Running, Last Trip Cause

m) Remaining time for O/L Trip, Thermal Inhibit, Coast Down Lock Out, Time Between Starts and Starts per Hour.

n) Event Recorder (last 60 events) with Phase and GF currents record at each event.

o) Last Trip including Cause, Phase and GF currents, Unbalance %, Hz, Hottest Stator and Non Stator RTD recorded.

p) Statistics, including Elapsed Run Time, Total Trips, Trips on Short Circuit, Start O/L, Run O/L, Frequency, Overcurrent, Stator RTD, Non-Stator RTD, G/F LOSET and HISET, Acceleration Time, Start Under Curve, Start Over Curve, I*I*T Start, Fail Shunt Trip, Phase Loss, Tach Accel, and 4 External Inputs.

q) Learned Start Curve. When enabled, the starter will record a start curve with 100 data points of current and time between Start and At-Speed. This data can be exported via the Comm. Port to be plotted on a graph or spread sheet for baseline measurement and maintenance analysis.

9) Serial Communications shall be built-in as a standard feature without the need for separate modules.

a) Communications protocol shall be RS-232 to a Windows based program for data entry, and / or Modbus RTU protocol via RS485 signals.

b) Units shall be capable of being connected to an intelligent communication device in a network of up to 247 devices with unique addresses.

d. Design Specifications

1) Power Ratings

a) Input: 200 – 600V ±10%, 3 phase 50 / 60Hz (selectable) ± 5Hz. Unit(s) will operate with any incoming phase sequence.

b) Output: Reduced voltage 3 phase AC derived

from phase-angle fired inverse-parallel thyristors, ramped to full voltage.

c) Control Method: To ensure reliable gate firing even in adverse power conditions, firing circuits shall use individual phase transformer coupling method for maximum isolation and rapid rise of firing pulse.

d) Current Rating(s): 39, 48, 62, 78, 92, 120, 150, 180, 220, 288, 360, 414, 475, 550, 718, 862, 1006, 1150, 1200, 1250 Amps (choose size for application).

e) Output Capacity: Heavy Duty, rated as follows. Light duty rated starters are not acceptable. Overload Capacity; 500% of unit rating for 60 seconds, 600% for 30 seconds; minimum 115% of nominal motor FLA continuous.

f) Control Power: 120VAC, 60Hz, 50VA minimum but adequate to operate all associated devices in each starter.

2) SCR Devices

a) PIV Ratings: 1600V or Minimum 2.5 times nominal line voltage on units rated less than 78A.

b) Protection: RC snubber network circuits on each phase assembly. To avoid possible component damage, MOV protective devices shall not be used inside the cabinet with the starter.

c) Efficiency: 99.7% through SCRs, 99.97% when bypass contactor is used.

3) Ambient Conditions

a) Temperature: As a standard of unit design quality, starter shall be documented to show that the open chassis design has been tested for 0 – 50° C (-32 to 122° F) operation, and Overload Capacity shall be rated at this temperature. Enclosed ventilated units are to be designed for standard airflow at 0 – 40° C.

b) Altitude: 3300 ft (1000 m) maximum without derating.

c) Humidity: – 95% RH, non-condensing.

d) Thermal: Heat sink temperature switches designed to trip at 85° C.

4) Electronics

a) Non-Volatile Memory will be used throughout the control and protection systems. To prevent the possibility of loosing protection values, stored programs or statistical data, battery back-up memory systems will not be allowed.

(1) The starter shall store all factory defaults in a preset replaceable EPROM memory chip.

(2) User Programming and statistical data shall be stored in EEPROM memory for ready alteration. Loss of power shall not affect memory status.

(3) For fast updates and operation, running programs shall use DRAM memory. The starter shall store the DRAM memory contents to the EEPROM upon power failure, and restore it upon return to normal.

b) Data Sampling

(1) Critical operating data such as instantaneous current for Short Circuit, Ground Fault and Immediate Overload calculations shall be sampled every 2 milliseconds to prevent lagging operation.

(2) Non-Critical data shall be obtained from a true RMS calculation circuit, and sampled in a 350 millisecond moving window of individual phase currents.

c) Real Time Clock with automatic leap-year updating shall be provided. This clock alone shall use a battery back-up with a Lithium-Ion battery rated for at least 10 years of continuous operation without power applied. The clock shall be capable of being reset in the field after changing the battery.

e. Mechanical Construction

1) Enclosure shall contain the digital solid state controller and disconnect means (optional) as required.

a) NEMA 1 enclosed units shall be ventilated, with fan forced cooling where necessary. Cooling fans shall be impedance protected and ball bearing construction for continuous use.

b) NEMA 4/12 enclosed units rated 150 amps and above shall be supplied with a shunt bypass contactor rated for the motor full load running amps. If specified elsewhere, Bypass Contactor may be rated for Across-the-Line starting

c) Wall mount enclosures shall include mounting feet as necessary to keep exposed heat sinks away from the wall for sufficient airflow (units under 150A only).

d) Free standing enclosures shall include leg stands to allow easy bottom conduit entry unless shown

otherwise on the drawings.

2) Terminations shall be made on factory supplied mechanical lugs of sufficient size to accommodate the required wire for the line and load. Lugs are to be clearly marked as Line (L1, L2, L3) and Load (T1, T2, T3) and with appropriate tightening torque specifications.

f. Quality Requirements

1) All incoming material shall be inspected and/or tested for conformance to quality assurance.

2) Power semiconductors shall be fully tested for proper electrical characteristics (dv/dt, di/dt, etc.).

3) All subassemblies shall be inspected and/or tested for conformance to vendors engineering and quality assurance specifications.

4) Printed circuit boards shall be burned in for a minimum of 48 hours at 60°C.

5) The complete unit shall be functionally tested under load before shipment to assure proper operation per specification. Complete test reports shall be available upon request

g. Documentation. Units shall be shipped with a complete set of documentation to include the following items:

1) Complete schematics and wiring diagrams

2) Enclosure outline drawings

3) System instruction manuals

4) Contactor and disconnect system data, if applicable

5) All drawings shall be done in AutoCAD and shall be available on magnetic medium (i.e., 3.5 inch disks).

h. Spare Parts. A recommended spare parts list, and associated pricing, will be supplied with each different solid state reduced voltage starter. The manufacturer will provide representation and local support to the job site. A list of authorized service centers will also be provided upon request.

i. Start Up, Adjustment and Training

1) Start Up Procedures. All starters will come factory pre-set for general applications so that only minor adjustments are necessary in the field to match specific conditions. Start up procedures shall be intuitive and simple enough so as not to require factory assistance or training. Basic start up shall include entering of motor data and Overload selection. Additional features will only be activated when necessary.

2) Adjustments. To facilitate ease of initial setup, all necessary adjustments shall be capable of being made without the need for pass codes. Pass code use shall be optional at user's discretion. All settings and adjustments shall not require a

battery back-up for retention.

3) Training. All necessary training for operator personnel shall be simple enough to be performed by local factory representatives if desired.

2. Terminal Blocks: Control type, one piece, 600 volt, 30 amperes, phenolic marking strip, screw with wire saddle-type clamps on both sides, total number of points as required, end-to-end mounting as required. General Electric CR151B series or equal.
3. Control Relays: EATON D26 Series Type M or equal. Relays shall be equipped with a neon indicating light mounted on the relay to indicate the state of the magnet coil. Number of contacts and types indicated on the drawings. Furnish with mounting channels. Furnish mounting channels in place for future relays where indicated.
4. Selector Switches: EATON Type 10250T or equal, oiltight, with knob operator and maintained contacts unless otherwise indicated. Operation, contact arrangements, and legend plates as indicated on the drawings.
5. Pushbuttons: EATON Type 10250T or equal, oiltight, with flush button operator, black color unless otherwise indicated. Operation, contact arrangement, and legend plates as indicated on the drawings.
6. Emergency Stop Pushbutton: The emergency stop switch shall be push-pull type complete with Square D Class 9001 switch or approved equal, with maintained contact attachments, and Type TR red mushroom push button unit. The pushbutton shall be labeled "EMERGENCY STOP".
7. Indicating Lights: EATON Type 10250T or equal, oiltight, LED with press-to-test circuit, color and legend plates as indicated on the drawings.
8. Time Delay Relays: EATON Type PN, for pneumatic type, 0-3 minutes adjustable. Agastat Series 7000 for timing ranges longer than 3 minutes. Operation, contacts, and timing ranges as indicate on the drawings.
9. Nameplates: Nameplates shall be 1/8 inch black-white-black laminated plastic plates with identifying nomenclature engraved into plate to expose white Commercial Gothic letters. Nameplates glued to MCC or motor starter enclosure.
10. Control Circuit Sequence Timer:
    a. Shall be as manufactured by the Siemens Energy & Automation, Inc. LOGO! 230RL Series, or approved equal.
    b. The timer control shall be equipped with required circuits to perform the functions as indicated on the plans.
    c. The timer shall operate on 120 volt, 60 cycle power. Time range of the timer shall be adjustable from 0-30 minutes.
11. Running Time Meter: Running time meters shall be conventional 3-1/2-inch square case meters designed for flush mounting. The meter shall display elapsed running time of each motor in hours by 6 digit dials. The meters shall be operable on 120 volt, 60 Hertz power.

12. Cabinets: Cabinets fabricated from galvanized NEC code gage steel with hinged door and latch, finished to match panelboards and with one inch termite treated plywood backing inside.
13. Wireways: Wireways shall be fabricated from NEC code gage steel, square cross-section, galvanized, prime painted and enamel finished. Manufacture and install in accordance with NEC Articles 362 and 374.
14. Three Phase Digital Multi-Function Power Monitor: The three phase digital multifunction power monitor shall measure simultaneously display metered electrical power functions, including: Volts, Amperes, Frequency, KW, KVAR, PF, Total KWH, Total KVARH, and Total Harmonic Distortion. It shall also include digital communications and up to 8 channels of analog outputs.
    a. The meter shall be UL listed and CE marked.
    b. Power meter shall be designed for Multifunction Electrical Measurement on 3 phase power systems. The meter shall perform to spec in harsh electrical applications in high and low voltage power systems.
        1) Meter shall support 3-Element Wye, 2.5 Element Wye, 2 Element Delta, 4 wire Delta systems.
        2) The meter shall accept universal voltage input.
        3) Surge withstand shall conform to IEEE C37.90.1.
        4) The meter shall be user programmable for voltage range to any PT ratio.
        5) Meter shall have a burden of not more than 0.36VA per phase, Max at 600V, 0.014VA at 120 Volts.
        6) The meter shall accept a voltage input range of up to 416 Volts Line to Neutral, and a range of up to 721 Volts Line to Line.
        7) Meter shall accept a current reading of up to 11 Amps continuous.
        8) The meter shall have color-coordinated voltage and current inputs.
        9) The meter shall have a phasor diagram that clearly shows wiring status.
    c. Power Meter shall use a dual input method for current inputs. Method one shall allow the CT to pass directly through the meter without any physical termination on the meter, ensuring the meter cannot be a point of failure on the CT circuit. The second method shall provide additional termination pass-through bars, allowing the CT leads to be terminated on the meter. The meter must support both termination methods.
        1) Fault Current Withstand shall be 100 Amps for 10 seconds, 300 Amps for 3 seconds, and 500 Amps for 1 second.
        2) Meter shall be programmable for current to any CT ratio. DIP

switches or other fixed ratios shall not be acceptable.

3) Meter shall accept burden of 0.005VA per phase, max at 11 amps.
4) Meter shall begin reading at a 5mA pickup current.
5) Pass through wire gauge dimension of 0.177" / 4.5 mm shall be available.
6) All inputs and outputs shall be galvanically isolated to 2500 Volts AC.
7) The meter shall accept current inputs of class 10: (0 to 11) A, 5 Amp Nominal, and class 2 (0 to 2) A, 1A Nominal Secondary.

d. The meter shall have an accuracy of +/- 0.1% or better for volts and amps, and 0.2% for power and energy functions. The meter shall meet the accuracy requirements of IEC687 (Class 0.2%) and ANSI C12.20 (Class 0.2%). The meter shall have a frequency measurement accuracy of not less than 0.001 Hz.
   1) The meter shall provide true RMS measurements of voltage, - phase to neutral and phase-to-phase; and current, per phase and neutral.
   2) The meter shall calculate RMS readings, sampling at over 400 samples per cycle on all channels measured readings continuously with no cycle blind spots.
   3) The meter shall utilize 24 bit Analog to Digital conversion.
   4) The meter shall provide Harmonics %THD (% of total Harmonic Distortion). Harmonic magnitude recording to the 40^{th} order shall be available for voltage and current harmonics.

e. The meter shall provide a simultaneous voltage and current waveform recorder.
   1) The meter shall be capable of recording 512 samples per cycle for a voltage sag or swell or a current fault event.
   2) The meter shall provide pre- and post-event recording capability.
   3) The meter shall have a programmable sampling rate for the waveform recorder.
   4) The meter shall have an advanced DSP design that allows power quality triggers to be based on a 1 cycle updated RMS.
   5) The meter shall allow up to 170 events to be recorded.
   6) The meter shall store waveform data in a first-in, first-out circular buffer to insure that data is always being recorded.

f. The meter shall include a three-line, bright red, 0.56" LED display.
   1) The meter shall fit in both DIN 92mm and ANSI C39.1 round cut-outs.
   2) The meter must display a % of Load Bar on the front panel to

provide an analog feel. The % Load bar shall have not less than 10 segments.

g. The meter shall be available in transducer only version, which shall not include a display.
   1) The meter shall mount directly to a DIN rail and provide RS485 Modbus or DNP 3.0 output.

h. The meter shall be a traceable revenue meter, which shall contain a utility grade test pulse allowing power providers to verify and confirm that the meter is performing to its rated accuracy.

i. Power meter shall include virtual measurement upgrade packs, which shall allow user to upgrade in field without removing installed meter.
   1) The six upgrade packs shall be:
      a) Volts, Amps, kW, kVAR, PF, kVA, Freq., kWh, kVAh, kVARh, and I/O Expansion
      b) Above with 2 Megabytes of memory for Data-logging
      c) Above with Power Quality Harmonics
      d) Above with Limit and Control Functions
      e) Above with 64 samples per cycle Waveform Recorder and 3 Megabytes of memory for Data-logging
      f) Above with 512 samples per cycle Waveform Recorder and 4 Megabytes of memory for Data-logging
   2) The virtual upgrade packs must be able to be implemented without physically removing the installed meter.
   3) Meter shall be a traceable revenue meter, and shall contain a utility grade test pulse allowing power providers to verify and confirm that the meter is performing to its rated accuracy.

j. The meter shall include 2 independent communications ports on the back and face plate, with advanced features.
   1) One port shall provide RS485 communication speaking Modbus ASCII, Modbus RTU, or DNP 3.0 protocol through back plate.
   2) Baud rates shall be from 1200 baud to 57600 baud for the RS485 port.
   3) The meter shall provide an optical IrDA port (through faceplate), as the second communication port, which shall allow the unit to be set up and programmed using a PDA or remote laptop without need for a communication cable.
   4) Meter shall have 8 Bit, No parity.
   5) When Ethernet mode is enabled with the Optional Ethernet card, the meter shall provide an RJ45 Ethernet connection that shall allow the unit to be assigned an IP address and communicate with Modbus protocol over Ethernet TCP/IP.
   6) The meter shall have Pocket PC based software available for

remote programming and integration.

k. The meter shall provide user configured fixed window or rolling window demand. This shall allow the user to set up the particular utility demand profile.
   1) Readings for kW, kVAR, kVA and PF shall be calculated using utility demand features.
   2) All other parameters shall offer max and min capability over the user selectable averaging period.
   3) Voltage shall provide an instantaneous max and min reading displaying the highest surge and lowest sag seen by the meter.
   4) The meter shall provide upgrade rate of 6 cycles for Watts, Var and VA. All other parameters shall be 60 cycles.

l. The meter shall support power supply of 90 to 265 Volts AC and 100 to 370 Volts DC. Universal AC/DC Supply shall be available and shall have burden of less than 11VA. An optional power supply of 18-60 Volts DC shall be available.

m. The meter shall provide Limits Alarms and Control Capability as follows:
   1) Limits can be set for any measured parameter.
   2) Up to 16 limits per parameter can be set.
   3) Limits shall be based on % of Full Scale settings.
   4) Manual Relay Control shall be available through software.
   5) Relay set delays and reset delays shall be available.
   6) Relay control shall be available through DNP over Ethernet with Ethernet Option Card.

n. The meter shall have data-logging capability with the 2, 3, and 4 Megabyte memory upgrade (Upgrade packs 2-6). The meter shall have a real-time clock allows for time stamping of all the data in the meter when log events are created. The meter shall have six logs:
   1) The meter shall have three historical logs for trending profiles. Each log shall be capable of being programmed with up to 64 parameters. The user shall have the ability to allocate memory between the three historical logs in order to increase or decrease the memory allotted to each of the logs.
   2) The meter shall have a log for Limits Alarms. The Limits log shall provide magnitude and duration of an event, time-stamp, and log value. The log must be capable of recording to 2048 events.
   3) The meter shall have a log for System Events. The System Events log shall record the following occurrences with a time-stamp: Demand Resets, Password Requests, System Startup, Energy Resets, Log Resets, Log Reads, Programmable Settings Changes.
   4) The meter shall have a log for I/O changes. The I/O Change

log shall provide a time-stamped record of any Relay Outputs and any Input Status changes. The log must be capable of recording up to 2048 events.

5) The meter with Virtual Upgrade packs 5 and 6 shall have a log which is capable of recording a waveform both when a user-programmed value goes out of limit and when the value returns to within limit.

o. The meter shall have I/O expandability through two Option card slots on the back.

1) The cards shall be capable of being installed in the field, without removing the meter from installation.

2) The meter shall auto-detect the presence of any I/O Option cards.

3) The Optioncard slots shall accept I/O cards in all of the following formats: 100BaseT Ethernet Communication Card; Four channel bi-directional 0-1mA Output Card; Four Channel 4-20mA Output Card; Two Relay Outputs/2 Status Inputs Card; Four Pulse Output/4 Status Inputs Card; Fiber Optic Card; IEC 61850 Protocol Ethernet Network Card.

4) The meter shall be capable of accepting any combination of up to two cards.

a) When two Ethernet cards are installed in the meter, and independent IP address and MAC address shall be assignable to each card.

5) The Ethernet Option Card shall provide the meter with 100BaseT Ethernet functionality. The Ethernet Option card shall:

a) Allow the meter to speak with 12 simultaneous sockets of Modbus TCP, so that multiple requests for data can be received simultaneously.

b) Allow the meter to speak with 5 simultaneous sockets of DNP over TCP/IP so that multiple requests can be handled simultaneously.

c) Process data at not more than 0.6 kbs to 1.5 kbs.

d) Allow auto transmit/receive detection for straight or null RJ45 cables.

e) Provide an embedded Web server that allows access to metered readings through the Internet, using any standard Web browser from a PC, smartphone, or tablet PC.

6) The 1mAO Option Card shall provide the following features:

a) 4-channel, bi-directional from 0-1mA outputs.

b) Assignable to any measured parameter.

c) 0.1% Full Scale accuracy throughout range and load.

d) Maximum load impedance to 10k Ohms, with no accuracy losses.

7) The 20mAO Option Card shall provide the following features:
   a) 4-channel, 4-20mA outputs
   b) Assignable to any measured parameter.
   c) 0.1% of Full Scale accuracy throughout range and load.
   d) Maximum load impedance to 850 Ohms, with no accuracy losses.
   e) Loop powered using up to 24 Volts DC.
8) The Relay Output/Status Input Option Card shall provide the following features:
   a) 2 Relay outputs, 2 Status inputs.
   b) Status Inputs – Wet/Dry Auto detect up to 150 VDC.
   c) Trigger on User Set Limits/Alarms (with Virtual Upgrade pack 4).
   d) Set delays and Reset delays.
9) The Pulse Output/Digital Input Option Card shall provide the following features:
   a) 4 KYZ pulse/4 Status inputs
   b) Programmable to any energy parameter and pulse value.
   c) Programmable to End of Interval Pulse.
   d) Can function for manual relay control and limit based control (with Virtual Upgrade pack 4).
   e) 120mA continuous load current.
   f) DNP input.
10) The Fiber Optic Option Card shall provide the following features:
   a) Built in logic to mimic RS485 half-duplex bus, allowing the user to daisy chain meters for low installation cost
   b) ST Terminated Option.
   c) Versatile Line Terminated Option
   d) Modbus and DNP 3.0 protocols available
11) The IEC 61850 Protocol Ethernet Network Option Card shall provide the following features:
   a) Integrates into any IEC 61850 network.
   b) Provides support for Modbus and IEC 61850 protocols simultaneously.
   c) Configurable for multiple logical nodes.
   d) Provides buffered and unbuffered reporting.
   e) Provides dual Ethernet IEC 61850 Protocol Network

option cards.

f) Is certified by a 3rd party Authorized IEC 61850 Test Laboratory.

g) Is capable of supporting two Ethernet/IP connections with separate IP address, each running IEC 61850 protocol.

p. The meter shall have a standard 4-year warranty.

q. Power meter shall be able to be stored in (-20 to +70) degrees C.

1) Operating temperature shall be (-20 to +70) degrees C.

2) NEMA 12 faceplate rating shall be available for the power meter.

r. Acceptable product is Electro Industries / Gaugetech, Model Shark 200 Meter or approved equivalent.

15. Transistor Sensitive Relay: Resistance sensitive device, plug-in DPDT, EATON or equal.

16. Backspin Sequence Timer:

a. Shall be four circuits, as manufactured by the Siemens Energy & Automation, Inc. LOGO! 230R Series, or approved equal.

b. The timer control shall be equipped with circuits to perform the functions as indicated on plans.

c. Time range of the timer shall be adjustable from 0-30 minutes.

17. Three Phase Electric Motor Protector shall be a SymCom, Inc. Model No. 777 or approved equal.

a. Input Voltage:

1) 200 - 480 VAC, 3 phase (Standard)

b. Frequency: 50 or 60 Hz

c. Motor Full Load amp Range:

1) 2 - 90 Amps, 3ø (Direct)

2) 91 - 800 Amps, 3ø (External CT's)

d. Programmable Operating Points:

1) LV - Low Voltage Threshold: 170V (450V*) - HV Setting

2) HV - High Voltage Threshold: LV Setting - 528V (660V*)

3) VUB - Voltage Unbalance Threshold: 2 - 15% or 999\

4) MULT - # of Loops or CT Ratio (XXX:5): 1 - 10 Loops or 100-800

5) OC - Over Current Threshold: (20 - 100A) / MULT

6) UC - Under Current Threshold: (0, 10 - 98A) / MULT

7) CUB - Current Unbalance Threshold: 2 - 25% or 999 (OFF)

8) TC - Over Current Trip Class: 5, J5, 10, J10, 15, J15, 20, J20, 30, J30

9) RD1 - Rapid Cycle Timer: 2 - 500 Seconds

10) RD2 - Restart Delay After All Faults Except Under Current (Motor Cool Down Timer: 2 - 500 Minutes

11) RD3 - Restart Delay After Under Current (Dry Well Recovery Timer): 2 - 500 Minutes
12) #RU - Number of Restarts After: 0, 1, 2, 3, 4, A (Automatic)
13) ADDR - RS485 Address: A01 - A99
14) #RF - Number of Restarts After All Faults Except Under Current: 0, 1, oc1, 2, oc2, 3, oc3, 4, oc4, A, ocA
15) UCTD - Under Current Trip Delay: 2 - 60 Seconds
16) GF - Ground Fault Current Threshold: (3 - 20A) / MULT or OFF

e. Physical Specifications
1) Low Voltage: 4 seconds
2) Output Contact Rating (Pilot Duty) SPDT: 480 VA @ 240 VAC
3) Transient Protection (Internal): 2500 V for 10 mSeconds

f. Accuracy
1) Voltage: +/- 1%
2) Current: +/- 3% (<100 amps direct)<>
3) Timing: 5% +/- 1 Second

g. Repeatability
1) Voltage: +/- 0.5%
2) Current: +/- 1% (<100 amps direct)<>

h. Temperature Range: 0 - 70 degrees Celsius
i. Dimensions: 3.0" H x 5.1" D x 3.6" W
j. Power Consumption: 10 Watts (Max.)
k. Weight: 1.2 lbs.
l. Motor saver shall be provided with the MODBUS Output monitoring port.

18. Three Phase Electric Motor Protector Remote Manager shall be a SymCom, Inc. Model RM-2000 with an RS485MS-2W serial interface for connection to the SymCom, Inc. Model 777-KW Motor Protector, or approved equal.
a. Control Voltage - 115VAC +/- 10%; 50-60 Hz
b. Transient Protection (Internal) - 2500 V for 10ms
c. Power Consumption - 3 Watts (Maximum)
d. Communication Ports
1) 1 Port for MS777
a) Setup: Even Parity, 1 Stop Bit
b) Baud Rate: 9600
c) Protocol: Modbus RTU
d) Available Addresses: 01
e) Serial Interface: RS485
2) 1 Port for PC, PLC, etc.
a) Setup: None, Odd, or Even
b) Baud Rate Parity Protocol: 1 or 2 Stop Bits
c) Available Addresses: 300 – 28800

d) Serial Interface: Modbus RTU; A01 - A99; RS485

e. Real-time Clock
   1) Y2K: Compliant
   2) Battery Back-up Life: 10 years @ 25 degrees Celsius without external power
   3) Last fault memory: Stores up to 4 faults with time and date stamp, includes voltages and currents at the time of trip

f. Output Relays
   1) (option 1): Consult Factory for Function of Relays
   2) Configuration: Two Independent Electro-Mechanical Form C(SP DT)
   3) Contact Material: Silver/Tin Oxide
   4) Pilot Duty Rating: 240 VA @ 120 VAC
   5) General Purpose Rating: 5 A @ 120 VAC

g. Analog Output (option 2)
   1) Types: 0-20 mA, 4-20 mA, 0-5 VDC, 0-10 VDC (specify with order, for others consult factory)
   2) Output Signal: KW, PF, Amps, or Volts
   3) Maximum Load: (Software Selectable)
      a) 0-20 mA: 500 Ohms max.
      b) 4-20 mA: 500 Ohms max.
      c) 0-10 VDC: 2 kilo Ohms min.
      d) 0-5 VDC: 2 kilo Ohms min.
   4) Accuracy: +/- 1% @ 25 degrees Celsius
   5) Isolation: 1 kVrms

h. Analog/Digital
   1) Inputs (option 3): Consult Factory

i. Physical Specifications: Remote Manager
   1) Certifications
      a) UL: UL 508
      b) cUL: cUL 508
      c) CE: Pending

j. Environment
   1) Class of Protection: NEMA 4x (Pending)
   2) Ambient Operating Temp.: -20 to 70 degrees Celsius
   3) Ambient Storage Temperature: -30 to 70 degrees Celsius
   4) Humidity: Up TO 85%, non-condensing

k. Enclosure
   1) Dimensions: 6.1" L x 6.5" W X 1.1" D
   2) Weight: 1.2 lbs.
   3) Material: Black Polycarbonate

l. Display: Liquid Crystal with extended temp range
   1) Size: 2 rows x 20 characters
   2) Lighting: LED Back-Light

m. Keypad: Eight 0.5" stainless steel dome buttons for tactile feedback
   1) Mechanical Life: 50,000 actuations
   2) Overlay Material: Polyester
   3) UV Exposure without degradation: 2000 Hrs.

n. Terminal: Depluggable terminal block

19. Capacitors and Capacitor Breakers:
   a. The KVAR rating of the capacitor shall be per the motor manufacturer's recommendation and such that the power factor of the individual motor and related control be as near unity as standard size capacitors permit at line voltage and no load conditions. Capacitors shall be designed and manufactured according to NEMA standards, and rated in continuous KVAR, voltage and frequency for operating within the ambient temperature range of -40^{o} to $+46^{o}$C. They shall be subject to all NEMA standard dielectric tests.
   b. They shall be filled with nonflammable high dielectric liquid and be individually fused with current-limiting fuses. Askarel and insulating liquids containing polychlorinated byphenyls (PCB's) shall not be provided. Capacitors shall have high ohmic value discharge resistors connected internally across the terminals of the capacitor units to reduce the residual voltage after the unit has been disconnected from the circuit.
   c. Capacitor circuit breakers shall be thermal-magnetic type and be suitable for capacitor furnished. Breaker rating shall be approximately 150 percent of capacitor rated current.
   d. Capacitor, and capacitor circuit breaker, shall be mounted in the motor control center.

20. Capacitor Isolation Contactor: The capacitor isolation contactor shall be provided to isolate the capacitors from the pump motor feeder circuit during starting of the pump motor. Rating of the isolation contactor shall match or exceed the capacitor circuit breaker rating.

D. Motor Control Center Approval: Prior to installation, the Contractor shall submit to the Engineer for their approval, five copies of the dimensional drawings and connection diagram of the motor control center. The Contractor shall also provide five sets of neatly bound instruction books which fully cover installation, operation and maintenance of the motor control center, including a spare parts list for each component of the control center.

E. Ordering of Motor Control Center: The motor control center shall be ordered and written confirmation submitted to the Engineer within twenty (20) calendar days after all shop drawings and catalog data relating to the motor control center have been approved by the Engineer.

F. Motor Control Center Tests: The motor control center shall be shop tested and checked for proper connections and operating of all component parts before shipment to the job site. A warranty stating that shop test has been satisfactorily conducted shall be furnished to the Engineer prior to delivery of the motor control center at the job site. The Contractor shall be held responsible for all delays caused by faulty operation of the control center due to improper connections or defective parts.

2.20 Automatic Transfer Switch:

A. The switch, number of poles, current rating, frequency, and voltage shall be as required by the contract drawings. The transfer switch shall be furnished without overcurrent protection. The transfer switch shall be rated for continuous duty in a NEMA 1 enclosure with hinged door and locking mechanism for all classes of load. Neutral conductor lugs on the transfer switch shall be furnished when indicated on the drawings. All main and arcing contacts and control elements shall be renewable from the front of the switch without removing the switch from its enclosure and without removing the main power connections. Automatic transfer switches shall have a bypass-isolation switch consisting of a two-way switch that provides manual bypass of the load to either source and permit isolation of the automatic transfer switch from all source and load power conductors. The transfer switch shall be in accordance with the requirements of UL Standard 1008, for emergency system and total system load. Automatic transfer switches shall be manufactured by ASCO or pre-approved equal.

B. The switch shall be electrically operated but mechanically held in both the normal and emergency positions, and shall be double throw and not an assembly of single throw devices, unless these devices are mechanically interlocked securely. An assembly of circuit breakers is not acceptable. The operator shall be momentarily energized from the source to which the load is being transferred. The complete time of transfer shall not exceed 10 cycles on a 60 Hz system or 1/6 second on any system.

C. Relays and control circuits shall be provided to obtain fixed preferential control with the switch connected to the normal source of power under normal conditions. Upon a sustained voltage drop of 30 percent in any phase of the normal power source from rated voltage, and after an adjustable time delay of 0 to 2 minutes, the switch shall close a control circuit to automatically transfer the load to the standby power source, provided the voltage and frequency of that source have attained at least 90 percent of their rated values. Upon return of normal power to within 10 percent of rated voltage on all phases and after a preset time delay, adjustable from 2 to 30 minutes, the switch shall automatically transfer the load to the normal source. The controller's sensing and logic shall be provided by a single built-in microprocessor for maximum reliability, minimum maintenance, and the

ability to communicate serially through an optional serial communication moduel. The following manual control elements and indicators shall be furnished with each transfer switch.

1. A test switch to simulate the failure of the normal power source, and test the operation of the transfer switch to standby power and back to normal power after preset time.

2. A device to allow manual transfer to either switch position in the event of an electrical failure in the control circuits.

3. Two signal lights to indicate the switch position. The lights shall be identified with nameplates, one entitled "Normal Power" (green), the other "Standby Power" (red).

4. Complete logic and circuit diagrams shall be supplied for the transfer switch and its control devices, including any modules or printed circuits.

D. Communications Module – Shall provide remote interface module to support monitoring of vendor's transfer switch and controller. Module shall provide status, analog parameters, event logs, equipment settings and configurations over embedded webpage and open protocol. Features shall include:

1. Modbus TCP/IP, SNMP, HTTP, SMTP open protocols shall be simultaneously supported.

2. Secure access shall be provided by requiring credentials for a minimum of 2 user privilege levels to the web app, monitor (view only), control (view and control) and administrator (view, control and change settings). 128-bit AES encryption standard shall be supported for all means of connectivity.

3. An event log displaying a minimum of 99 events shall be viewable and printable from the embedded webpages and accessible from supported open protocols.

4. Four 100 Mbps Ethernet copper RJ-45 ports, 5 serial ports, termination dip switches and LEDs for diagnostics.

5. DIN rail mountable.

B. A prototype switch of the same design and rating shall have been tested by a recognized independent testing laboratory and have successfully met all the requirements specified herein, in addition to having met all of the requirements of UL Standard 1008 for use in emergency systems as defined in the National Electrical Code, NFPA No. 70. Where such requirements differ from this

specification, the requirements herein shall prevail. The submitted test report shall include data on the following tests: (1) withstand; (2) overload; (3) endurance; and (4) temperature rise. The test shall show that the endurance and overload tests have been conducted at voltages equal to or greater than the voltage of the system on which the switch will be used. The temperature rise and short circuit tests may be conducted at any convenient voltage provided that all relays are energized at rated voltage during the temperature rise test. A cycle of operation shall consist of making and breaking the specified currents through the normal and emergency main contacts. Maintenance, adjustments, or replacement of parts will not be permitted during the series of tests. All tests, except the short circuit test, shall be conducted with the switch fully enclosed. Single pole or single phase test data will not be acceptable. The complete series of tests shall be made on a single automatic transfer switch assembly within a 90 day period. The representative automatic transfer switch assemblies which are subject to this testing will not be acceptable for installation under this contract.

2.21 Dry Type Transformers: Energy efficient type voltage, kVA and %Z ratings as indicated on Drawings, full capacity, constant potential, 3-phase, 3-wire, class 220 degrees C insulation, 80 degree C temperature rise, average sound level not to exceed 55dB, NEMA ST-20, copper windings, (6) 2.5% full capacity taps, (2) full capacity above normal and (4) full capacity below normal. kVA rating noted on drawings.

A. Transformer shall be designed to provide a minimum of 30% lower losses than TP-1 efficiencies under linear load.

B. Efficiencies, no-load losses, load losses and impedance values shall be calculated at temperature reference of 75°C at UPF. No load losses shall be no more than the following:

KVA	**No Load Losses (Watts)**
15 KVA	**70 W**
30 KVA	**90 W**
45 KVA	**130 W**
75 KVA	**160 W**
112.5 KVA	**240 W**
150 KVA	**280 W**
225 KVA	**370 W**
300 KVA	**550 W**
500 KVA	**960 W**

2.22 SERVICE ENTRANCE: Provide a meter base and other materials, as required by the electric utility which will provide service to the facility, for installation of metering equipment and attachment of service conductors.

KVA	Efficiency at 35% load
15 KVA	**97.9%**
30 KVA	**98.3%**
45 KVA	**98.4%**
75 KVA	**98.6%**
112.5 KVA	**98.7%**
150 KVA	**98.8%**
225 KVA	**99.0%**
300 KVA	**99.0%**
500 KVA	**99.1%**

PART 3 - EXECUTION

3.01 GENERAL: Work shall be performed in a workmanlike manner by craftsmen skilled in the particular trade. All work shall present a neat and finished appearance.

3.02 MATERIAL & EQUIPMENT INSTALLATION: Follow manufacturer's installation instructions explicitly unless otherwise indicated. Follow Engineer's decision, at no additional cost to the Owner, wherever any conflict arises between manufacturer's instructions, codes and regulations, and these Contract Documents. Keep copy of manufacturer's installation instructions on the job site available for review at all times.

3.03 CUTTING & PATCHING: Lay out work carefully in advance. Do not cut or notch any structural member or building surface without specific approval of the Engineer. Carefully carry out any cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, paving, or other surfaces required for the installation, support, or anchorage of conduit, raceways, or other electrical materials and equipment. Following such work, restore surfaces neatly to original condition using skilled craftsmen of the trades involved at no additional cost to the Owner.

3.04 LOAD BALANCE: Balance electrical load between phases as nearly as possible on panelboards, motor control centers, etc.

3.05 MOTOR ROTATION: After final service connections are made, check and correct, if necessary, the rotation of all motors. Coordinate all such task with the pump contractor.

3.06 CLEANING & TOUCH-UP PAINTING: Keep the premises free of accumulation of waste material or rubbish. Upon completion of work, remove materials, scraps, and debris from premises and from interior and exterior of all devices and equipment. Touch-up scratches, scrapes, or chips in interior and exterior surfaces of devices and equipment with finishes matching as nearly as possible the type, color, consistency, and type of surface of the original finish.

3.07 WIRING METHODS: Generally, and unless otherwise specified or indicated, wiring shall consist of insulated conductors installed in raceways of types indicated.

3.08 CONDUIT: Minimum size conduit shall be one-half inch, unless otherwise indicated. Use the following types of conduit for the locations listed:

A. Exterior, Exposed:

1. Rigid steel, galvanized.

B. Exterior, Underground:

1. Direct buried: Rigid PVC Schedule 80 heavy wall conduit.
2. Concrete encased: Rigid PVC Schedule 40 heavy wall conduit.

C. Interior, Concealed:

1. Rigid steel, galvanized.

D. Interior, Exposed:

1. Rigid steel, galvanized.

3.09 INSTALLATION

A. CONDUIT

1. Conduit system installations shall meet or exceed the requirements of the NEC. Raceways shall be concealed or exposed as indicated, and shall be at least six inches away from parallel runs of flues and steam or hot water pipes. Group raceways in same area together. Raceways shall be supported at intervals required by the NEC, and shall have exposed runs installed parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Avoid field-made bends and offsets where possible, but where necessary, make them with an approved hickey or conduit bending machine. Heating of conduit to facilitate bending will not be acceptable. Changes in direction of runs shall be made with symmetrical bends or cast metal fittings. Do not install crushed or deformed raceways. Avoid trapped raceways where possible. Take care to prevent the lodgment of plaster, dirt, or trash in raceways, boxes, fittings, and equipment during the course of construction. Raceways shall be entirely free of obstructions or shall be replaced. All conduit shall be reamed, burrs removed, and cleaned for proper introduction of wires and cables. Immediately after installation, plug or cap all conduit ends with watertight and dust-tight conduit seals until the time for pulling wires.

2. Install insulated grounding bushings on the ends of all rigid conduits, except where conduits terminate in threaded hubs on cast boxes or cabinets, in which case insert manufacturer's standard insulating sleeves. Provide suitable expansion fittings for raceways crossing expansion joints in concrete slabs, or provide other suitable means to compensate for the building expansion and contraction. Wooden plugs inserted in concrete or masonry are not acceptable as a base for raceway fastenings, nor shall raceways or pipe straps be welded to steel structures. Support multiple raceways adjacent to each other by ceiling trapeze. Support individual raceways by wall brackets, strap hangers, or ceiling trapeze, fastened by wood screw on wood, toggle bolts on

hollow masonry units, expansion shields on concrete or brick, and machine screws or welded threaded studs on steel work. Threaded studs driven in by a powder charge and provided with lock washers and nuts are acceptable in lieu of expansion shields.

3. PVC conduit installed underground shall have a minimum cover of two feet. Use rigid steel, factory-made ells for all bends 30 degrees or larger. Provide expansion joints as required or as recommended by the manufacturer. When joining PVC to conduit to metallic fittings, use approved PVC terminal adapter. When joining PVC conduit to rigid steel conduit, use an approved PVC female adapter. All PVC conduit joints shall be solvent welded with solvent recommended by the conduit manufacturer.

4. Separate parallel runs of two or more conduits in a single trench with spacers designed for the purpose. Install spacers at intervals not greater than that specified in the NEC for support of the type conduit used. Support conduits installed in fill areas suitably to prevent accidental bending until backfilling is complete.

5. Do not backfill underground conduit until it has been inspected and approved by the Engineer or his representative.

6. Final connection to motors, wall or ceiling mounted fans, dry transformers, and to other equipment where flexible connection is desired or required to minimize vibration shall be made with 18-inch minimum lengths of liquid-tight, polyvinyl chloride jacketed, flexible steel conduit where the required conduit size is three inches or less. Where the required conduit size is greater than three inches, rigid steel conduit shall be continued to the motor terminal box.

7. Pullstrings shall be placed in all empty conduits ten feet in length or longer.

B. CONDUCTORS: Conductors 600 Volts & Below: All wire shall be continuous from outlet to outlet. Splices, where required, may be made in outlet and pull boxes only. Use wire connectors of insulating material or solderless pressure connectors properly taped for all splices. Soldered mechanical joints insulated with tape will not be acceptable. Vinyl plastic tape of suitable quality is acceptable in lieu of rubber and friction tapes. Conductor sizes shall not be less than those shown. Conductors shall not be smaller than No. 12 AWG for lighting or power circuits, or No. 14 AWG for control circuits, unless otherwise indicated.

Arrange wiring in cabinets, panels and motor control centers neatly cut to proper lengths, and remove surplus wire. Apply Stak-On or similar terminals to control wiring for connection to terminals, and bridle and secure in an approved manner.

List all circuits emanating from power, distribution, and lighting panelboards by function on the directory card. Identify all circuits entering motor control centers or other control cabinets by directory card listing terminal block number and function or by means of tags securely fastened to the conductors

C. OUTLETS: Provide each outlet in the wiring or raceway systems with an outlet box to suit the conditions encountered. Each box shall have sufficient volume to accommodate the number of conductors entering the box in accordance with the requirements of the NEC. Provide flush or recessed fixtures with separate junction boxes when required by the fixture terminal temperature requirements. Set boxes installed in concealed locations flush with the finished surfaces and provide with proper type extension rings or plaster covers where required. Install boxes in a rigid and satisfactory manner and support independently of conduit by bar hangers in frame construction or fasten directly with wood screws on wood, bolts and expansion shields on concrete or brick, toggle bolts on hollow masonry units, and machine screws or welded threaded studs on steelwork. Threaded studs driven in by a power charge and provided with lock washers and nuts are acceptable in lieu of expansion shields. Where boxes are concealed in walls, if not embedded in concrete, the hole shall be no larger than required to receive the box. Locations of outlets indicated are approximate. Study the building plans in relation to the spaces and equipment surrounding each outlet, so that the lighting fixtures are symmetrically located according to the room layout. When necessary, with the approval of the Engineer, relocate outlets to avoid interference with the mechanical equipment or structural features.

D. PULL BOXES: Construct pull boxes, where specified or required, of code-gauge galvanized sheet metal of not less than the minimum size required by the NEC. Pull boxes for exterior use shall be cast metal or stainless steel, as indicated. Furnish boxes with screw-fastened covers. Where several feeders pass through a common pull box, tag the feeders to indicate clearly their electrical characteristics, circuit number, and panel designation. All boxes shall be readily accessible and shall not be installed in finished areas unless approved by the Engineer. Provide pull boxes not more than 150 feet apart in long runs.

E. RECEPTACLES & WALL SWITCHES: Equipment shall be located at the following height above the floor, unless otherwise indicated:

1. Outdoor convenience receptacles, as shown.

2. Indoor convenience receptacles, 18 inches above floor.

3. Wall switches, 48 inches above floor.

4. Special receptacles, as shown.

F. DEVICE PLATES: Install plates with all four edges in continuous contact with the finished wall surfaces without the use of mats or similar devices. Plaster fillings will not be permitted. Install plates vertically and with an alignment tolerance of 1/16-inch. Do not use sectional type device plates.

G. LIGHTING FIXTURES: Install lighting fixtures at the height and in the manner indicated. Provide accessories, such as straps, mounting plates, nipples, or brackets, for proper installation. Provide suspended incandescent fixtures with swivel hangers to insure a plumb installation. Single-unit fluorescent fixtures shall have twin stem hangers. Suspended multiple-unit or continuous-row fluorescent units shall have a tubing or stem for wiring at one point and tubing or rod suspension provided for each unit length of chassis. Rods shall be of not less than 1/4-inch diameter and shall have a finish to match the fixture.

H. MCC: Install equipment in strict accordance with approved drawings and manufacturer's recommendations. Secure MCC, and other free-standing motor control rigidly to floors or mounting pads with anchor bolts, Phillips Drill Company concrete anchors, or other approved means. Grout mounting channels provided with motor control into the floor or mounting pads, unless the control is firmly anchored with the specified concrete anchors, in which case the channels may be removed.

1. Concrete Pad: Concrete pad shall be constructed as indicated. Tops of concrete pads shall be level and shall project 3-1/2 inches above finished floor. Conduits for secondary and grounding conductors shall be set in place prior to pouring of concrete pad.

I. GROUNDING: Except where specifically indicated otherwise, ground all exposed noncurrent-carrying metallic parts of electrical equipment, raceway systems, and the neutral of all wiring systems in strict accordance with the NEC, State, and other applicable laws and regulations. Where ground rods are indicated or used, they shall be of copper-clad, not less than 3/4-inch diameter, ten feet long, driven full length into the earth. Special requirements shall be as shown and as specified herein.

1. Grounding Circuits Above 150 Volts to Ground: Ground all enclosing cases and mounting frames of all switches. Control panels, motors, junction boxes, and other electrical or electrically operated equipment with a separate grounding conductor from the source of supply. Run the grounding conductor inside the conduit enclosing the power conductors supplying the equipment. Supply all metallic conduits with grounding bushings and connect at each end to the grounding conductor.

a. Make the ground conductor connections to motors ten HP and above or circuits 20 amperes and above by solderless terminal and a 5/16-

inch minimum bolt tapped to the motor frame or equipment housing. Ground connections to smaller motors or equipment may be made by fastening the terminal to a connection box. Connect junction boxes to the equipment grounding system with grounding clips mounted directly on the box or with 3/8-inch machine screws.

2. Grounding Circuits Below 150 Volts to Ground: Ground circuits protected at 60 amperes or more, or serving motors larger than five HP in accordance with the provisions for "Grounding Circuits Above 150 Volts to Ground". On smaller circuits, the metallic conduit system may serve as the equipment ground where allowed by the NEC.

3. Grounding Connections: Make all buried grounding connections by brazing or cadweld type joint. Make all other grounding connections by brazing, cadweld, or with approved pressure terminals.

4. Overload Protective Devices: The Contractor shall compile, by visual inspection of equipment installed for each motor, the following data in neatly tabulated form:

   a. Equipment drive.
   b. Nameplate amperes.
   c. Service factor.
   d. Overload catalog number.
   e. Overload current range and setting.

   A typed copy of this information shall be filed with the Engineer prior to the start-up of any equipment.

3.10 TESTS: After completion of all wiring, insulating resistance testing of all power and control circuits shall be performed with a 500-volt megger. The test on each circuit shall be performed for one minute in the presence of the Engineer or his representative, and a written test report of the results shall be submitted to the Engineer before acceptance can be obtained. Equipment which may be damaged during this test should be disconnected. The tests shall be performed with all other equipment connected to the circuit. After the electrical system installation is completed, and at such time as the Engineer may direct, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements of these specifications. The test shall be performed in the presence of the Engineer or his authorized representative. The Contractor shall furnish all instruments, electric power and personnel required for the tests.

A. MCC: The MCC shall be shop tested and checked for proper connections and operating of all component parts before shipment to the job site. A warranty stating that shop test has been satisfactorily conducted shall be furnished to the Engineer

prior to delivery of the MCC at the job site. The Contractor shall be held responsible for all delays caused by faulty operation of the control center due to improper connections or defective parts.

3.11 MCC Operational and Maintenance Training: The Contractor shall include two days of operational and maintenance training time in the bid. The training shall be conducted at the site, unless otherwise requested by the Owner or Engineer.

3.12 GUARANTEE: The complete electrical system, equipment, materials, and associated items shall be guaranteed against defective parts and operation due to faulty material or workmanship during the period of one year following acceptance and final payment by the Engineer. The Contractor shall make all repairs or replacements necessary to accomplish the required performance within the time specified by the Engineer and agreed to by the Contractor.

3.13 MEASUREMENT AND PAYMENT: The electrical work shall be measured and paid for at the contract lump sum price bid.

A. Payment for construction of Anahola Water System Site Electrical will be made by Lump Sum. Payment shall represent full compensation for furnishing all materials, labor, tools, equipment and incidentals required to complete all electrical work not specifically addressed in the items below.

B. Payment for construction of Anahola Water System Motor Control Center System will be made by Lump Sum. Payment shall represent full compensation for furnishing all materials, labor, tools, equipment and incidentals required to complete the work.

C. Payment for the item Anahola Water System SCADA System shall not be paid for under this section. Payment for this item shall be made under the Supervisory Controls and Data Acquisition (SCADA) section.

D. Payment for the item Anahola Water System Emergency Generator System shall not be paid for under this section. Payment for this item shall be made under the Emergency Generator and Accessories section.

E. Payment for any nonrecurring utility installation costs will be made by the Owner.

F. With the exception of the nonrecurring utility installation costs, all costs in connection with furnishing and installing of the various items in accordance with standard practice, the details shown on the drawings and in accordance with these specifications, shall be included in the lump sum price of which the item is a part.

END OF SECTION

SECTION 16100

SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) SYSTEM

PART 1 - GENERAL

1.01 GENERAL CONDITIONS: This section covers the Supervisory Control and Data Acquisition (SCADA) system including equipment, wiring, adjustment and testing as indicated on the plans and specified herein.

A. As specified in Section 16000, Electrical Work. The provisions of these related sections apply to this section and work described in this section shall comply with them.

1.02 SCOPE OF WORK: Provide all articles, materials, equipment, operations, and services herein or on Drawings, including all labor, materials, taxes, fees, insurance, and incidentals required to insure completion.

A. Test Complete Installation: Installation shall be complete in every detail as specified and ready for use. Any item supplied by Contractor developing defects within one year of final acceptance by Owner shall be replaced by such materials, apparatus, or parts to make such defective portion of complete system conform to true intent and meaning of these Drawings and Specifications, at no cost to Owner.

B. System Overview – These specifications are for a distributed SCADA system for a water system, including Programmable Logic Controller (PLC) and Operator Panel. This system shall require but not limited to the following work:

1. Providing one (1) PLC at the Anahola Farm Lots site, including but not limited to the following major equipment:

   a. PLC
   b. UPS
   c. 5-Port Ethernet Hub
   d. 10” HMI Operator Panel
   e. One (1) Power Supply

2. The SCADA communications systems shall be as indicated on the drawings and as follows:

   a. The system shall be used for transmitting alarms, status and telemetry, calculated data, diagnostic and error logging information from the PLC to the Master SCADA station. The PLC shall also be able to upload any portion of their database to a future

Master SCADA station upon request or event.

b. The future Master SCADA station shall be able to send to the PLC, commands and interrogation requests, and to download to the PLC the full Database, Application, Software and Parameters, via the communications channel.

c. The PLC shall be able to communicate and exchange data with hierarchies in the system and to inform the future Master SCADA station about their activity.

d. Contractor shall coordinate the planning and construction of the SCADA system (programming, I/O list, etc.) with the Owner.

C. This system shall be an integrated system of hardware and firmware totally engineered, programmed, assembled and tested. System shall be complete with all appurtenances, whether specifically referenced herein or not, but which may be required for operation.

D. During bidding and construction, Contractor shall coordinate his work with other trades to avoid omissions and overlapping responsibilities. Electrical contractor shall notify other trades and suppliers of project voltages, including control voltages.

E. Work by Others: Instrument transmitters shall be provided by respective sections of this contract. Installation of equipment complete with power wiring and electric controls and interlock wiring shall be part of Electrical Work.

1.03 SUBMITTALS: Submittals shall be made for approval and resubmitted until approval is received for the following:

Provide required copies, according to the Special Provisions Section 1.13 of the specifications, of submittal information to the Engineer for distribution after review.

Furnish submittal information on the following items:

A. Catalog Cuts: Submit for approval catalog cuts of following equipment

1. SCADA system components and equipment.

2. Conductors and Wiring.

3. Wiring and functional or block diagrams.

4. Manufacturer's recommendations for installation.

5. Logic diagrams and ladder diagrams.

6. Manufacturer's recommended list of spare parts for a one-year period of operation.

B. Electrical Installation Drawings: At least 10 days prior to any testing the Contractor shall submit four (4) sets of approved complete electrical installation drawings. The installation drawings shall include the manufacturer's wiring diagrams for the SCADA system and any built-to-order equipment.

C. As-Built Drawings: Upon completion of the final inspection and testing, the Contractor shall provide six (6) copies of as-built installation drawings and manufacturer's wiring diagrams for the SCADA system and any built-to-order equipment.

1.04 LOCAL SUPPORT: The manufacturer of the SCADA system supplied shall be represented by a company with offices in the State of Hawaii. This local office shall be capable of responding to requests for maintenance and repair to the system by having a technician skilled in the repair, maintenance and operation of the system at the job site within 24 hours of being notified. This local representative shall carry all spare parts which are recommended by the manufacturer.

PART 2 - PRODUCTS

2.01 GENERAL: Unless otherwise indicated, provide all first quality, new materials, free from any defects, in first class condition, and suitable for the space provided. Provide materials approved by UL wherever standards have been established by that agency. Where two or more units of the same class of material or equipment are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer.

2.02 STANDARD PRODUCTS: Unless otherwise indicated, provide materials and equipment which are the standard products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturer’s latest standard design which conforms to the specifications.

2.03 SCADA SYSTEM CONTROL AND DESCRIPTION: The new system consists of one new SCADA PLC and touchscreen system at the new Anahola Farm Lots site.

2.04 MATERIALS AND EQUIPMENT:

A. SCADA Cabinet: The Contractor’s SCADA work shall include terminating all telemetry inputs and outputs to terminal blocks within the SCADA cabinet. Termination shall be maintained tight to top, front of the enclosure’s left side. Terminal blocks shall be neatly aligned in a single column. The SCADA enclosure shall also include grounding strip, 120V AC power for connection to 24V DC power supply and UPS.

B. Programmable Logic Controller:

1. Programmable Logic Controller (PLC) shall be microprocessor based, solid-state construction utilizing second source semiconductors, unless otherwise specified. The PLC shall have a serial port and Ethernet ports and be able to communicate using Ethernet/IP protocols. Each PLC shall be supplied with the number and types of I/O points as indicated elsewhere in the plans and specifications. Future expansion shall be possible by simply plugging in additional I/O modules to the rack-less I/O bus. Additional I/O modules shall connect next to each other without requiring a fixed size rack. PLC, I/O, touchscreen, and Ethernet switch components shall use 24VDC and shall be powered through a UPS backup with a minimum 60 minutes of backup time. Digital Outputs shall utilize transistor outputs and use auxiliary relays for controls, and Analog signals shall utilize 4-20maDC based signals. All downloading to the PLC controller and touchscreen shall be over Ethernet. All programming shall utilize ladder logic. Parts shall be off the shelf design and common throughout so as to minimize spare parts requirements. PLC shall be housed in the SCADA cabinet. Unit shall be Siemens Simatic S7-1200 or approved equal.

C. Operator Interface Touchscreen shall be installed in the front of the SCADA cabinet, or other suitable location as required. Touchscreen shall have a basic color screen. Touchscreens shall monitor and control local functions of the PLC. They shall communicate to the PLC using Ethernet communication, through a DIN rail mounted switch in the PLC panel. They shall be rated for NEMA 4X and shall display a minimum of 640x480 resolution. Touchscreens shall be "deployed" remotely over the Ethernet connection for centralized development and quality control. Unit shall be Siemens KTP 10" compact panel or approved equal.

D. Instrumentation System Transmitter Power Supply: The power supply shall be mounted in the SCADA cabinet and deliver regulated 24-36 volts DC power at a maximum current recommended by the analog transmitter supplier. The unit shall operate on 117 volts AC at 50-70 Hz. Load regulation shall be 150 mV maximum from no-load to full-load current. Line regulation shall be 150 mV from 105 to 135 volts AC.

E. See Drawings for additional information on the recommended materials and equipment for the SCADA system.

F. Spare Parts:

1. One (1) HMI Operator Panel

2. One (1) PLC

3. One (1) 8 Digital Input Module

4. One (1) Power Supply

PART 3 - EXECUTION

3.01 CONSTRUCTION METHODS:

A. Flush mount indicators, selector switches, pushbutton switches, and pilot lights in a logical arrangement.

1. Mount devices listed, shown, or required for a complete and operable system in accordance with device manufacturer's instructions, these specifications, and as recommended in NEMA PB1.1.

2. Ground control panel to safety ground of power source.

3. Analog signals must use shielded pairs cabling.

3.02 PROGRAMMING:

A. Contractor shall coordinate all PLC programming with the Owner.

B. The PLC supplier and Contractor shall provide the complete programming and documentation for PLC to comply with the requirements set forth herein.

C. Contractor shall provide Owner with a copy of the implemented software.

3.03 COMMISSIONING: Instruments are to be commissioned under the direct supervision of a qualified representative of the instrument manufacturer. The Owner and or the Owner's representative shall have the right to witness any test, inspection, or calibration or start-up activity.

A. Test and exercise each device to demonstrate correct operation, first individually, then collectively as a functional network. Apply continuously variable analog inputs to verify proper operation and setting of analog devices and discrete devices (i.e. switches, etc.). Make provisional settings on relays and pressure switches.

B. Unless otherwise specified, tests shall be made to cover at least five points: approximately 0 percent, 25 percent, 50 percent, 75 percent, and 100 percent of range. Individual device accuracy requirements shall be as specified by contract requirements or by published manufacturer accuracy specifications whenever contract requirements are not specified.

C. If test results conflict with calibration, the Contractor shall recalibrate and repeat test until test results prove calibration to be correct.

D. The supplier of all equipment shall be an organization which is committed to the provision of ongoing support and development and can show a history which supports this position. In particular, the supplier must so state in writing that they have performed 5 similar projects with this proposed configuration. It must support and use industry standards and be committed to the use of open standards. The supplier must perform all work within the State of Hawaii.

3.04 TEST REPORT: Prepare a test report showing actual value, instrument value, 4-20 mA value (at the PLC) for each test, and range of the instrument. Each test shall bear the signature of the contractor's representative who supervised the tests and the manufacturer's representative. Three copies of these reports in bound sets label "CALIBRATION DATA" are to be furnished to the Owner's Representative.

3.05 ADDITIONAL START-UP SERVICES: The Contractor shall include an additional two days of programming time and the cost for the PLC's programmer to visit the site for one of the days in the bid. This time may be used at the discretion of the Owner for additional programming, changes, and/or training. This time is over and above the work necessary to provide a complete and operable system.

3.06 GUARANTEE: The SCADA system, equipment, materials, and associated items shall be guaranteed against defective parts and operation due to faulty material or workmanship during the period of one year following acceptance and final payment by the Engineer. The Contractor shall make all repairs or replacements necessary to accomplish the required performance within the time specified by the Engineer and agreed to by the Contractor.

3.07 MEASUREMENT AND PAYMENT: The electrical work shall be measured and paid for at the contract lump sum price bid.

Payment for construction of Supervisory Controls and Data Acquisition (SCADA) will be made by Lump Sum. Payment shall represent full compensation for furnishing all materials, labor, tools, equipment and incidentals required to complete the work in accordance with the drawings and specifications.

END OF SECTION

SECTION 16300

EMERGENCY GENERATOR AND ACCESSORIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. It is the intent of these specifications to describe a new complete automatic starting emergency generator system, including all necessary equipment and accessories, suitable for emergency service. Any omission in specified equipment will not relieve the supplier of the responsibility for providing a complete system, including all items required for starting and normal operation, except such items which are specifically noted as being furnished by others.

B. The generating set shall be driven by a diesel engine using No. 2 Standard Diesel Fuel, and shall be rated as indicated. The synchronous speed shall not exceed 1800 RPM.

C. The generator shall be coupled to the engine by means of a flexible coupling. The engine and generator shall be aligned, secured and dowelled on a substantial base fabricated of structural steel and mounted on vibration isolators.

D. The generating unit shall be designed for automatic operation and shall be furnished with all necessary apparatus and instruments for proper control of the engine and the generator, as specified herein.

E. All electrical equipment shall be new, of standard manufacture, shall be constructed in accordance with the applicable requirements of NFPA, ANSI and NEMA standards. The equipment shall carry standard manufacturer's guarantee, but shall be not less than one year.

F. The engine shall be in accordance with NEMA standards, new, a standard current model of a recognized engine manufacturer, and shall carry the standard guarantee, except that guarantee shall be not less than one year after final acceptance by the Owner. The generator unit shall be manufactured by a firm recognized as experienced and skilled in the diesel driven electric generating units, which firm maintains an Officer-in-Charge and service organization of skilled electrical and mechanical personnel in Hawaii.

G. Space limitations are such that the overall dimensions of the unit shall not exceed those as indicated.

H. The vendor will be required to furnish the services of an Engineer to check the

installation after completion, to supervise the starting of the equipment and putting it into service, and to conduct field tests.

I. The generating unit and control equipment shall be provided complete and ready for normal service operation as soon as field connections have been made to wiring system and fuel and exhaust systems.

J. Provide full tank of fuel at final acceptance.

1.02 RELATED WORK DESCRIBED ELSEWHERE

Section	Title
16000	ELECTRICAL WORK

1.03 SUBMITTALS

A. Shop Drawings: Submit for approval eight (8) complete shop drawings and manufacturer's literature for the Owner's review before any work is ordered or fabricated. Partial or incomplete submittals will be returned without review. Submit manufacturer's literature for the following:

1. Engine generator system and accessory equipment.

2. Wiring diagrams, and mounting procedures.

B. Manufacturer’s Equipment Instruction Manuals.

1. Eight copies of shop test results.

1.04 WORK BY OTHERS

During bidding and construction, Contractor shall coordinate his work with other trades to avoid conflicts, omissions, and overlapping responsibilities. Electrical Contractor shall notify other trades and suppliers of the project voltages, characteristics, and limitations.

1.05 MAINTENANCE SERVICE

A. Initial Maintenance Service:

Provide full maintenance service by skilled competent employees of the equipment installer for a period of 24 months following date of final acceptance by the Owner. Include preventive maintenance, performed during normal working hours, as specified below. Include repair or replacement of worn or defective parts or components, and lubrication, cleaning, and adjusting as required for operation in

conformance with specified requirements. Include 24-hours-per-day, 7-days-per-week emergency call back service. Trained service personnel shall be on the job site within 8-hours of the original emergency service call. Exclude only repair or replacement due to misuse, abuse, accidents, or neglect caused by persons other than the Installer's personnel.

1. Provide quarterly inspection following date of final acceptance by the Owner.

2. Provide preventive maintenance annually following date of final acceptance by the Owner.

3. Provide a copy of the quarterly and annually maintenance inspection reports to the Owner.

4. In addition to work specified above, preventive maintenance shall include:

    a. Measure generator output voltage to verify proper operation.

    b. Other maintenance as recommended by the engine generator manufacturer.

    c. Other tests, as recommended by the regulator manufacturer, to monitor regulator operation.

1.06 WARRANTY

Installation shall be complete in every detail and ready for use. Any item supplied by Contractor developing defects within two (2) year of final acceptance by the Owner, shall be replaced by such materials, apparatus or parts including installation labor to make such defective portion of complete system to true intent and meaning of drawings and specifications, at no cost to the Owner.

1.07 ENVIRONMENTAL CONDITIONS

The equipment shall be suitable for continuous outdoor duty at the Anahola Farm Lots site. The ambient temperatures may range from 50 to 100 degrees F and ambient relative humidity will range between 30 and 100 percent. The equipment will be exposed to sunlight, rain, dust, washdown water, and ocean salt spray.

1.08 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Owner of any discrepancy before performing the work.

1.10 QUALITY ASSURANCE

Equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory service for at least 5 years prior to bidding.

PART 2 - MATERIALS AND DETAILS

2.01 ENGINE GENERATORS

A. The engine generators shall be rated as indicated for emergency duty with temperature rise and design in accordance with NEMA and ANSI standards. The next larger standard rating of the engine generator manufacturer may bid if the engine generator can properly function in the space indicated, if the rating indicated is not a standard item for the manufacturer. If a larger engine generator is provided, the contractor shall revise other systems as necessary to accommodate the larger engine generator at no additional cost to the Owner. Engine generator shall operate at full load with outside ambient air temperature between 50 and 100 deg F.

B. Maximum allowable sound levels at 100% load shall not exceed 75 dBA at 23 feet in a Free Field.

C. Engine generator shall have an integral subbase fuel tank, 304 stainless steel, with a minimum of 777 gallons capacity, UL 142 Listed, double wall construction, low fuel alarm, fuel in rupture basin alarm. Provide hazardous materials label on each side of fuel tank per NFPA 704 requirements. Provide factory installed fuel tank venting per NFPA 1 66.2.2.2.5.1.

1. Fill port on fuel tank shall be located outside of tank and not inside of enclosure.

2. Tank shall be capable of being monitored through SCADA system.

3. Tank shall be provided with overfill valve and 5 gallon spill containment.

4. Provide 12 foot vent extension.

D. The generator shall be new and be a current standard production model of a recognized manufacturer of generators of proved reliability, and shall be built in accordance with applicable requirements of IEEE, ICEI and NEMA specifications.

E. The generator shall be of the revolving field type, with amortisseur of damper windings. It shall be designed for operation at the specified speed of the engine.

F. The excitation system shall be integral with the generator and shall have current characteristics to meet the requirements of the generator manufacturer's design. The excitation system shall consist of a permanent magnet generator, solid state voltage regulator, and brushless-type excitation generator.

G. Winding pitch shall be 2/3 of pole pitch.

H. Manufacturer: Caterpillar, Cummins, or approved equal.

2.02 ENGINES

The engines shall be 4-cycle, water-cooled, compression ignition diesel engine, meet current EPA emission certifications, EPA certified for Stationary Emergency Application (emits equivalent U.S. EPA Tier 3 Nonroad Standards), utilizing No. 2 low sulfur diesel fuel with 40 degrees minimum API gravity. The rated net horsepower of the engine, at the generator synchronous speed, with all accessories attached, shall not be less than that required to produce the KW specified. The horsepower rating shall take into account engine generator efficiency losses. The engine shall be capable of producing the specified KW (without overload) for emergency duty.

Engine generator shall maintain +/-5% voltage tolerance and +/-3% frequency tolerance during operation. Coordinate voltage and frequency tolerance requirements with well and booster pumps manufacturers. The generator shall be sized as required to ensure proper operation of the well and booster pumps during emergency generation operation.

2.03 ENGINE EQUIPMENT

A. The following listed equipment shall be mounted on the engine:

1. Fuel injection system complete, including primary and secondary fuel oil filters and fuel oil transfer pump.

2. Governor shall be isochronous.

3. Full pressure lubricating oil system, including pump and lubricating oil filter.

4. DC Electric starting system with magnetic conductors.

5. Engine instrument panel, mounted at operator's eye level, containing engine operating controls, oil pressure gauge, and water temperature gauge, oil temperature gauge and engine RPM meter.

6. Safety shutdown for low lube oil pressure, high jacket water temperature, engine overspeed, engine overcrank, loss of coolant, or low coolant level.

7. Complete cooling system, consisting of remote radiator and pusher fan, engine driven water circulating pump, thermostat controlled bypass to control jacket water temperature, and radiator drain connection.

8. Complete wiring on engine with oil and heat resistant cable and terminal box. All exhaust piping system shall be wrapped around (insulation).

9. Enclosed circuit breaker.

2.04 EXHAUST SILENCER

Exhaust silencer shall be critical grade, maximum allowable sound levels at 100% load shall not exceed 75 dBA at 23 feet in existing surroundings.

2.05 ACCESSORY EQUIPMENT

A. Starting Batteries

1. Heavy duty starting batteries shall be maintenance free, provided with extra flexible jumpers and compression type terminal lugs. The ampere-hour rating of the battery shall be sufficient for six cyclic crankings at 50 degrees F while retaining a battery of 1.5 volts or more per cell. The specific gravity shall not exceed 1.250.

2. Batteries shall be mounted in the engine generator enclosure.

B. Battery Charger

Battery charger shall be the enclosed, constant voltage, heavy duty, industrial type designed for operation from a 120 volt, single phase, 60 Hertz, alternating current supply. The charger shall be suitable for keeping the engine starting batteries in a charged condition during periods when the engine is idle. Rectifier elements shall be silicon diodes capable of continuous operation at full rated load (10 amperes) with convection cooling in ambient temperatures up to 120 degrees F. The charger output shall be continuously adjusted automatically from 0 to 10 amperes, depending on the state of the charge of the battery. A voltmeter and an ammeter shall be provided to show the charger output. The voltmeter dial shall have red markings to show the lower and upper limits of the normal operating range. The charger shall be equipped with protective relays to be interlocked with the engine starting circuit, to disconnect the alternating current supply to the charger during engine cranking and to ensure against charger failure upon resumption of charging following a cranking operation. Instead of the relay, a current limiting circuitry will be acceptable. The enclosure for the charger shall be of corrosion resistant material

or shall be suitably protected against corrosion. D.C. charging shall not change more than ±2% when supply voltage changes ±2% when supply voltage changes ±10%. Battery charger shall be mounted in the engine generator enclosure.

C. Jacket Water Heater

A thermostatically controlled electric heater shall be mounted in the engine coolant jacketing to automatically maintain the coolant within plus or minus 3 degrees of the control temperature. The heater shall operate independently of engine operation so that starting times are minimized. The control temperature shall be the temperature recommended by the engine manufacturer to meet the starting time specified, 120VAC, protected by a circuit breaker located in the generator control panel.

D. Alternator Anti-condensation Heater

Heater shall be controlled by 120VAC fused power via power relay in the generator control panel. Upon generator start signal, AC supply will automatically disconnect via power relay and automatically reconnect when start signal is terminated and generator is off. Heater shall be sized properly to prevent winding corrosion due to condensation.

2.06 ENGINE WIRING

All wiring required on the engine shall be completely wired at the factory and shall be terminated in one junction box ready for field connection. All conductors on terminal board shall be properly identified. The conductor insulation shall be heat- and oil-resistant.

2.07 GENERATOR CONTROL PANEL

A. Generator

1. The generator control equipment shall be furnished in a vibration isolated enclosed sheet steel cabinet arranged for mounting over the generator at operator's eye level.

2. All connections shall be capable of being made from the side and all equipment housed within the enclosure shall be easily accessible for adjustment.

3. A generator circuit breaker shall be provided. Rating of the circuit breaker shall be as indicated in the drawings.

4. A generator heater and alternator anti-condensation heater shall be provided which shall be energized when the engine is not operating.

B. Instruments

1. Instruments shall be of the flush mounting type, round or square front, of approximately 4-1/2 inches in size or digital with 0.5" digital display. Instrument ranges shall be so chosen that full load values show at approximately 2/3 of full scale. Instruments shall be calibrated for use in a steel panel.

2. Voltage elements for use above 300 volts shall be for use with potential transformers, AC ammeters with scales beyond 50 amperes shall be for use with current transformers.

3. Instruments shall have an accuracy not worse than plus or minus 3 percent of full scale reading. The following instruments shall be furnished:

AC voltmeter (to read all three phases).

AC ammeter (to read all three phases).

KW meter

KWH meter

Frequency meter

Running time meter to display hours and 1/10 hours (non-reset type)
Tachometer

C. Instrument Phase Switches: Ammeter and voltmeter phase switches shall be furnished.

D. Automatic Voltage Regulator: The voltage regulator shall be chosen to match the characteristics and requirements of the exciter with which it is to be used. It shall be of the type which varies the exciter field current and shall be capable of holding the AC voltage within the limits of plus or minus 2 percent from no load to full load. The regulator shall not hunt excessively and shall act to restore rated voltage quickly after sudden load changes. Regulator may not be connected line to neutral on 3 phase, 4 wire circuits.

E. Current Transformers: Current transformers shall be of the Donut type. They shall

be securely mounted and insulated and must not hang loosely on the conductors.

F. Potential Transformers: Small control type transformers rated not less than 50 VA may be used to obtain 120 volt potential for the voltage regulator and the voltmeter.

G. Wiring: All wiring shall be installed in a neat and workmanlike manner. Clearly marked terminals and terminal board shall be provided for all external connections. A complete wiring diagram shall be furnished. This diagram shall clearly identify each lead in the circuit by a number and correspondingly numbered adhesive strips shall be fixed to the individual wires for identification.

2.08 AUTOMATIC START-STOP EQUIPMENT AND CONTROL

A. General

The automatic equipment shall be furnished as a part of the generator control. The automatic start-stop equipment shall be specifically designed for, and intended for use with, the engine described in these specifications. The circuits shall be such that control current only flows through the interconnecting leads between the automatic equipment and the engine. Any engine mounted devices, such as solenoids, the pull-in coil of the starting contactor, etc., which draw more than 5 amperes in operation shall be relayed at the engine.

B. Function

The automatic control equipment is to act to start the engine and bring it up to operating speed in the shortest possible time after receipt of the signal to start. Then, upon receipt of the signal to shut down, the engine shall continue in operation without load for an adjustable period of 0 to 5 minutes to permit cooling of the combustion chambers, before it is to be stopped.

C. Operation

The signal to start will consist of the closure of the automatic control circuit which will be operated at battery voltage through contacts on the automatic transfer control equipment. These contacts will remain closed so long as the engine is required to run and will open when the engine is required to shut down. Cranking of the engine shall commence immediately after the automatic control external circuit is closed and is to be continued until the engine starts and runs. If the engine fails to start and run within this period of time, cranking discontinues for approximately 8 seconds, or as recommended by the manufacturer but not to exceed 12 seconds, and is then to be re-established. The control equipment shall provide for six such cranking periods between. The accuracy of timing shall not be worse than plus or minus 20 percent. If, after six cranking attempts, the engine has not started, the control shall

lock itself out and require manual re-setting. After the automatic control circuit reopens, the engine shall continue to run for an adjustable period of from 0 to 5 minutes and then shall be stopped and left in readiness for another start. The time interval, if any, between stopping and readiness for a subsequent start shall not exceed 10 seconds. If, during the 0 to 5 minutes running period mentioned above, the automatic control circuit should re-close, the engine shall continue in operation until such time as the circuit again re-opens, when the control shall again commence timing prior to shut-down.

D. Safety Devices

The automatic control equipment shall be arranged to operate in conjunction with the safety devices described elsewhere in these specifications, and to disconnect the battery charger from the battery during the cranking period.

E. Indicating and Control Equipment

A master select switch, three position rotary type, shall be mounted on the front panel of the generator control equipment housing. The switch shall be plainly marked "TEST-OFF-AUTOMATIC". In the "AUTOMATIC" position, the control equipment shall be in readiness to start the engine upon signal. In the "TEST" position, it shall start and run the engine, until the switch is placed in the "OFF" position. In the "OFF" position, the switch shall break enough circuits between the engine and the control equipment to prevent engine operation. The manual switch shall be momentary "on" contact type. The following indicating lamps shall be mounted on the front of the panel adjacent to the selector switch.

A green lamp labeled PILOT. This lamp shall burn to indicate that the control equipment is in readiness to start the engine automatically. Pilot light shall be "push-to-test" type.

A red lamp for each of the following:

- Failed to start
- Overspeed
- Low lube oil pressure
- High coolant temperature
- Emergency Stop
- Low coolant temperature
- Low coolant level

The lamps shall burn to indicate that the control equipment is locked out for trouble indicated. Pilot light shall be push-to-test type.

A normally open contact which closes upon engine failure to start, overspeed, low

lube oil pressure, or high jacket water temperature shall be provided for remote alarm.

F. Materials and Construction

1. All equipment used in the automatic control shall be of high quality and shall be similar and equal to the following.

2. Timing devices shall be digital and done by the processor in the engine control module.

2.09 ENGINE GENERATOR SET ENCLOSURE:

A. Provide sound attenuated weather-proof outdoor type enclosure.

B. Sound level of 75dBA at 23 feet based on free field conditions.

C. Rigidity wind test equal to 150 mph.

D. Roof load equal to 50 psf.

E. Rain test equal to 5 inches per hour.

F. Features:

1. Corrosion Resistant Constructions

a. Aluminum enclosure

b. Body made from steel components treated with polyester powder coating.

2. Louvers:

a. Provide louvers and dampers for engine generator inlet and exhaust and ventilation air.

b. Fixed louvers, all aluminum construction, riveted into aluminized steel frame to form rigid, water resistant assembly. Motorized dampers as specified hereinafter.

c. Properly sized louvers and dampers to allow sufficient engine combustion air, radiator cooling air, and ventilation air with maximum 035 inch water restriction. Coordinate with engine generator

manufacturer.

3. Muffler Mounting Bracket:

   a. Provide suitable bracket to secure critical grade generator silencer within the enclosure.

   b. Coordinate with engine generator supplier as required.

4. Security and Safety:

   a. Lockable access doors with keys.

   b. Cooling fan and battery charging alternator fully guarded.

   c. Fuel filled reached via lockable access doors when exterior fuel tanks are provided.

   d. Exhausted silencing system totally enclosed for operator safety.

   e. Roof outlet exhaust with sealed roof aperture and rain-cap.

   f. Stub-up cover sheets for rodent proofing.

2.010 SHOP TESTS

A. The complete generator unit shall be shop tested at place of manufacturer, prior to shipment, together with its generator controls and its engine automatic start-stop controls. These tests will include a continuous run with an 80% power factor load as follows: one hour of operation at 50 percent, two hours at 100 percent. Continuous recording strip chart type instruments shall be used during the load tests to record simultaneously the output reading of AC voltage, kilowatts and frequency. Tests shall also include repeated starts and stops to demonstrate the action of the control equipment under all possible conditions, such as momentary closure of the external circuit, re-closure of circuit during shutdown timing, etc.

B. Purchaser's representatives reserve the right to witness these tests if so desired. Seven (7) copies of the logs certified by the manufacturer shall be furnished to the Owner.

PART 3 - EXECUTION

3.01 GENERAL

Equipment and appurtenances specified in this section shall be installed in the position indicated and in accordance with the manufacturer's written instructions. All appurtenances required for a complete and operating system shall be provided, including but not limited to such items as piping, conduit, valves, wall sleeves, wall pipes, concrete foundations, concrete collars, anchors, grouting, power supply, and controls.

3.02 ENGINE GENERATOR

The engine-generator shall be installed in accordance with the Manufacturer's instructions, and shall be installed level.

3.03 MANUFACTURER'S SERVICES

Provide the services of the manufacturer's factory-trained service representative to check the installation after completion, to supervise the start up of the equipment and placing it into service, to conduct the field test, and to instruct Owner's operating personnel on procedures. The presence of the manufacturer's service representative shall in no way relieve the Contractor from his responsibility to perform all work in accordance with this contract.

3.04 PERFORMANCE TESTING

A. Each equipment shall be field tested to ensure compliance with the performance requirements as specified.

B. Before running generator, verify that no short circuits or accidental grounds exist. Perform insulation resistance test on generator using instrument which applies voltage of approximately 500 volts to provide direct reading of resistance. Minimum resistance shall be 250,000 ohms. Perform resistivity test on windings using a low ohm ohm-meter to verify that windings meet the manufacturer's requirements.

C. When the engine-generator unit has been completely installed and ready for tests, Contractor shall notify the Owner that the unit is ready for field tests. The Contractor shall perform all field tests and shall provide required fuel and other consumables. The tests shall include the following:

1. Simulate or duplicate conditions for safety shutdown.

2. Automatic starting and stopping of the engine-generator units.

3. Load testing utilizing a Contractor furnished inductive load bank (80% power

factor, lagging) and tested in accordance with NFPA 70 (Article No. 701) and 110:

a. "Cold start" test.

b. Provide one 2-hour test at 50% load.

c. Provide one 2-hour test at 75% load.

d. Provide one 4-hour test at 100% load, with sound level measurement at 23 feet distance. Maximum allowable sound levels at 100% load shall not exceed 75 dBA at 23 feet.

e. One step rated load pickup test.

D. Provide a copy of the performance testing report to the Owner.

3.05 MEASUREMENT AND PAYMENT

Payment for construction of Anahola Water System Emergency Generator System will be made by Lump Sum. Payment shall represent full compensation for furnishing all materials, labor, tools, equipment and incidentals required to complete the work including generator, fuel tank, stationary and removable bollards, and other appurtenances. The concrete pad for the generator shall be paid for under a separate line item.

END OF SECTION