HO'OLEHUA WATER SYSTEM IMPROVEMENTS
PACKAGE 1 – HO'OLEHUA
IFB-18-HHL-008

TECHNICAL SPECIFICATIONS

INDEX TO TECHNICAL SPECIFICATIONS

INDEX TO TECHNICAL SPECIFICATIONS

SECTION 00511 - REINFORCED CONCRETE RESERVOIR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 01 Specification Sections, apply to this Section.

B. Water System Standard, 2002, for the Department of Water Supply, County of Maui

1.2 DESCRIPTION

A. Furnish all labor, materials, tools and equipment required to construct reinforced concrete reservoir according to the contract. All work shall be completed in accordance with the Water System Standards and to the satisfaction of the Maui Department of Water Supply (DWS).

1.3 SUBMITTALS

A. Submit for any modification to the material and the identification number of the materials listed in approved material list.

PART 2 - MATERIALS

2.1 PRODUCTS

A. Conform to Division 400 – APPROVED MATERAL LIST AND STANDARD DETAILS of the Water System Standards.

PART 3 - EXECUTION

3.1 PROCEDURES

A. Conform to Division 300 – CONSTRUCTION of the Water System Standards.

PART 4 - METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.1 PAYMENT

A. Payment for the reinforced concrete reservoir and appurtenances will be made at the lump sum bid price.

END OF SECTION

SECTION 01010 - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS AND COVENANTS: The General Conditions, General Specifications, Special Conditions, and other applicable documents preceding these specifications shall govern all work specified hereinafter in all Divisions and Sections.

1.02 APPLICABLE REGULATIONS: The Contractor shall comply with all local laws, ordinances, rules and regulations pertaining to such work and must obtain all required permits, licenses, and certificates and publish and post all notices required thereby.

1.03 DESCRIPTION OF THE WORK: These specifications are divided for convenience into titled divisions and sections as set forth in the TABLE OF CONTENTS preceding these specifications and shall not be considered an accurate or complete segregation of the several units of labor and materials. No responsibility, either direct or implied is assumed by the Department of Hawaiian Home Lands (DHHL) for omissions or duplications of the subject matter. The Contractor will be held responsible for the complete work whenever or wherever the parts are described in one or more trade heads. Any mention in these sections or indication on the drawings of articles, materials, operations, or methods, require that the Contractor furnish each item so mentioned or indicated, of the kind, type, or design and quality of each item so mentioned on the drawings, and that the Contractor furnish all labor, materials, equipment, incidentals and supervision necessary to complete the work in accordance with the drawings and the true meaning and intent of these specifications, even though such mention of articles, materials, operations, methods, quality, qualifications or condition is not expressed in complete sentences.

Where devices or items, or parts thereof are referred to in the singular, it is intended that such references shall apply to as many such devices, items, or parts as are required to properly complete the work.

Schedule of work included in these specification sections are given for convenience and shall not be considered as a comprehensive list of items necessary to complete the work of any section.

The Contractor shall employ the usual standard practice of coordinating the work covered in each section with the work of other sections. The necessary information and the items, accessories, anchors, connections, patterns, templates, etc., shall be delivered when required in order to prevent any delay in the progress and completion of the work.

1.04 PLANS AND SPECIFICATIONS: These specifications are intended to cover all labor, materials and standards of workmanship employed in the work indicated on the plans and called for in the specifications or reasonably implied therein. The plans and specifications complement one another. Any part of the work mentioned in one and not represented in the other, shall be done the same as if it had been mentioned or represented in both.

The Contractor shall not alter from the drawings and specifications. In the event of errors or discrepancies, the Contractor shall immediately notify the Engineer.

All figured dimensions take precedence over scaled measurements. No important dimension shall be determined by scale.

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

1.05 REFERENCE STANDARDS: All work shall be done in accordance with the most current standards listed below as amended and/or amplified herein.

ASA American Standards Association

ASTM American Society for Testing and Materials

AISC American Institute of Steel Construction

ACI American Concrete Institute

UBC Uniform Building Code - current edition

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General project coordination procedures.

2. Project meetings.

1.02 PERFORMANCE AND COORDINATION

A. Contractor is in charge of the Work within the Project Contract Limits, and shall direct and schedule the Work. Include general supervision, management and control of the Work of this project, in addition to other areas more specifically noted throughout the Specifications. Final responsibility for performance, interface, and completion of the Work and the Project is the Contractor's.

B. The Contractor is responsible for jobsite Administration. Provide a competent superintendent on the job and provide an adequate staff to execute the Work. In addition, all workers shall dress appropriately and conduct themselves properly at all times. Loud abusive behavior, sexual harassment and misconduct will not be tolerated. Workers found in violation of the above shall be removed from the job site as directed by the Project Manager.

C. DHHL will hold the Contractor liable for all the acts of Subcontractors and shall deal only with the Prime Contractor in matters pertaining to other trades employed on the job.

D. Coordination: Provide project interface and coordination to properly and accurately bring together the several parts, components, systems, and assemblies as required to complete the Work pursuant to the GENERAL CONDITIONS and SPECIAL CONDITIONS.

1. Provide interface and coordination of all trades, crafts and subcontracts. Ensure and make correct and accurate connections of abutting, adjoining, overlapping, and related work. Provide anchors, fasteners, accessories, appurtenances, and incidental items needed to complete the Work, fully, and correctly in accordance with the Contract Documents.

2. Provide additional structural components, bracing, blocking, miscellaneous metal, backing, anchors, fasteners, and installation accessories required to properly anchor, fasten, or attach material, equipment, hardware, systems and assemblies to the structure.

3. Provide excavation, backfilling, trenching and drilling for trades to install their work.

4. Provide concrete foundations, pads, supports, bases, and grouting for trades as needed to install their work.

5. Materials, equipment, component parts, accessories, incidental items, connections, and services required to complete the Work which are not provided by Subcontractors shall be provided by the Contractor.

6. Coordination: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1.03 COOPERATION WITH OTHER CONTRACTORS

A. DHHL reserves the right at any time to contract for or otherwise perform other or additional work within the Project Contract Limits. The Contractor of this project shall to the extent ordered by the Project Manager, conduct its work so as not to interfere with or hinder the progress or completion of the work performed by other Contractors.

1.04 COORDINATION WITH OTHER PRIME CONTRACTORS

A. Multiple Prime Contractors performing work under separate agreements with DHHL may be present near the project location, adjacent to and abutting the Project Contract Limits. This Contractor shall coordinate activities, sequence of work, protective barriers and any and all areas of work interfacing with other Prime Contractor's work. Contractor shall provide a continuity of finishes, walks, landscape, etc. at abutting Contract Limits so no additional work will be required. Any damage to other Prime Contractor's Work committed by this Contractor (or its Subcontractor) shall be repaired promptly at no additional cost to DHHL.

B. Coordinate Subcontractors and keep them informed of any work from the other Projects that may affect the site or the Subcontractor's work. If the Contractor has any questions regarding its coordination responsibilities or needs clarification as to the impact in scheduling of its work and the work of other projects, this Contractor shall notify the Project Manager in writing.

C. Subject to approval by the Project Manager, this Contractor shall amend and schedule its work and operations to minimize disruptions to the work and operations of other projects.

1. Relocate or remove and replace temporary barriers, fencing supports or bracing to allow work by others to proceed unimpeded. Do not remove required barriers supporting work until specified time or as approved by the Project Manager. This does not relieve the Contractor of the responsibility of proper coordination of the work. If directed by the Project Manager, leave in place any temporary barriers.

2. Coordinate work that abuts or overlaps work of the other projects with the Project Manager and other Prime Contractors to mutual agreement so that work is 100 percent complete with continuity of all materials, systems and finishes.

3. When directed by the Project Manager, provide access into the construction zone to allow the other project's Contractor(s) to perform

their Work and work that must be interfaced.

4. Contractor shall adjust and coordinate its Work and operations as required by the other projects as part of the Work of this contract without additional cost or delay to DHHL.

5. When directed by the Project Manager provide a combined Contractor's construction schedule.

D. DHHL intends to construct BID PACKAGE 2 and BID PACKAGE 3 work during the execution of this Project. Construction of BID PACKAGE 2 is tentatively scheduled from November 2018 through January 2020. Construction of BID PACKAGE 3 is tentatively scheduled from January 2019 through February 2020. BID PACKAGE 2 consists of improvements to the Hoʻolehua Water System in Kalamaʻula. BID PACKAGE 3 consists of the construction of a Photovoltaic System farm in a lot adjacent to the Kauluwai Well Site (Site 1). Refer to drawings for location of and limits of BID PACKAGE 2 and 3 work. Contractor shall adjust and coordinate its work and operations as required by BID PACKAGE 2 and 3 work as part of the Work of this Contract without additional cost or delay to DHHL.

1. Contractor shall adjust and coordinate its work and operations as required by BID PACKAGE 2 and 3 work as part of the Work of this Contract without additional cost or delay to DHHL.

2. Contractor shall schedule a meeting with the Project Manager no later than thirty (30) days after Notice to Proceed to review the BID PACKAGE 2 and 3 contract documents developed as of that date. It is intended the BID PACKAGE 1 Contractor becomes familiar with the Scope of Work of BID PACKAGES 2 and 3, and the common areas affected.

3. The BID PACKAGE 1 Bidder shall study the work to be performed in BID PACKAGE 2 and 3 and bid on a basis of not interfering with or delaying the BID PACKAGE 2 and 3 Contractor(s). BID PACKAGE 1 Contractor shall provide the Project Manager a weekly updated schedule and description of its work. This weekly update will be used to inform BID PACKAGE 2 and 3 Contractor(s) of the BID PACKAGE 1 work schedule and also used by the Project Manager to coordinate the efforts of both Increment Contractors.

4. This Contractor shall inform and coordinate its Subcontractor(s) on the scope and required areas of work in BID PACKAGES 2 and 3. If the Contractor has any questions regarding its coordination, responsibilities or needs clarification as to the impact in schedule of its Work and the Work of BID PACKAGES 2 and 3, this Contractor shall notify Project Manager in writing no later than seven (7) days after the review meeting.

5. Subject to approval by the Project Manager, this Contractor shall amend and schedule its work and operations to minimize disruption to the work and operation of BID PACKAGE 2 and 3 Contractor(s).

6. Relocate and/or remove and replace temporary barriers, fencing, supports or bracing to allow work by others to proceed unimpeded. Do not remove required barriers supporting work until specified time or as approved by Project Manager. If directed by Project Manager, leave in-

place any temporary barriers.

7. Coordinate work that abuts or overlaps work of BID PACKAGES 2 and 3 with the Project Manager and other Prime Contractor to mutual agreement so that work is 100 percent complete with continuity of all materials, systems and finishes.
8. When directed by the Project Manager, provide access into the construction zone to allow BID PACKAGES 2 and 3 Contractor(s) to perform their work that must be interfaced with BID PACKAGE 1 work.

1.05 SUBMITTALS

A. Photo Documentation: Prior to the start of jobsite work, the Contractor shall photo document the existing conditions at the site and file with the Project Manager one complete set of documents.

B. Combined Contractors Construction Schedule: Provide schedule as determined by Project Manager for coordination with other prime Contractors.

1.06 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences as directed by the Project Manager, at the Contractor's field office, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Project Manager of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Contractor record significant discussions and agreements achieved.

Distribute the meeting minutes to everyone concerned, including Project Manager, within seven (7) days of the meeting.

B. Pre-construction Conference: Project Manager shall schedule a pre-construction conference before the start of construction, at a time convenient to the Project Manager, but no later than seven (7) days before the Project start date or jobsite start date whichever is later. Conference will be held at the Project site or another convenient location. The Project Manager shall conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Project Manager, Construction Manager, Design Consultants; Facility Users; Contractor and its superintendent; major Subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

a. Tentative construction schedule.

b. Phasing.

c. Critical work sequencing and coordination.

d. Designation of responsible personnel.

e. Use of the premises.

f. Responsibility for temporary facilities and controls.

g. Parking availability.

h. Office, work, and storage areas.

i. Equipment deliveries and priorities.

j. First aid.

k. Security.

l. LEED Requirements (for LEED Projects only) such as:

1. Construction Waste Management and recycling

2. Commissioning

3. Recordkeeping, submittals, etc.

m. Progress cleaning.

n. Working hours.

C. Progress Meetings: Conduct progress meetings at monthly or other intervals as determined by the Project Manager. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to Project Manager, Construction Manager, each Contractor, Subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

b. Review present and future needs of each entity present, including the following:

1. Outstanding Requests For Information (clarification).

2. Interface requirements.

3. Sequence of operations.

4. Status of outstanding submittals.
5. Deliveries.
6. Off-site fabrication.
7. Access.
8. Site utilization.
9. Temporary facilities and controls.
10. Work hours.
11. Hazards and risks.
12. Progress cleaning.
13. Quality and work standards.
14. Force Account work.
15. Change Orders and Change Proposals.
16. Documentation of information for payment requests.

c. Corrective Action Plan: Contractor shall provide a plan of corrective action for any item which is delayed or expected to be delayed, then that item impacts the contractual dates.

3. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 – PRODUCTS - Not Used

PART 3 – EXECUTION - Not Used

END OF SECTION

SECTION 01320 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's Construction Schedule.
2. Submittals Schedule.
3. Schedule of Prices.
4. Payment Application.

B. Related Sections include the following:

1. SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION for preparing a combined Contractor's Construction Schedule.
2. SECTION 01330 - SUBMITTAL PROCEDURES for submitting schedules and reports.
3. SECTION 01340 – DRAWINGS TO BE FURNISHED BY THE CONTRACTOR for submitting Construction documents such as Shop Drawings or Requests For Information.

1.02 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical activities are activities on the critical path and control the total length of the project. They must start and finish on the planned early start and finish times.
2. Predecessor activity is an activity that must be completed before a given activity can be started.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of project.

C. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Event: The starting or ending point of an activity.

E. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either DHHL or the

Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity.

3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

F. Schedule of Prices: A statement furnished by Contractor allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Payment Applications.

1.03 SUBMITTALS

A. Required Submittals: Submit eight (8) sets of the list of the required submittals, by Specification Section, within fifteen (15) days after award of the contract or upon earlier written instructions from the Project Manager. A general listing is provided under SECTION 01330 - SUBMITTAL PROCEDURES.

1. The listing shall indicate and include the following:

a. The number of copies required for submittal.

b. Planned submittal date.

c. Approval date required by the Contractor.

d. A space where the "date of submittal" can be inserted.

e. A space where the "date of approval" can be inserted.

f. A space where an "action code" can be inserted.

B. Construction Schedule: Submit seven (7) sets of the Construction Schedule for review within fifteen (15) days after the award of the contract or upon earlier written instructions from the Project Manager.

C. Schedule of Prices: Submit three (3) sets of the Schedule of Prices integrated with the Construction Schedule for review within fifteen (15) days after the award of the contract or earlier upon written instructions from the Project Manager.

1. Use the DHHL's forms for Payment applications.

D. Payment Application: Submit the payment application at earliest possible date and no sooner than the last day of the month after all payroll affidavits, updated submittal registers, and schedules have been submitted.

1.04 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate Contractors.

B. Construction Schedule: Coordinate Contractor's Construction Schedule with the Schedule of Prices, Submittals Schedule, loaded monthly event activity, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

C. Schedule of Prices: Coordinate preparation of the schedule with preparation of Contractor's Construction Schedule.

1. Correlate line items in the Schedule of Prices with other required administrative forms and schedules, including the following:
   a. DHHL's Payment Application form and the Construction Progress Report continuation sheet for the event cost estimate per time period.
   b. Submittals Schedule.

PART 2 - PRODUCTS

2.01 SUBMITTALS SCHEDULE

A. Comply with the DHHL CONSTRUCTION GENERAL CONDITIONS, Section 5.5 - SHOP DRAWINGS AND OTHER SUBMITTALS and SECTION 1340 – DRAWINGS TO BE FURNISHED BY THE CONTRACTOR. Furnish required submittals specified in this Section and in the Technical Sections. Submittals include one or more of the following: shop drawings, color samples, material samples, technical data, material safety data information, schedules of materials, schedules of operations, guarantees, certifications, operating and maintenance manuals, and field posted as-built drawings.

B. Preparation: Furnish a schedule of submittals per Project Manager.

1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Prices, and Contractor's Construction Schedule.
2. The schedule shall accommodate a minimum of twenty (20) calendar days for projects on Oahu and twenty-five (25) calendar days for all other islands for DHHL's review.
3. Prepare and submit an updated list to the Project Manager at monthly intervals or as directed by the Project Manager. The listing shall reflect all approvals received since the last update.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE (PERT CHART CRITICAL PATH METHOD (CPM))

A. The construction schedule shall address the entire project, to the extent required by the Contract Documents, and shall show an expedient and practical execution of work. If requested by the Project Manager, the Contractor shall participate in a preliminary meeting to discuss the proposed schedule and requirements prior to submitting the schedule.

B. The Construction Schedule shall indicate the following:

1. Elements of the Project in detail time scaled by month or by week, and a project summary.

2. The order and interdependence of activities and the sequence in which the work is to be accomplished.
3. How the start of a given activity is dependent upon the completion of preceding activities and how its completion restricts the start of following activities.
4. The submittal and approval of shop drawings, samples, procurement of critical materials and equipment, receipt of materials with estimated costs of major items for which payment will be requested in advance of installation, fabrication of special materials and equipment, and their installation and testing.
5. Activities of DHHL that have an effect on the progress schedule, such as the required delivery dates for DHHL furnished materials and equipment and other similar items.
6. Provide a separate report with the following:
    a. The description of the activity.
    b. The duration of time in calendar days.
    c. For each activity indicate the early start date.
    d. For each activity indicate the early finish date.
    e. For each activity indicate the late start date.
    f. For each activity indicate the late finish date.
    g. Total float time.
    h. Cost of event.
    i. Contract-required dates for completion of all or parts of the Work.
    j. Events are to be used on “Monthly Progress Report” for monthly payment request.

C. Upon completion of the Project Manager’s review, the Contractor shall amend the schedule to reflect the comments. If necessary, the Contractor shall participate in a meeting with the Project Manager to discuss the proposed schedule and changes required. Submit the revised schedule for review within seven (7) calendar days after receipt of the comments.

D. Use the reviewed schedule for planning, organizing and directing the work, for reporting progress, and for requesting payment for the work completed. Unless providing an update, do not make changes to the reviewed schedule without the Project Manager’s approval.

E. Should changes to the schedule be desired, submit a request in writing to the Project Manager and indicate the reasons for the proposed change. If the changes are major, the Project Manager may require the Contractor to revise and resubmit the schedule at no additional cost to DHHL. Contractor shall mitigate the impact of all changes by readjusting the sequence of activities, duration of time, or resources utilizing available float.

1. A change is major if, in the opinion of the Project Manager, the change affects the substantial completion date or other contractual and milestone

dates.

2. Minor changes are those that only affect activities with adequate float time.

F. Once the schedule is reviewed by the Project Manager, the Contractor shall submit six (6) sets of the revised schedule within fourteen (14) calendar days.

G. Throughout the duration of the project, the Project Manager may require more detailed breakdowns of activities, logic, and schedule submittals from the Contractor.

H. Updated Schedules: Submit at monthly intervals or as directed by the Project Manager. The schedule shall reflect all changes occurring since the last update including the following:

1. Activities started and completed during the previous period.

2. The estimated duration to complete each activity that was started but not completed.

3. Percentage of cost payable for each activity.

4. Modifications and pending proposed changes.

5. Narrative report describing current and anticipated problem areas or delaying factors with their impact together with an explanation of corrective actions taken or proposed.

I. Failure on the part of the Contractor to submit updated schedules may be grounds for the Project Manager to withhold progress payments for items noted on the schedule.

J. Contractor shall prosecute the work according to the CPM Schedule. The Project Manager shall rely on the reviewed Contractor's CPM Schedule and regular updates for planning and coordination. The Project Manager's review of the Contractor's CPM Construction Schedule does not relieve the Contractor of its obligation to complete the work within the allotted contract time. Nor does the review grant, reject or in any other way act on the Contractor's request for adjustments to complete remaining contract work, or for claims of additional compensation. These requests shall be processed in accordance with other relevant provisions of the contract.

K. If the Project Manager issues a field order or change order or other directive that affects the sequence or duration of work activities noted on the construction progress schedule, the Contractor shall promptly update the schedule. To accomplish this update, add, delete or revise the work activities noted or change the logic in the schedule to show the Contractor's plan to incorporate the change into the flow of work. All change orders and time extension requests that affect the construction schedule shall be evaluated based on their impact on the approved Construction Schedule.

L. If the current work is behind schedule or projected to be behind schedule, such as negative float on a critical activity or inability to meet the Contract Completion Date, the Project Manager may require the Contractor, at the Contractor's cost, to take remedial measures to get the project back on schedule. This may require increasing the work force, working overtime and weekends, air freighting materials, or other similar actions.

M. If at any time the Project Manager determines that any critical activity has fallen behind the CPM schedule by fifteen (15) calendar days or more, the Contractor shall submit a remedial plan to recapture the lost scheduled time. Include a revised schedule. Furnish the remedial plan no later than seven (7) calendar days from Project Manager's notification.

N. If an accelerated schedule is proposed, refer to DHHL CONSTRUCTION GENERAL CONDITIONS, Section 7.22 – CONSTRUCTION SCHEDULE.

2.03 SCHEDULE OF PRICES

A. Furnish a schedule of prices per Project Manager.

B. Provide a breakdown of the Contract Sum in enough detail to facilitate developing and the continued evaluation of Payment Applications. Provide several line items for principal subcontract amounts, or for materials or equipment purchased or fabricated and stored, but not yet installed, where appropriate. Round amounts to nearest whole dollar; total shall equal the Contract Price.

C. Each item in the Schedule of Prices and Payment Application shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

2.04 PAYMENT APPLICATION

A. Use the Schedule of Prices as the Monthly Construction Progress Report. Each Payment Application shall be consistent with previous applications and payments. The Project Manager shall determine the appropriateness of each payment application item.

B. Payment Application Times: The date for each progress payment is the last day of each month. The period covered by each Payment Application starts on the first day of the month or following the end of the preceding period and ends on the last day of the month.

C. Updating: Update the schedule of prices listed in the Payment application when Change Orders or Contract Modifications result in a change in the Contract Price.

D. Provide a separate line item for each part of the Work where Payment Application may include materials or equipment purchased or fabricated and stored, but not yet installed.

E. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance or bonded warehousing if required.

F. Provide separate line items for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

G. Payment Application Forms: Use and submit copies of the Payment Application and Construction Progress forms provided by DHHL. Forms are available at DHHL's District office. Furnish seven (7) copies.

H. Application Preparation: Complete every entry on form. Execute by a person authorized to sign legal documents on behalf of the Contractor.

1. Entries shall match data on the Schedule of Prices and Contractor's Construction Schedule. Use updated schedules if revisions were made. Include amounts of Change Orders and Contract Modifications issued before last day of construction period covered by application.

I. No payment will be made until the following are submitted each month:

1. Monthly Estimate, seven (7) copies.
2. Monthly Progress Report, seven (7) copies.
3. Statement of Contract Time, seven (7) copies.
4. Updated Submittal Register, one (1) copy.
5. Updated Progress Schedule, one (1) copy.
6. All Daily Reports, one (1) copy.
7. All Payroll Affidavits for work done, one (1) copy.

J. Retainage: DHHL will withhold retainage in compliance with the DHHL CONSTRUCTION GENERAL CONDITIONS, Section 8.6 – RETAINAGE.

K. Transmittal: Submit the signed original and six (6) copies of each Payment Application for processing.

2.05 GENERAL CONTRACTOR AND SUBCONTRACTORS DAILY PROGRESS REPORTS

A. The General Contractor is responsible for submitting the General Contractor and Subcontractor Daily Progress Reports (Daily Reports) for the General Contractor, all subcontractors, and any lower-tier subcontractors.

B. The form of the Daily Reports shall be as directed by the Project Manager. A separate report shall be made and submitted for the General Contractor (each calendar day) and each subcontractor (each day worked). The report shall include the following information for each employer: Name of General Contractor or Subcontractor, Report Number, Contract Day (consecutive calendar day from Notice to Proceed (NTP) Date), Date worked, work location and description, number of workers, trade/labor classification, and work hours. For General Contractor, only the Contract Day is required because the Report Number will be the same number.

C. The Daily Reports shall be prepared from the project NTP Date. Daily Reports shall continue to be prepared and submitted up to the Project Acceptance Date. After the Project Acceptance Date, Daily Reports will be submitted for days worked only, and continue to date of Contract Completion Notice. Running Contract Day will stop at Project Acceptance Date.

D. Submit/upload copies of the previous day's reports to the appropriate online folder(s) within DHHL's web based construction management system as directed by the Project Manager by 10:00 a.m. of the next working day.

E. Daily Reports can be handwritten in the field, and shall be uploaded by the General Contractor to DHHL 's web based construction management system. The reports shall use the following file naming convention:

CN R# CD# YYMMDD

CN:	Company Name of General Contractor or Subcontractor (2 capital letters)
R#:	Daily Report number (3 digits, used only by Subcontractor)
CD#:	Contract Day (consecutive calendar day from NTP Date, 3 digits)
YYMMDD:	Report Date in numerals (year, month, day, 6 digits)
Examples:	HS 011 015 170314, for Honolulu Subcontractor, Inc.
	HG 015 170314, for Honolulu General Contractor, Inc.

F. Refer to the SPECIAL CONDITIONS for additional requirements for the CONTRACTOR'S DAILY REPORT.

PART 3 – EXECUTION – Not Used

END OF SECTION

SECTION 01330 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Comply with the GENERAL CONDITIONS “Shop Drawings and Other Submittals” section and “Material Samples” section.

B. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

C. Related Sections include the following:

1. SECTION 01320 - CONSTRUCTION PROGRESS DOCUMENTATION for submitting schedules and reports, including Contractor’s Construction Schedule and the Submittals Schedule.

2. SECTION 01340 – DRAWINGS TO BE FURNISHED BY THE CONTRACTOR for Contractor Construction submittals, such as Shop Drawings and Requests for Information.

3. SECTION 01770 - CLOSEOUT PROCEDURES for submitting warranties, project record documents and operation and maintenance manuals.

1.02 SUBMITTAL PROCEDURES

A. Coordinate Work and Submittals: Contractor shall certify the submittals were reviewed and coordinated.

B. Submittal Certification: Provide in MS Word when submitting electronically. Project Manager will provide an electronic copy of the Submittal Certification. Provide a reproduction (or stamp) of the “Submittal Certification” and furnish the required information with all submittals. Include the certification on:

1. The title sheet of each shop drawing, or on

2. The cover sheet of submittals in 8-1/2-inch x 11-inch format, or on

3. One face of a cardstock tag (minimum size 3-inch x 6-inch) tied to each sample. On the sample tag, identify the sample to ensure sample can be matched to the tag if accidentally separated. The opposite face of the tag will be used by the Project Manager to receive, review, log stamp and include comments.

C. Variances: The Contractor shall request approval for a variance. Clearly note any proposed deviations or variances from the Specifications, Drawings, and other Contract Documents on the submittal and also in a separately written letter accompanying the submittal.

D. Submittal Certification Form (stamp or digital)

CONTRACTOR'S NAME: _____

PROJECT: _____

DHHL PROJECT NO: _____

As the General Contractor, we checked this submittal and we certify it is 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.

SUBMITTAL NUMBER _____ DATE RECEIVED _____

REVISION NUMBER _____ DATE RECEIVED _____

SPECIFICATION SECTION NUMBER /PARAGRAPH NUMBER _____

DRAWING NUMBER _____

SUBCONTRACTOR'S NAME _____

SUPPLIER'S NAME _____

MANUFACTURER'S NAME _____

NOTE: DEVIATIONS FROM THE CONTRACT DOCUMENTS ARE PROPOSED AS FOLLOWS (Indicate "NONE" if there are no deviations)

_____

_____

_____

CERTIFIED BY	

Note: Form can be combined with Design Consultant's Review stamp. This is available from the Project Manager.

PART 2 - PRODUCTS – (Not Used)

PART 3 - EXECUTION

3.01 SUBMITTAL REGISTER AND TRANSMITTAL FORM

A. Contractor shall use submittal register and transmittal forms as directed by the Project Manager.

B. The listing of required submittals within this Section is provided for the Contractor's convenience. Review the specification technical sections and prepare a comprehensive listing of required submittals. Furnish submittals to the Project Manager for review.

C. Contractor shall separate each submittal item by listing all submittals in the following groups with the items in each group sequentially listed by the specification section they come from:

1. Administrative
2. Data
3. Tests
4. Closing

D. Contractor shall separate all different types of data as separate line items all with the column requirements.

E. Contractor shall send monthly updates and reconciled copies electronically to the Project Manager and the Design Consultant in MS Word or MS Excel or other format as accepted by the Project Manager.

Section No. – Title	Shop Drawings & Diagrams	Samples	Certificates (Material, Treatment, Applicator, etc.)	Product Data, Manufacturer's Technical Literature	MSDS Sheets	Calculations	Reports (Testing, Maintenance, Inspection, etc.)	Test Plan	O & M Manual	Equipment or Fixture Listing	Schedules (Project Installation)	Maintenance Service Contract	Field Posted As-Built Drawings	Others	Guaranty or Warranty	Manufacturer's Guaranty or Warranty (Greater than one year)
01310 – Project Management and Coordination											■			■		
01320 – Construction Progress Documentation											■			■		
01330 – Submittal Procedures			■											■		
01340 – Drawings to be Furnished by the Contractor	■												■			
01770 – Closeout Procedures	■												■	■	■	
02050 – Demolition and Removal														■		
02500 – Road Pavement							■				■		■		■	
02713 – Water Distribution							■				■		■			
02531 – Sanitary Sewerage							■				■		■			
03310 – Cast-in-place-Concrete (Reservoir)	■						■				■		■		■	
15130 – Booster Pump Units	■						■		■	■	■		■		■	■
15193 – Fuel Systems (Diesel)	■						■		■	■	■		■		■	■
15400 – Plumbing	■						■			■	■		■			

Section No. – Title	Shop Drawings & Diagrams	Samples	Certificates (Material, Treatment, Applicator, etc.)	Product Data, Manufacturer's Technical Literature	MSDS Sheets	Calculations	Reports (Testing, Maintenance, Inspection, etc.)	Test Plan	O & M Manual	Equipment or Fixture Listing	Schedules (Project Installation)	Maintenance Service Contract	Field Posted As-Built Drawings	Others	Guaranty or Warranty	Manufacturer's Guaranty or Warranty (Greater than one year)
15653 – Ventilation	■						■			■	■		■		■	■
15830 – Ceiling Fans	■						■			■	■		■		■	■
16000 – Electrical Work	■								■	■	■		■			■
16020 – 3 Ph. Distribution Transformer	■						■		■	■	■		■		■	■

END OF SECTION

SECTION 01340 - DRAWINGS TO BE FURNISHED BY CONTRACTOR

The following shall supplement the General Conditions.

1.01 Shop drawings and submittals shall be made in accordance with Section 5.5 - Shop Drawings and Other Submittals of the General Conditions.

1.02 All submittals, RFIs, change requests and other documentation shall be submitted electronically via Newforma.

1.03 The Contractor's stamp and verification of drawings shall consist of the following format:

HOOLEHUA WATER SYSTEM IMPROVEMENTS
DHHL CONTRACT NO. IFB-18-HHL-008

(Contractor's Name) _____

(Signature) _____ (Date) _____

This submittal has been checked and verified in accordance with the requirements of the contract documents and any equipment submitted herewith can be installed in the allocated spaces.

Submittal No. _____

Specification Section No. _____

Paragraph No. _____

Contract Drawing Ref. _____

Subcontractor _____

Supplier _____

Manufacturer _____

Exceptions Taken: Yes _____ No _____

Details of Exception _____

_____

_____

1.04 The person signing the Contractor's submittal stamp shall be the one designated under the contract agreement with the DHHL. The signature shall be in original ink. Stamped signature will not be acceptable. Submittal forms shall be completely filled out, signed and dated.

1.05 All changes made to the submittal drawings by the Contractor in the form of written or typewritten markings shall be initialed and dated by the Contractor.

1.06 When the Contractor takes any exception to the submittal drawings, such exception shall be brought to the attention of the Engineer. The exception shall be submitted with the shop drawings together with sufficient details and justifications.

1.07 Within thirty (30) days after receipt of notice to proceed, the Contractor shall submit to the Engineer in duplicate, a schedule, listing all items that will be submitted for review and approval action by the DHHL, the State Department of Transportation, or the County of Maui. The schedule shall include, among other things, a list of shop drawings and manufacturer's literature, certificates of compliance, material samples, and guarantees.

The schedule shall indicate the type of item, contract requirement reference; the Contractor's scheduled date for submitting the above items and projected needs for approval answers and procurement dates. In preparing the schedule, adequate time (minimum of 15 days) shall be allowed for review and approval; additional time shall be allowed to provide for possible resubmittal. Also, the scheduling shall be coordinated with the approved progress schedule.

1.08 The Contractor shall maintain at the job site two sets of full size contract drawings, marking them in red to show all variations between the construction actually provided and that indicated or specified in the contract documents, including buried or concealed herein, or where variations in scope or character of work from that of the original contract are authorized, the drawings shall be marked to define the construction actually provided. Where equipment installation is involved, the size, manufacturer's name, model number and power input or output characteristics are applicable shall be shown on the as-built drawings. The representations of such changes shall conform to standard and detail as necessary to clearly portray the as-built construction. The drawings shall be maintained and updated on a daily basis.

Monthly and final payments of the Contactor shall be subject to prior approval of the drawings.

On completion of the work, both sets of marked-up drawings shall be delivered to the Engineer, and shall be subject to his approval before acceptance.

END OF SECTION

SECTION 01430 - ENVIRONMENTAL PROTECTION

PART 1 - GENERAL

1.01 GENERAL: This section covers prevention of environmental pollution and damage during and as the result of construction operations under this contract and for those measures set forth in other sections of the TECHNICAL SPECIFICATIONS. For the purpose of this specification, environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to utility of the environment for aesthetic, cultural and/or historical purposes. The control of environmental pollution and damage requires consideration of air, water, and land, and includes management of visual aesthetics, noise, solid waste, as well as other pollutants. It is the responsibility of the Contractor to investigate and comply with all applicable Federal, State and County laws and regulations concerning environmental protection and pollution control, and to secure all necessary permits.

1.02 SUBMITTALS: The Contractor shall submit an environmental protection plan in accordance with the provisions as herein specified. Environmental protection plan shall include but not be limited to the following:

A. Methods for protection of features to be preserved within authorized work areas. The Contractor shall prepare a listing of methods to protect resources needing protection; i.e., trees, shrubs, vines, grasses and ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, archaeological, and cultural resources.

B. Procedures to be implemented to provide the required environmental protection and to comply with all applicable laws and regulations. The Contractor shall set out the procedures to be followed to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures set out in accordance with the environmental protection plan.

C. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles or spoil material.

D. Environmental monitoring plans for the job site, including land, water, air and noise monitoring.

E. Methods of protecting surface and groundwater during construction activities.

F. Training for his personnel during the construction period.

1.03 IMPLEMENTATION: After receipt of Notice to Proceed, the Contractor shall submit in writing the above environmental protection plan for approval of the Engineer within 15 days after Notice to Proceed. Approval of the Contractor's plan will not relieve the Contractor of his responsibility for adequate and continuing control of pollutants and their environmental protection measures.

1.04 SUBCONTRACTORS: Assurance of compliance with this section by subcontractors will be the responsibility of the Contractor.

1.05 NOTIFICATION: The Engineer will notify the Contractor in writing of any observed noncompliance with the aforementioned Federal, State or local laws or regulations, permits, and other elements of the Contractor's environmental protection plan. The Contractor shall, after receipt of such notice, inform the Engineer of proposed corrective action and take such action as may be approved. If the Contractor fails to comply promptly, the Engineer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or costs or damages allowed to the Contractor for any such suspension.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PROTECTION OF ENVIRONMENTAL RESOURCES: The environmental resources within the project boundaries and those affected outside the limits of permanent work under this contract shall be protected during the entire period of this contract. The Contractor shall confine his activities to areas defined by the drawings and specifications.

3.02 PROTECTION OF LAND RESOURCES: Prior to the beginning of any construction, the Contractor shall identify all land resources to be preserved within the Contractor's work area. Except in areas indicated on the drawings or specified to be cleared, the Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without special permission from the Engineer. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. Where such special emergency use is permitted, the Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs.

A. Work Area Limits: Prior to any construction, the Contractor shall mark the areas that are not required to accomplish all work to be performed under this contract. Isolated areas within the general work area, which are to be saved and protected, shall also be marked or fenced. Monuments and markers shall be protected before construction operations commence. Where construction operations are to be conducted during darkness, the markers shall be visible. The Contractor shall convey to his personnel the purpose of marking and/or protection of all necessary objects.

B. Protection of Landscape: Trees, shrubs, vines, grasses, land forms and other landscape features indicated and defined on the drawings to be preserved shall be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques.

C. Reduction of Exposure of Unprotected Erodible Soils: Earthwork brought to final grade shall be finished as indicated and specified. Side slopes and back slopes shall be protected as soon as practicable upon completion of rough grading. All earthwork shall be planned and conducted to minimize the duration of exposure of unprotected soils. Runoff from the construction site shall be controlled by construction of diversion ditches, benches, and berms to retard and divert runoff to protected drainage courses.

D. Disposal of Solid Waste by Removal From State Property: The Contractor shall transport all solid waste off State property and dispose of it in compliance with Federal, State and local requirements for solid waste disposal.

E. Disposal of Chemical Waste: Chemical waste shall be stored in corrosion resistant containers, removed from the work area and disposed of in accordance with Federal, State, and local regulations.

3.03 PROTECTION OF WATER RESOURCES: The Contractor shall keep construction activities under surveillance, management and control to avoid pollution of surface and groundwaters. Special management techniques as shall be implemented to control water pollution.

A. Protection of Waterways: Construction of drainage facilities as well as performance of other contract work which will contribute to the control of siltation shall be carried out in conjunction with the earthwork operations or as soon as thereafter as is practicable.

Prior to or during any suspension of construction operations for any appreciable length of time, the Contractor shall provide for any temporary erosion control measures deemed necessary. Such measures shall be continued until the permanent drainage facilities have been constructed and when called for, until the protective ground cover is sufficiently established to be an effective erosion deterrent. Should such measures fail and an appreciable quantity of material begins to erode into the natural waterway, the Contractor shall act immediately to bring the siltation under control.

B. Pollution: The Contractor shall exercise every reasonable precaution throughout the life of the project to prevent pollution of rivers, streams or impoundments. Pollutants such as chemicals, fuels, lubricants, bitumens, raw sewage and other harmful waste shall not be discharged into or alongside of the stream, or into natural or manmade channels leading thereto. The Contractor shall also comply with the applicable regulations of the State Department of Land and Natural Resources and other statutes relating to the prevention and abatement of pollution.

The Contractor shall conduct his operations near harbors, bays, swimming and water recreation areas, to avoid and minimize pollution. He shall comply with the applicable regulations of the United States Department of Interior, State Department of Health and other authority having jurisdiction.

Monitoring of water areas affected by construction activities shall be the responsibility of the Contractor. All water areas affected by construction activities shall be monitored by the Contractor.

3.04 PROTECTION OF FISH AND WILDLIFE RESOURCES: The Contractor shall keep construction activities under surveillance, management and control to minimize interference with, disturbance to and damage of fish and wildlife.

3.05 PROTECTION OF AIR RESOURCES: The Contractor shall keep construction activities under surveillance, management and control to minimize pollution of air resources. All activities, equipment, processed, and work operated or performed by the Contractor in accomplishing the specified construction shall be in strict accordance with the State of Hawaii Public Health Regulations, Chapter 43, "Air Pollution Control." Special management techniques as set out below shall be implemented to control air pollution by the construction activities, which are included in the contract.

A. Particulates: Dust particles, aerosols, and gaseous by-products from all construction activities and processing and preparation of materials shall be controlled at all times, including weekends, holidays and hours when work is not in progress. The Contractor shall maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause the air pollution standards mentioned above to be exceeded or which would cause a hazard or a nuisance. Sprinkling or other methods approved by the Engineer will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated at such intervals as to keep the disturbed area damp at all times. The Contractor must have sufficient competent equipment available to accomplish this task. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs.

B. Hydrocarbons and carbon monoxide emissions from equipment shall be controlled to Federal and State allowable limits at all times.

C. Odors shall be controlled at all times for all construction activities, processing and preparation of materials.

D. Monitoring of air quality shall be the responsibility of the Contractor. All air areas affected by the construction activities shall be monitored by the Contractor.

3.06 PROTECTION FROM SOUND INTRUSIONS: The Contractor shall adhere to the requirements of the Department of Health and shall implement acceptable noise abatement methods to minimize the construction noise level.

Noise shall be kept within acceptable levels at all times in conformance with Title II, Administration Rules, Chapter 43, Community Noise Control, State Department of Health, Public Health Regulations. The Contractor shall obtain the pay for community noise permit from the State Department of Health when the

construction equipment or other devices emit noise at levels exceeding the allowable limits.

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

3.07 POST CONSTRUCTION CLEANUP: The Contractor shall clean up areas used for construction.

3.08 RESTORATION OF LANDSCAPE DAMAGE: The Contractor shall restore all landscape features damaged or destroyed during construction operations outside the limits of the approved work areas. Such restoration shall be in accordance with the plan submitted for approval by the Engineer. This work will be accomplished at the Contractor's expense.

3.09 MAINTENANCE OF POLLUTION CONTROL FACILITIES: The Contractor shall maintain all constructed facilities and portable pollution control devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

3.10 TRAINING OF CONTRACTOR PERSONNEL IN POLLUTION CONTROL: The Contractor shall train his personnel in all phases of environmental protection. The training shall include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, and installation and care of facilities (vegetative covers and instruments required for monitoring purposes) to ensure adequate and continuous environmental pollution control.

END OF SECTION

SECTION 01440 - ARCHAEOLOGICAL FINDINGS

PART 1 - GENERAL

1.01 PRESERVATION AND RECOVERY OF HISTORICAL, ARCHAEOLOGICAL. AND CULTURAL RESOURCES: Existing historical, archaeological, and cultural resources within the Contractor's work area will be so designated by the Engineer if any have been identified. The Contractor shall take precautions to preserve all such resources as they existed at the time they were pointed out to him. The Contractor shall provide and install all protection for these resources so designated and shall be responsible for their preservation during this contract. If during excavation or other construction activities in areas with existing or known resources, as well as in any other work area, any previously unidentified or unanticipated resources are discovered or found, all activities that may damage or alter such resources shall be temporarily suspended. Such temporary suspension of work shall not be attributable to the Contractor. These resources of cultural remains (prehistoric or historic surface or subsurface) include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rocks or coral alignments, parings, wall, or other constructed features; and any indication or agricultural or other uses. Upon such discovery or find, the Contractor shall immediately notify the Engineer. When so notified, the Engineer will notify the State Historic Preservation Officer (SHPO) for further direction.

As directed by the Engineer, the Contractor may be allowed to continue any operation which would not further disturb the site(s); however, all work within the protected area shall be suspended until the Engineer is notified by the SHPO that all investigations or salvage operations have been completed.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01567 - POLLUTION CONTROL

PART 1 – GENERAL

1.01 GENERAL CONDITIONS

GENERAL REQUIREMENTS AND COVENANTS: The General Conditions, General Specifications, Special Conditions, and other applicable documents preceding these specifications shall govern all work specified hereinafter in all Divisions and Sections.

1.02 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 DHHL CONSTRUCTION GENERAL CONDITIONS, Section 7.16 - Responsibility for Damage Claims.

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 43 - 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 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. Drainage outlets and silting basing shall be constructed and maintained as shown on the plans to minimize erosion and pollution of waterways during construction.

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 unless otherwise permitted in the SPECIAL PROVISIONS.

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 under Section 09900 - Painting, such spray painting shall be done by the "airless spray" process. Other types of spray painting will not be allowed.

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 be done by force account as described in DHHL CONSTRUCTION GENERAL CONDITIONS Section 4.2a – Additional Work and paid for in accordance with Section 8.4b – Force- Account Work therein. The count of elapsed working days to be charged against the contract in this situation shall be computed in accordance with DHHL CONSTRUCTION GENERAL CONDITIONS, Section 7.18 – Contract Time.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

SECTION 01750 - GUARANTEE

PART 1 - GENERAL

1.01 GENERAL

A. The Contractor guarantees all materials and equipment furnished to be in operable condition upon final acceptance of the work and that all such materials and equipment conform to the requirements of this contract and be fit for the use intended.

B. He further guarantees all such materials and equipment against defects and poor workmanship and, to the extent that he is responsible for design, the Contractor guarantees the design to meet the criteria and operating requirements specified against failure to perform in accordance with such criteria and operating requirements.

C. The period of this guarantee shall commence upon acceptance of the work by the appropriate agency, and shall extend through the project performance evaluation period not to exceed 1 year for all materials and equipment, provided that this period shall be extended from the time of correction of any defect or failures, corrected under the terms of this guarantee, for a like period for the corrected work.

D. The Contractor shall correct all defects or failures discovered within the guarantee period. The appropriate agency will give the Contractor prompt written notice of such defects or failures following their discovery. The Contractor shall commence corrective work within five (5) days following notification and shall diligently prosecute such work to completion. The Contractor shall bear all costs of corrective work, which shall include necessary disassembly, transportation, reassembly and retesting, as well as repair or replacement of the defective material or equipment, and any necessary disassembly and reassembly of adjacent work.

E. Any period that a particular equipment is not operable due to its failure shall not be considered as a part of the guarantee period. The guarantee period shall be extended for a like period. If due to failure of other equipment the equipment is unable to perform its intended function, the guarantee period shall be extended for a like period. Time that equipment is operating shall be counted as applying to the warranty. Such time shall be determined by use of plant operator's log or other suitable documentation.

F. If the Contractor falls to perform corrective work in the manner and within the time stated, the Department of Hawaiian Home Lands (DHHL) may proceed to have such work performed at the Contractor's expense and his sureties will be liable therefor. The DHHL shall be entitled to reasonable attorney's fees and court costs necessarily incurred by the Contractor's refusal to honor and pay such costs of corrective work.

G. The Contractor's performance bond shall continue in full force and effect during the period of this guarantee.

H. The rights and remedies of the DHHL under this provision do not preclude the exercise of any other rights or remedies provided by this contract or by law with respect to unsatisfactory work performed by the Contractor.

I. This guarantee shall be deemed supplemental to guarantee provisions provided in other sections of the specifications for the individual units and systems of units so specified.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01770 – CLOSE-OUT PROCEDURES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

Close-Out Procedures shall be made in accordance with DHHL's General Conditions Section 7.31.1 – SUBSTANTIAL COMPLETION.

1.02 SUMMARY

A. This Section outlines the DHHL Close-Out documents requirements. It includes information about the distribution process, the format and quantities of various types of information, and the internal review process for document acceptance. Fulfillment of these requirements is a condition precedent to the Contractor receiving final payment.

1. Project Record Documents.

2. Operation and Maintenance Manuals.

3. Warranties.

4. Instruction for the State's personnel.

B. Transmittal Memo

All Close-Out documents will be submitted to the designated Construction Manager with a Transmittal Memo. The Transmittal Memo must include the following information:

- Date of Conveyance
- Project Name
- IFB Number
- Contract Number
- DHHL Project Manager
- Contractor Name
- Contractor Address
- Name/Transmitting Signature of Contractor Agent
- Name/Telephone Number of Document Submitter
- List of documents transmitted

C. Document Types and Formats

MATERIALS	FORMAT
Transmittal Summary	
Documents Transmittal Memo	Word or Excel*
Project Operations and Maintenance	
Project Manual with Specifications	Searchable PDF*
Operation and Maintenance Manuals	Searchable PDF*
Guaranty / Warranty Materials	PDF*
Testing / Inspection Certifications	PDF*
Record Documents	
Site Survey	CAD & PDF*
Shop Drawings	CAD & PDF*
As-Built Drawings	CAD & PDF*
Scope, Cost and Schedule Data	PDF
Final Cost Summary by account	
Final Schedule of equipment/valves/etc. submitted by General Contractor	
Final Schedule	
Final Chart to provide project description and scope.	
Final Executive Summary	
Other Documents	
Other documents – addenda, change order, project correspondence files, etc.	(As needed) *
Reports, including photographic records	PDF*
Electronic files (photos, scanned documents)	JPEG, PDF*
*See notes on CAD / Electronic documents	

1.03 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting a Final Inspection, complete the following in addition to the requirements of the GENERAL CONDITIONS:

1. Advise the Project Manager of pending insurance changeover requirements.

2. Submit specific warranties, final certifications, and similar documents.

3. Arrange to deliver tools, spare parts, extra materials, and similar items to a location designated by the DHHL Project Manager. Label with manufacturer's name and model number where applicable.

4. Complete startup testing of systems.

5. Submit test, adjust, and balance records.

6. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.

7. Complete final cleaning requirements, including touch up painting.

8. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

9. Submit the Operation and Maintenance (O&M) Manual(s) for review

1.04 FINAL COMPLETION

A. Preliminary Procedures: Within ten (10) days from the Project Acceptance Date, complete the following items in addition to the requirements of the GENERAL CONDITIONS:

1. Instruct the State's personnel in operation, adjustment, and maintenance of products.

1.05 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit two (2) copies of any updated and action-taken list. In addition to the requirements of the GENERAL CONDITIONS, include name and identification of each area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list in sequential order.

2. Include the following information at the top of each page:

a. Project Name and Title.

b. DHHL IFB No.

c. DHHL Contract No.

d. Date and page number.

e. Name of Contractor.

1.06 PROJECT RECORD DOCUMENTS AND REQUIREMENTS

A. General:

1. Definition: “Project Record Documents”, including Record Drawings, shall fulfill the requirements of “Field-Posted As-Built Drawings” listed in the GENERAL CONDITIONS.

2. Do not use Project Record Documents for daily construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Project Manager’s reference during normal working hours. Maintain these documents as specified in paragraph entitled “Record Drawings” hereinafter.

3. The Design Consultant, under contract with the State, will update the drawings to show all addendum, Post-Contract Drawing (PCD), and sketch changes. The Contractor will transmit these drawings to the Construction Manager who will sent to the Design Consultant to make all “red-line” corrections to these drawings to record the changes depicted on the Contractor’s Field Posted Record (“As-Builts”) by accepted drafting practices as approved by the Project Manager.

4. Where the recorded changes depicted on the Contractor’s Field Posted Record (“As-Builts”) are in the form of shop drawings, the Contractor shall provide those shop drawings in the same material and size as the drawings transmitted to the Contractor. The new drawing sheets shall be titled and numbered to conform to the construction drawings and clearly indicate what information they supersede in the actual construction drawings. For example: a new drawing that replaces drawing C-3, could be numbered C-3a.

5. The Contractor shall bring to the attention of the Construction Manager any discrepancy between the changes made by the Design Consultant and those depicted on addendum, PCD, and sketch changes. The Manager will resolve any conflicts.

6. Submit final Record Documents (Field Posted Record Drawings) within ten (10) days after the Final Inspection Date but no later than the Contract Completion Date, unless the General conditions require an earlier submittal date.

7. The Contractor shall guarantee the accuracy of its final Record Documents. The State will hold the Contractor liable for costs the State incurs as a result of inaccuracies in the Contractor’s Record Documents.

8. Prepare and submit construction photographs and electronic files, damage or settlement surveys, property surveys, and similar final record information as required by the Project Manager.

9. Deliver tools, spare parts, extra materials, and similar items to a location designated by the Project Manager. Label with manufacturer’s name and model number where applicable.

10. Submit final/corrected Operation and Maintenance Manual(s).

B. Record Drawings:

1. Maintain a duplicate full-size set of Field Posted Record (“As-Built's”) Drawings at the job site. Clearly and accurately record all deviations from alignments, elevations and dimensions, which are stipulated on the drawings and for changes directed by the Project Manager that deviate from the drawings.

2. Record changes immediately after they are constructed in place and where applicable, refer to the authorizing document (Addenda, Field Order, Change Order, or Contract Modification). Use red pencil to record changes. Make Field Posted Record Drawings available to the Project Manager at any time so that its clarity and accuracy can be monitored.

    a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.

    b. Accurately record information in an understandable drawing technique.

    c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

    d. Mark the contract drawings or the shop drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on contract drawings.

    e. Mark important additional information that was either shown schematically or omitted from original Drawings.

    f. Locate concealed building utilities by dimension from bench marks or permanent structures. Locate site utilities by dimensions, azimuth and lengths from bench marks or permanent structures.

    g. Note field order numbers, Change Order numbers, Contract Modification numbers, Alternate numbers, post-construction drawing numbers (PCD) and similar identification (RFI numbers) where applicable.

    h. The Contractor shall initial each deviation and each revision marking.

3. Use the final updated Contract Drawing set plus applicable shop drawings for making the final Field Posted Record Drawings submittal.

4. Certify drawing accuracy and completeness. Label and sign the record drawings.

5. Label the title sheet and on all sheets in the margin space to the right of the sheet number, written from the bottom upward, with the title “FIELD POSTED RECORD DRAWINGS” and certification information as shown below. Provide a signature line and company name line for each

subcontractor that will also certify the respective drawing. Adjust size to fit margin space.

THESE FIELD POSTED AS-BUILT DRAWINGS ARE ACCURATE AND COMPLETE.

Certified By: _____ Date:_____

Company:_____

6. Revise the Drawing Index and label the set "FIELD POSTED RECORD DRAWINGS". Include the label "A COMPLETE SET CONTAINS [_____] SHEETS" in the margin at the bottom right corner of each sheet. Quantify the total number of sheets comprising the set.

7. If the Project Manager determines a drawing does not accurately record a deviation or omits relevant information, the State will correct any FIELD POSTED RECORD DRAWINGS sheet. Contractor will be charged for the State's cost to correct the error or omission.

8. Use the final Field Posted Record Drawings sheets to create one electronic version of the set. The set shall be recorded in Adobe Acrobat PDF (Portable Document Format). Create a single indexed, bookmarked PDF file of the entire set of drawings and record on the CD. Submit one set of the final Field Posted Record Drawings sheets and the complete electronic CD set(s).

1.07 WARRANTIES

A. Submittal Time: Submit written manufacturer's warranties at request of the Project Manager for designated portions of the Work where commencement of warranties other than Project Acceptance date is indicated.

B. Organize manufacturer's warranty documents into an orderly sequence based on the table of contents of the Specifications.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-inch x 11-inch paper.

2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer and prime contractor.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES", Project Name and Title, IFB Number, Contract Number, and name of Contractor.

4. Use the final submittal of the warranties to create an electronic Adobe Acrobat PDF (Portable Document Format) version of the bound warranty documents files. Each sheet shall be separately scanned, at 600 DPI or

better into a PDF file, indexed and recorded on a recordable compact disc (CD).

C. Provide three (3) sets of manufacturer's warranties that exceed one year and one CD as part of the closing document submittals. Provide additional copies of each warranty to include in operation and maintenance manuals.

1.08 OPERATION AND MAINTENANCE MANUALS

A. Assemble complete sets of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:

The Contractor shall bind and turn over to the Construction Manager three (3) sets of manufacturers' warranties and operating data and/or maintenance manuals of each system, subsystem, and piece of equipment not part of a system, instructions or schedules for all equipment and special materials requiring them, and associated copies of testing reports and certificates. The three (3) binders will categorize and index each piece of equipment and material included using a Construction Specifications Institute (CSI) format to be provided by the DHHL, and shall be clearly marked noting "project specific" equipment, model numbers, and equipment cut sheets, value tag charts, electrical panel charts and other applicable information. As mentioned above, all pages of the manuals must be submitted in digital format. Such manuals will be collected and organized by the Contractor and submitted to the Construction Manager, after review by the Construction Manager, prior to the issuance of the certificate of Substantial Completion. Except for the changes noted in this section, the Contractor will follow the procedure outlined in the Standard General Conditions. Include operation and maintenance data required in individual Specification Sections and as follows:

1. Operation Data:

   a. Emergency instructions and procedures.

   b. System, subsystem, and equipment descriptions, including operating standards.

   c. Operating procedures, including startup, shutdown, seasonal, and weekend operations.

   d. Description of controls and sequence of operations.

   e. Piping diagrams.

2. Maintenance Data:

   a. Manufacturer's information, Material Safety Data Sheets, and a list of spare parts.

b. Name, address, and telephone number of installer or supplier.

c. Maintenance procedures.

d. Maintenance and service schedules for preventive and routine maintenance.

e. Maintenance record forms.

f. Sources of spare parts and maintenance materials.

g. Copies of maintenance service agreements.

h. Copies of warranties and bonds.

B. Organize the Operation and Maintenance Manuals into suitable sets of manageable size. Submit two (2) sets prior to final inspection, bound in 8-1/2 x 11-inch text pages. Bind and index data in heavy-duty, “D” type 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Binder color shall be maroon, or if not available red. Identify each binder on front and spine with the printed title “OPERATION AND MAINTENANCE MANUAL”, Project Name and Title include building number when appropriate, DHHL Contract Number, IFB Number, Prepared For*:* Department of Hawaiian Home Lands*,* Prepared By*:* [Contractor] and Volume Number. Each binder is a single volume.

C. Electronic Format

1. Provide all information (narratives, drawings and manual) on a Compact Disc (CD). Provide drawings and plans prepared for the O&M Manuals drawn electronically and saved as a PDF file. Name and index the files for ease of identification and updates.

2. Provide the complete O&M Manual using Adobe Acrobat PDF (Portable Document Format) files. Each sheet shall be separately scanned into a PDF file, indexed, bookmarked, hyperlinked to the table of contents and recorded on a compact disc (CD). Scanned documents shall be scanned at 600 DPI or better. Indexes and bookmarks may be highlighted or colored text. The final submittal shall include written instructions for installing, accessing and retrieving information from the compact disc.

D. Pre-Final Submittal: Submit two (2) printed sets of Pre-Final Operation and Maintenance Manuals, for review by the DHHL Project Manager, at least five (5) days prior to scheduled final inspection. Manuals shall be marked as Pre-Final. Make any correction noted before submitting the final Operation and Maintenance Manuals.

1. The user and the DHHL will each keep one (1) copy of the Pre-Final submittal to operate and maintain the facility from the Project Acceptance Date through submission of the final submittal. Therefore, the submittal

shall contain all the required information that is available at the time of submission.

2. One (1) set will be returned with comments. Additional review comments may include problems discovered during the O&M Manual's review, site validation, and facility start up and will be provided to the Contractor after facility Project Acceptance Date.

E. Final Submittal: Use the final submittal of the manuals to create the electronic PDF file version of the bound Operation and Maintenance Manuals documents. Include the Submittal (100%) review comments along with a response to each item. Provide six (6) Final sets of the printed manuals and six (6) Final compact discs (CDs) as part of the closing document submittal. Final printed manual and disks shall be marked as Final.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.01 FINAL CLEANING

A. General: Execute final cleaning prior to final inspection. Provide final cleaning for each phase of work prior to starting the next phase. In addition to requirements of Article 7 of the GENERAL CONDITIONS conduct cleaning and waste-removal operations to comply with local laws and ordinances and federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Comply with manufacturers written instructions unless noted otherwise. Complete the following cleaning operations before requesting final inspection for entire Project or for a portion of Project:

1. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.

2. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits resulting from construction activities.

3. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.

4. Remove tools, construction equipment, machinery, and surplus material from Project site.

5. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

6. Remove debris and surface dust from limited access spaces, including: roofs, gutters, downspouts, drainage systems, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

7. Clean transparent materials, including mirrors and glass in doors and windows. Remove temporary labels, glazing compounds and other noticeable, and vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors, transparent glass, and glossy surfaces, taking care not to scratch surfaces.

8. Remove labels that are not permanent.

9. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

    a. Do not paint over “UL” and similar labels, including mechanical and electrical nameplates.

10. Leave Project clean and ready for occupancy.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the State’s property. Do not discharge volatile, harmful, or dangerous materials into drainage and sewer systems or onto State property. Remove waste materials from Project site and dispose of lawfully.

D. Adjust operation Products and equipment to ensure smooth and unhindered operation.

PART 4 – MEASUREMENT AND PAYMENT

4.01 BASIS OF MEASUREMENT AND PAYMENT

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

END OF SECTION

SECTION 02050 - DEMOLITION AND REMOVAL

PART 1 - GENERAL

1.01 SUMMARY

A. Accomplish all demolition, removal and related work indicated on or required by the plans, as specified herein.

1.02 GENERAL REQUIREMENTS

A. It shall be the responsibility of the Contractor to examine the project site and determined for himself the existing conditions.

B. Obvious conditions which exist on the site shall be accepted as part of the work, even though they may not be clearly indicated on the plans and/or described herein, or may vary therefrom.

C. All debris of any kind accumulated from the work of this Section shall be disposed of off the site.

D. Permits, Notices Etc.:

1. The Contractor shall procure and pay for all necessary permits or certificates that may be required in connection with this work.

2. The Contractor shall serve proper notice and consult with the Contracting Officer regarding any temporary disconnections or disruptions of plumbing or other utility lines in the area which may interfere with the removal work, and all such lines where necessary shall be properly disconnected before commencing with the work.

PART 2 – PRODUCTS: (NOT USED)

PART 3 - EXECUTION

3.01 DEMOLITION AND REMOVAL

A. All work shall be executed in an orderly and careful manner, with due consideration for all items to remain, and the Contractor shall be strictly responsible for any damages thereto.

B. REMOVAL OF CONCRETE SLABS AND ASPHALTIC CONCRETE: The Contractor shall remove all concrete slabs and/or asphaltic concrete pavements as indicated on the drawings. At the point where the pavement or slab is to remain, make a neat saw cut, 1” minimum depth unless otherwise indicated, prior to demolishing the portion of the pavement or slab indicated for removal.

3.02 MAINTAINING TRAFFIC

A. The Contractor shall conduct operations with minimum interference to

streets, driveways, sidewalks, etc.

B. When necessary, the Contractor shall provide, erect and maintain lights, barriers, etc. as required by traffic and safety regulations.

3.03 BARRICADE: Erect temporary barricades as required, to prevent people from entering into project area to the extent as approved by the Contracting Officer. Safe working conditions shall be maintained at all times for all personnel. The extent of barricade may be adjusted as necessary with the approval of the Contracting Officer. This work shall be accomplished at no extra cost to the State.

3.04 PROTECTION OF EXISTING PROPERTY: Adequately protect for the duration of the work all existing and adjoining structures, walkways, utilities, paving, trees and landscaping to remain.

3.05 USE OF EXPLOSIVES: Use of explosives shall not be permitted.

3.06 DUST NUISANCE: Keep the project area free of dust nuisance at all times by watering and/or brooming.

3.07 REPAIR OF EXISTING IMPROVEMENTS: All existing improvements, including roads, driveways, parking areas, walkways and landscaping not designated for demolition that have been damaged by construction activities, shall be repaired to the original condition and to the satisfaction of the Contracting Officer. Damage done by heavy equipment especially on roads not stable for such equipment shall be repaired to the original condition and to the satisfaction of the Contracting Officer.

3.08 CLEAN-UP AND DISPOSAL: From time to time and as directed by the Contracting Officer, and at the completion of the demolition and removal work, remove from the site all rubbish, debris, excess excavated material accumulated from this work and leave the area neat and clean to the satisfaction of the Contracting Officer. Debris shall be removed and transported in a manner that will prevent spillage on the streets or adjacent area.

END OF SECTION

SECTION 02100 – CLEARING AND GRUBBING

PART 1 – GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Conditions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED

A. Furnish all labor, materials, equipment and tools necessary to accomplish all clearing and grubbing work as indicated on the plans and as specified herein.

B. It shall be the responsibility of the Contractor to examine the project site and determine for himself the existing conditions.

C. Obvious conditions of the site existing on the date of the bid opening shall be accepted as part of the work, even though they may not be clearly indicated on the plans and/or described herein or may vary therefrom.

D. All debris of any kind accumulated from clearing or grubbing shall be disposed of off-site weekly and the whole area left clean. The Contractor shall be required to make all necessary arrangements related to the proposed place of disposal.

E. Burning onsite will not be permitted.

1.03 RELATED WORK IN OTHER SECTIONS

Trench Excavation and Backfill ..... Section 02221

Temporary Soil Erosion Control ..... Section 02270

SUBSURFACE SOIL DATA: Subsurface soil investigations have been made at the Hoolehua Water System Improvements, Site 1 – Kauluwai Well Site and Site 7 – Hoolehua Maintenance Yard site by Geolabs, Inc. entitled “Geotechnical Engineering Exploration, Site No. 1 and Site No. 7, DHHL Molokai Projects”, Molokai, Hawaii dated December 5, 2017. Test pit logs are shown in the soils report. A copy of the complete soils report is available on the DHHL website or the bid compact disc.

The Contractor is expected to examine the site and the record of soil investigation and decide for himself the character of materials to be encountered. The Engineer will not assume responsibility for variations of subsoil quality or condition at locations other than places shown and at the time investigations were made.

The soils report and its recommendations are made part of these specifications except where expressly modified herein.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PROTECTION

A. Adequate precautions shall be taken before commencing and during the course of the work to insure the protection of life, limb and property.

B. The Contractor shall protect from damage all surrounding structures, tress, plants, grass, walks, pavements, utility boxes, etc. Any damages will be repaired or replaced by the Contractor to the satisfaction of the Engineer.

3.02 PERMITS

The Contractor shall apply for and obtain the necessary permits prior to the commencement of work. The Contractor shall pay for all fees.

3.03 BARRICADE

Erect temporary barricade to prevent people and animals from entering the project area, to the extent as approved by the Engineer. Such barricades shall not be less than 5'-0" in height. The extent of barricades may be adjusted as necessary with the approval of the Engineer. This work shall be accomplished to the satisfaction of DHHL and at no extra cost to DHHL. Barricades shall be removed upon completion of work and job site premises left clean.

3.04 MAINTAINING TRAFFIC

A. The Contractor shall conduct operations with minimum interference to streets, driveways, sidewalks, etc.

B. When necessary, the Contractor shall provide, erect and maintain lights, barriers, etc., as required by traffic and safety regulations with special attention to protection of life.

3.05 CONSTRUCTION LINES, LEVELS AND GRADES

A. The Contractor shall verify all lines, levels and elevations indicated on the plans before any clearing, excavation or construction begins. Any discrepancy shall be immediately brought to the attention of the Director and any change shall be made in accordance with his instruction. The Contractor shall not be entitled to extra payment if he fails to report the discrepancies before proceeding with any work whether within the area affected or not.

B. All lines and grades shall be established by a Surveyor licensed in the State of Hawaii.

C. Starting of clearing and grubbing operations will be construed to mean that the Contractor agrees that the existing grades, inverts, and improvements are essentially correct as indicated.

3.06 DEMOLITION, REMOVAL AND RELOCATION

A. Execute all work in an orderly manner, with proper safety precautions observed at all times. Provide warning signs, lights, barricades, etc. as required or as directed by the Director.

B. Removed material having no salvage value, as determined by the Director, shall become the property of the Contractor and shall be removed from the premises at no cost to the County.

3.07 CLEARING AND GRUBBING

A. The Contractor shall clear off and remove from the area to be graded, all rubbish, grass and weeds, stumps, large roots, buried logs, garbage, boulders and other unsuitable material. Where soft wet soils are encountered, light equipment should be used.

B. No excavation or filling shall be undertaken until area has been cleared and grubbed.

C. Recycling green waste: Where a commercial composting or recycling facility is available on the island on which the project is situated and where economically practical, deliver the green waste material (e.g. yard debris and tree trimming, logs and stumps, untreated wood, etc.) to a composting or recycling facility for recycling. Confirm the types and condition of acceptable green waste material with the composting facility and pay all applicable charges. Submit a copy of the receipt for disposal (e.g. tipping fees) to the Director.

3.08 DISPOSAL

A. All removed materials with no salvage value shall be removed from the premises. All removed material with salvage value as determined by the Director shall be neatly stored on the premise as direction by the County.

B. Excessive accumulation of debris, rubbish and dirt will not be permitted. All material or debris shall be removed regularly from the site. A fog spray or other dust settling method shall be employed to dampen areas where there is excessive dust and dirt.

C. All items to be later reused shall be carefully removed, inspected by the Director and neatly stored away. Items damaged during the removal work shall be replaced with new of the matching type, size and shape at no cost to the County of Maui.

D. Comply with Federal, State and local hauling and disposal regulations.

3.09 CONTRACT ZONE LIMITS

The Contract Zone Limits shown on the plans indicate only in general the limits of the work involved. The Contractor, however, is required to perform any and all

necessary and incidental work which may fall outside of these demarcation lines. The Contractor is also expected to confine all of his construction activities within the Contract Zone Limits, except as provided hereinbefore, and not to spread his equipment indiscriminately about the area.

3.10 CLEAN-UP

Clean up and remove all debris accumulated from construction operations from time to time, when and as directed. Upon completion of the construction work and before final acceptance of work, remove all surplus materials, equipment, etc., and leave entire job site clean and neat to the satisfaction of the Director.

3.11 UNSUITABLE EXCAVATED MATERIAL

The Contractor shall remove from the site all unsuitable excavated material unless specified otherwise by the Engineer. The unsuitable material not containing organic material shall be hauled and placed in the excavation for coralline material where shown on the drawings. Unsuitable material containing organic material shall be disposed of off-site.

Removal, including hauling and disposal, of the unsuitable material will not be paid for directly, but shall be considered incidental to the project.

END OF SECTION

SECTION 02202 – STRUCTURAL EXCAVATION, BACKFILL AND COMPACTION

PART 1 – GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Conditions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Furnish all labor, materials, tools, equipment and related items necessary for excavating and backfilling trench for water lines, drain lines, sewer lines, electrical units, and appurtenances in conformity with the dimensions, profiles, section and details shown on the plans and the Water System Standards of the Department of Water Supply, County of Maui, State of Hawaii, 2002 and as supplemented and/or modified herein. The Contractor shall be solely responsible for the means, techniques, procedures, and sequences for dewatering and bracing and shoring the excavation.

1.03 RELATED WORK IN OTHER SECTIONS

Site Earthwork .....Section 02210

Trench Excavation and Backfill .....Section 02221

SUBSURFACE SOIL DATA: Subsurface soil investigations have been made for the Hoolehua Water System Improvements project at Site No. 1 – Kauluwai Well Site and Site No. 7 – Hoolehua Maintenance Facility by Geolabs, Inc. entitled: "Geotechnical Engineering Exploration, Site No. 1 and Site No. 7, DHHL Molokai Projects", Molokai, Hawaii" dated: December 5, 2017. Test pit logs are shown in the soils report. A copy of the complete soils report is available on the DHHL website or the bid compact disc.

The Contractor is expected to examine the site and the record of soil investigation and decide for himself the character of materials to be encountered. The Engineer will not assume responsibility for variations of subsoil quality or condition at locations other than places shown and at the time investigations were made.

The soils report and its recommendations are made part of these specifications except where expressly modified herein.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 EXCAVATION

A. Excavation for structures shall be carried down to elevations required by the drawings and shall be graded level on unfilled, undisturbed, firm bearing soil.

Soft spots shall be compacted to unyielding firmness if soil conditions are suitable and approve footing cuts may be made exact dimensions of the footing.

B. If any conditions not described in the Contract Documents such as perched water, seepage, lava tubes or blisters of a potentially adverse nature, these conditions shall be immediately brought to the attention of the Geotechnical Engineer so supplemental recommendations can be made to address these conditions.

C. The Contractor is responsible for providing protection from erosion, ponding and storm water pollution. Construction Best Management Practice (BMP) shall be utilized for the duration of the project.

3.02 UNSUITABLE EXCAVATED MATERIAL

The Contractor shall remove from the site all unsuitable excavated material unless specified otherwise by the Engineer. The unsuitable material not containing organic material shall be hauled and placed in the excavation for coralline material where shown on the drawings. Unsuitable material containing organic material shall be disposed of off-site.

Removal, including hauling and disposal, of the unsuitable material will not be paid for directly, but shall be considered incidental to the project.

END OF SECTION

SECTION 02210 – SITE EARTHWORK

PART 1 – GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Conditions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Furnish all labor, materials, services, equipment and related items necessary to excavate, fill, remove, transport, stockpile and dispose of all materials within the limits of the project required to construct the site work improvements in accordance with these specifications, dimensions, sections and details shown on the plans, and the approval of the Department.

1.03 RELATED WORK IN OTHER SECTIONS

Trench Excavation and Backfill ..... Section 02221

Temporary Soil Erosion Control ..... Section 02270

SUBSURFACE SOIL DATA: Subsurface soil investigations have been made for the Hoolehua Water System Improvements project at Site No. 1 – Kauluwai Well Site and Site No. 7 – Hoolehua Maintenance Facility by Geolabs, Inc. entitled: "Geotechnical Engineering Exploration, Site No. 1 and Site No. 7, DHHL Molokai Projects", Molokai, Hawaii" dated: December 5, 2017. Test pit logs are shown in the soils report. A copy of the complete soils report is available on the DHHL website or the bid compact disc.

The Contractor is expected to examine the site and the record of soil investigation and decide for himself the character of materials to be encountered. The Engineer will not assume responsibility for variations of subsoil quality or condition at locations other than places shown and at the time investigations were made.

The soils report and its recommendations are made part of these specifications except where expressly modified herein.

1.04 PROTECTION

A. Erosion Control: The Contractor shall incorporate into his work schedule the Temporary Erosion Control Measures and the Permanent Erosion Control procedures indicated on the plans and as specified in the contract.

B. Dust Control: Every effort shall be made by the Contractor to keep dust to a minimum. Spraying the ground with water or other means of control shall be used wherever possible. The Contractor shall have an adequate supply of water for moisture conditioning of fill material.

Without limiting the generality or applicability of other indemnity provisions of the contract, the Contractor agrees that he shall indemnify and hold harmless the Department from and against all suits, actions, claims, demands,

damages, costs and expenses (including but not limited to attorney's fees) arising out of any damage to any property whatsoever or injury to any person whomsoever, in any way caused or contributed to by dust from the Contractor's operations.

C. Existing Utilities and Work Areas: The Contractor shall be responsible for the protection of existing surface and subsurface utilities and poles within and abutting the project site, trench excavations and other work areas. Any damages will be repaired or replaced by the Contractor to the satisfaction of the Engineer.

D. Finished Grades and Subgrades: All subgrades shall be kept moist until covered by subbase, base course, or concrete. All finished grades shall be kept moist until covered by landscaping or other permanent groundcover.

Where shrinkage cracks are noted after compaction of the subgrade or finished grade, the subgrade or finished grade shall be re-scarified, moisture-conditioned to above the optimum moisture content, and recompacted to the specified requirement at no additional cost to the Department. During construction, the Contractor shall properly grade and maintain all excavated surfaces to provide positive drainage and prevent ponding of water. In the event that ponding of water caused softening of the subgrades, the Contractor shall remove the soft soils and shall backfill the excavation with compacted fill at no additional cost to the Department.

PART 2 – PRODUCTS

2.01 MATERIALS

For Hoolehua Water System Improvements, fills, backfills, select borrow, large over-sized rocks and boulders and rock fill shall conform to the soils report, entitled: "Geotechnical Engineering Exploration, Site No. 1 and Site No. 7, DHHL Molokai Projects", Molokai, Hawaii" dated: December 5, 2017 and the plans entitled "Hoolehua Water System Improvements".

PART 3 – EXECUTION

3.01 GRADING

A. General: All cuts, fills and trenching to be constructed shall be monitored by a licensed geotechnical consultant (soils engineer) retained by DHHL, who shall approve all foundation preparation, fill material, methods of placing and compaction and perform field density tests during the grading. Geotechnical engineer shall notify DHHL that the work appears to be in general conformance with the project documents based on observations and testing. No deviation from these specifications shall be made except upon the written approval of the Engineer and/or other public agencies having jurisdiction.

B. Excavations: All excavation shall be made to the lines and grades as shown on the project plans. All excavation shall be inspected and approved by the Geotechnical Engineer. Where conditions encountered require, he shall direct the necessary modifications to be made.

   Suitable material from excavation shall be used in the fill, and unsuitable material free of organic material from excavation shall be disposed of in the designated borrow site to replace material borrowed.

C. Drainage: Care shall be exercised during grading so that areas involved will drain properly. Water shall be prevented from running over the slopes by the temporary berms, drainage swales, diversion by ditches, silting basins and the detention basin.

D. Field Testing: The Engineer shall be notified at least two days prior to the start of grading. A pre-grading conference shall be held between the parties involved so as to discuss methods of operations, site problems and scheduling. Field density tests shall be taken by the Geotechnical Engineer retained by DHHL.

E. Supervision: At all times, the Contractor shall have a responsible field superintendent on the project in full charge of the work with authority to make decisions. He shall cooperate with the Engineer in carrying out the work. Any instructions given to him by the Engineer shall be considered to have been given to the Contractor personally.

F. Rainy Weather: No fill shall be placed, spread or rolled during unfavorable weather. When the work is interrupted by rain, operations shall not be resumed until field tests by the Engineer indicate that conditions will permit satisfactory results.

G. Unforeseen Conditions: If unforeseen or undetected soil conditions such as soft spots, existing utility trenches, structure foundations, voids or cavities, boulders, seepage water or expansive soil pockets, etc. are encountered, unless otherwise indicated of provided for in the proposal, the Contractor at his sole expense shall make all necessary corrective measures in the field as such conditions are detected.

Large lava tubes, defined herein as lava tubes or cavities that extend greater than 25 feet in either direction, beyond the end points of any opening that may be created by work under this contract, and exceed 5 feet in its smallest diameter or width as measured throughout the 25-foot length, and/or show obvious evidence of transmitting water, are excluded from this requirement.

3.02 UNSUITABLE EXCAVATED MATERIAL: The Contractor shall remove from the site all unsuitable excavated material unless specified otherwise by the Engineer. The unsuitable material not containing organic material shall be hauled and placed in the excavation for coralline material where shown on the drawings. Unsuitable material containing organic material shall be disposed of off-site.

Removal, including hauling and disposal, of the unsuitable material will not be paid for directly, but shall be considered incidental to the project.

END OF SECTION

SECTION 02215 – BLASTING

PART 1 – GENERAL

1.1 DESCRIPTION:

A. Furnish all materials, labor and equipment required to accomplish all excavation, filling and grading as indicated on the drawings.

B. The work specified in this section shall also consist of any blasting used in any excavation process.

1. Definition: The term “controlled blasting” is defined as excavation of rock in which the various elements of the blast, including hole size, depth, spacing, burden, charge, size, distribution, and delay sequence are carefully balanced and controlled to provide a distribution of charge that will excavate the rock to the required limits with smooth surfaces.

   Controlled blasting minimizes overbreak, stressing, and fracturing of the rock beyond the design lines. Smooth wall blasting, presplitting, cushion blasting, and line drilling are examples of operations included in the term controlled blasting.

1.2 QUALITY ASSURANCE:

A. Workforce Experience-Blasting

1. The Contractor shall retain the services of a recognized blasting consultant experienced on similar projects to develop all controlled blasting designs and details.

2. Blasting supervisors shall have a minimum of five-years-experience in supervising the loading and firing of charges for excavation of tunnels and shall have all necessary licenses and permits required by Federal, State and local agencies or others having jurisdiction. The Contractor shall certify that blasting supervisors meet this experience and license requirement.

B. Requirements of Regulatory Agencies

1. Permits: The Contractor shall obtain the required permits for all blasting and other operations.

2. Reference Codes: Applicable ordinances, codes, statutes, rules and regulations of the City & County of Honolulu, the State of Hawaii, and the Federal government shall be complied with during performance of the work.

1.3 RELATED WORK IN OTHER SECTIONS

A. The Contractor must submit a letter of indemnification to the DHHL for damages and injuries caused by blasting as determined by the Engineer. This letter must meet the written acceptance of DHHL prior to award of the contract.

B. Blast Design: Specifics of proposed blast design shall be submitted prior to the start of blasting operations and prior to each change in blast design, and shall include the following:

1. Drilling pattern, hole diameters, spacing, depth, and inclination.
2. Type, strength, amount in terms of weight and number of cartridges of explosives proposed for use in each hole, on each delay and the total for the blast.
3. Distribution of the charge in the holes, priming of each hole, and stemming of holes.
4. Type, sequence and number of delays, delay pattern, wiring diagram for blast, size and type of hookup lines and lead lines, type and capacity of firing source and type of condenser discharge blasting machine.
5. Written evidence of the qualifications of the person or persons who will be directly responsible for supervising, loading, and firing of the shot.
6. Proposed schedule of dates/times of each shot.
7. Blast design shall be subject to review and acceptance by the Engineer. Inappropriate design will be rejected. Review by the Engineer of the blast design and techniques shall not relieve the Contractor of responsibility for the accuracy, adequacy, and safety of the blasting operations, or for exercising proper fired supervision and judgment, and producing the end results required by these specifications.

C. Daily Records: Daily records of all blasting operations shall be maintained, and the Engineer shall be provided with one copy of the record of each day's work on the following work day. The following data shall be included in the daily record:

1. Unusual occurrences, including rock falls, unstable ground, groundwater problems, work delays, and equipment malfunction, and time of each occurrence.
2. Complete description of each blast round used, including:
   a. Date, time and limits of blast.
   b. On a diagram of the appropriate blast pattern, indicate holes not drilled, drilled but not loaded, changes in spacing or in pattern of delays or in loading of holes and burden of round.
   c. Number of explosives used by weight and number of cartridges.

d. Total number of delays used and number of holes for each delay period.

e. An evaluation of the blast indicating areas of significant overbreak and planned adjustments for the next blast.

f. Location and elevation of significant rock strata boundaries, and brief description of the rock.

PART 2 – MATERIALS

2.1 BLAST MONITORING EQUIPMENT: The Contractor shall provide a minimum of two, 10 to 200 Hertz three-component recording blast seismographs with three-component seismic wave paper trace, self-calibration capability, variable trigger level setting, and digital peak particle velocity memory operation (in inches per second). One seismograph shall have an air wave detector for monitoring air blast overpressures. These devices shall be maintained by Contractor for use in monitoring blasting vibrations.

PART 3 – EXECUTION

3.1 PROTECTIVE MEASURES

A. The Contractor shall hire an independent consultant to perform a pre-blast and post-blast survey of the surrounding structures.

B. All excavation shall be protected and guarded against danger to life, limb and adjacent properties.

C. Shoring, as required to safely preserve the excavations and earth banks free from damages resulting from the work, shall be provided and installed by the Contractor.

D. All excavations shall be kept free from standing water. The Contractor shall do all pumping and draining that may be necessary to remove the water to the extent required in carrying on the work. Grading shall be controlled so that the ground surface is properly sloped to prevent water runoff from entering open trench excavations.

E. The Contractor shall conduct operations with minimum interference to streets, driveways, sidewalks, passageways, traffic, and adjacent properties, etc.

The Contractor shall schedule all work that involves excessive noise, dust, dirt or any other detrimental aspect of this work in order that there will be minimum disruptions.

3.2 LAYING OUT:

A. The laying out of baselines, establishment of grades and staking out the entire work shall be done by a Licensed Professional Land Surveyor, licensed in the State of Hawaii, at the expense of the Contractor, and he shall be

solely responsible for their accuracy. The Contractor shall erect and maintain substantial batter boards showing construction lines and levels.

B. Should any discrepancies be discovered in the dimensions given in the plans, the Contractor shall immediately notify the Engineer before proceeding nay further with the work; otherwise, he will be held responsible for any costs involved in correction of construction placed due to such discrepancies.

3.3 JOB CONDITIONS FOR BLASTING

A. General Safety Requirements:

1. Work shall be performed in a manner to minimize hazards and exposure of the public, construction personnel and equipment to hazardous and potentially hazardous conditions.
2. The Contractor shall coordinate all blasting operations with other contractors. The Contractor shall make all reasonable effort to perform his work with minimal disruptions to work by other contractors.
3. Contractor shall physically sweep and survey the area to be shot immediately before a blast and document who did it and that it was done.
4. Contractor shall place personnel at commonly known approaches to the blasting zones, or known footpaths during blasting operations to divert pedestrians from the site during blasting operations.
5. Contractor shall place warning signs at obvious approaches to blasting areas, and at known footpaths.

B. Blasting

1. Blasting patterns shall be maintained so as not to exceed 2 inches per second peak radial particle velocity at the ground line of the nearest structure for distances greater than 35 feet.
2. For utilities and improvements closer than 35 feet, special procedures shall be implemented and 2 inches/second velocities will be permitted if no damage is sustained. The Contractor shall adopt trial blast procedures with monitoring or vibrations and inspection for damage. Charge weights per delay shall be adjusted as experience indicates.
3. Blasting operations shall be controlled so that air blast overpressures shall not exceed 0.02 pounds per square inch at any structure.
4. The Contractor shall take measurements to determine if the Contractor’s operations are exceeding the specified particle velocity and overpressure limitations. The data will be available to the Engineer.
5. If the data indicates that the particle velocity or overpressure limitations are not being met, measures shall be taken to reduce particle velocity or overpressure to the specified levels, including such measures as reducing

the size of charge, changing blasting delays used, and shortening length of blast round.

C. Damages:

Reference is made to DHHL Interim General Conditions 2.5, 7.17 and 7.19 which shall be applicable to any blasting conducted by the Contractor intended for the work under this contract.

PART 4 – EXECUTION

4.1 MEASUREMENT: Blasting will not be measured for payment.

4.2 PAYMENT: Blasting will be considered incidental to the various contract items and will not be paid for separately.

END OF SECTION

SECTION 02221 – TRENCH EXCAVATION AND BACKFILL

PART 1 – GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Conditions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Furnish all labor, materials, tools, equipment and related items necessary for excavating and backfilling trench for water lines, drain lines, sewer lines, electrical units, CATV, and appurtenances in conformity with the dimensions, profiles, section and details shown on the plans. Work shall be governed by Section 11 – Trench Excavation and Backfill of the Standard Specifications for Public Works Construction, September 1986, Department of Public Works, City and County of Honolulu; Sections 302.02 and 302.03 of the Water System Standards, 2002, Honolulu Board of Water Supply; and Section 206 of the Standard Specifications for Road and Bridge Construction, 2005, State of Hawaii, Department of Transportation, Highways Division. The Contractor shall be solely responsible for the means, techniques, procedures, and sequences for dewatering and bracing and shoring the excavation.

1.03 RELATED WORK IN OTHER SECTIONS

Site Earthwork .....Section 02210

Pipe and Fittings ..... Section 02721

Potable Water System…….....Section 02713

Sanitary Sewer System…… Section 02731

Fuel Systems (Diesel)……...Section 15193

1.04 SUPPLEMENTS: All excavated material shall be unclassified regardless of its composition, whether soil, solid rock, coral, asphalt pavement, concrete, rubbish or other material.

The installation and removal of sheeting shall be done in a manner that will not cause settlement or disturbance of the pipe cradle material.

All existing ground, roadways and other improvements damaged, destroyed or disturbed shall be, at the Contractor's expense, replaced, reconstructed and restored in kind to an equal or better condition satisfactory to the Engineer.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Materials for roads shall be in accordance with the following sections of the State of Hawaii Standard Specifications for Road and Bridge Construction,

2005, as revised, except as amended on the plans and/or in the specifications herewith:

Aggregates……..... Section 703

B. Trench Backfill Material: Trench Backfill Material shall meet the requirements of Structure Backfill Material A or Trench Backfill Material A of Section 703.20 and 703.21 respectively, of the Hawaii Standard Specifications for Road and Bridge Construction, 2005.

C. Pipe Cushion: Pipe cushion shall consist of No. 3B fine gravel as described by ASTM C33 (No. 67 gradation).

PART 3 – EXECUTION

3.01 TRENCH BOTTOMS: Should the trench bottom be within 2-feet of the soft clayey material, the trench shall be over-excavated to provide 2-feet of suitable material under the bottom of the trench. Suitable material shall be coralline material or crushed rock required by the particular utility company and installed as specified herein.

Should voids be encountered when trenching for utilities, the contractor shall provide for the placing and compacting of additional fill material to fill any voids encountered to obtain a level trench bottom. The materials, equipment and labor required shall be considered incidental to excavation for utilities in the proposal schedule.

3.02 PLACEMENT AND COMPACTION: Trench backfill shall be moisture-conditioned to within 3-percent of the optimum moisture content, placed in level lifts not exceeding 8-inches in loose thickness and compacted to a minimum of 90-percent maximum dry density per ASTM Test Method D1557.

END OF SECTION

SECTION 02270 – TEMPORARY SOIL EROSION CONTROL

PART 1 – GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Conditions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Submit three (3) sets of the erosion control materials for approval by the Engineer. Furnish all labor, materials, services, equipment and related items necessary to implement the temporary erosion control measures, submitted separately, as required by these specifications and as ordered by the Engineer during the life of the contract to control water pollution through the use of berms, dikes, dams, sediment basins, fiber mats, netting, gravel, mulches, grasses, slope drains, and other erosion control devices or methods.

A. Temporary erosion and siltation control measures as described herein shall be applied to any erodible material within this project, including local material sources and work areas.

B. The Contractor shall be responsible for providing the necessary erosion control measures which are shown on the plans or which may be ordered by the Engineer. All grading operations shall be performed in conformance with the applicable provisions of the "Water Pollution Control and Water Quality Standards" contained in the "Public Health Regulations," State Department of Health.

C. The Contractor shall be responsible for promptly (next day after storms) removing all silt and debris resulting from his work and deposited in drainage facilities, roadways, neighboring lands, and other areas.

1.03 RELATED WORK IN OTHER SECTIONS

Site Earthwork ..... Section 02210

PART 2 – PRODUCTS

2.01 MATERIALS

A. Mulches: To be bagasse, hay, straw, fiber mats, netting, wood cellulose, bark, wood chips, or other suitable material acceptable to the Engineer and shall be reasonably clean and free of noxious weeds and deleterious materials.

B. Slope Drains: To be constructed of fiber mats, plastic sheets, or other materials acceptable to the Engineer.

PART 3 – EXECUTION

3.01 TEMPORARY EROSION CONTROL

A. The Engineer has the authority to limit the surface area exposed by clearing and grubbing and to limit the surface area exposed by excavation, borrow and fill operations. The Engineer may also direct the Contractor to provide immediate, permanent, or temporary pollution control measures to prevent contamination of streams, lakes, ponds, drainage channels and pipes, roads, neighboring lands, and other areas.

   Except for specified measures which may be shown on the plans, the Contractor shall determine the appropriate erosion control measures to use. Such work may involve the construction of temporary berms, dikes, dams, sediment basins, and slope drains, and the use of temporary mulches, mats, and grassing, or the construction and use of other control devices or methods as necessary to control erosion.

B. The Contractor shall incorporate all erosion control measures shown in the plans. The erosion controls may be modified as necessary to adjust to conditions that develop during construction. All modifications are subject to approval by the Engineer.

C. The Contractor shall limit the surface area exposed by grubbing, stripping of topsoil, and grading to that which is necessary for him to perform the next operation and which is within his capability and progress in keeping the finish grading, mulching, grassing, and other such pollution control measures current. The grubbing of the vegetative root mat and stumps and the stripping of topsoil shall be confined within the limits of grading which can be actively and continuously prosecuted within 15 calendar days. The area to be graded shall be limited to the minimum area necessary to accommodate the Contractor's equipment and work force and shall not at any time exceed 15 acres, unless otherwise stated on plans, without prior approval of the Engineer. Any area remaining bared or cleared for more than 10 calendar days and which is not within the limits of active construction shall be immediately hydro-mulch seeded or remedied as directed by the Engineer at the Contractor's expense without cost to the Department. All areas where finish grading has been completed shall be grassed within three calendar days after the completion of grading for that area.

D. The Contractor shall, at the end of each work operation in any one day, shape the earthwork in such a manner as to control and direct the runoff to minimize the erosion of soils. He shall construct earth berms along the top edges of embankments or along the property line with adjacent properties, streams and water channels, to intercept any runoff. Temporary slope drains shall be provided to carry runoff from the top of cuts and fills. Temporary facilities for controlled discharges

shall be provided for runoff impounded, directed, or controlled by project activities or by any erosion control measure employed.

E. Cut slopes shall be shaped, topsoil added if necessary, and planted as the work progresses. In no case shall the exposed surface be greater than 15 feet in height. Whenever major excavation is suspended or halted and the slope is bared for more than 15 consecutive days, the exposed surfaces shall be hydro-mulch-seeded or protected as directed by the Engineer at the Contractor's expense without cost to the Department of Hawaiian Home Lands. Fill slopes shall be finished as specified and in accordance with the requirements outlined for cut slopes above.

F. Construction of berms, cofferdams, or other such construction in or near the vicinity of streams, ponds, waterways, or other bodies of water shall be with approved materials.

G. The temporary erosion and siltation control measures outlined in these specifications are minimum requirements and shall not preclude the provision of any additional measures which the Contractor may deem necessary. Damages caused by the erosion of soils and the pollution of downstream areas shall be the responsibility of the Contractor and all costs for repairing, correcting, replacing and cleaning damaged or polluted facilities shall be borne by the Contractor.

END OF SECTION

SECTION 02500 – ROAD PAVEMENT

PART 1 – GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Conditions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Furnish all labor, materials, tools, equipment and related items necessary to complete, in place, asphalt concrete pavement for roads in conformity with the dimensions, profiles, sections and details shown on the plans and specified herein.

1.03 SUBMITTALS: The Contractor shall submit for approval the job mix formula for the Asphalt Concrete to be supplied for the project. The job mix formula shall indicate the source of aggregates and grades of bituminous material to be used in the mix. The total amount of bituminous binder in the mix shall be between 4.5 percent to 8.0 percent by weight depending on the specified Asphalt Concrete Mix. All test data used to develop the job mix formula shall also be submitted. The job mix formula for the mixture shall be in effect until modified in writing by the Engineer. Should a change in sources of materials be made, a new job mix formula shall be established and approved before the new material is used.

The bituminous mixtures shall be designed using procedures contained in Chapter III, Marshall Method of Mix Design, of the Asphalt Institute's Manual Series No. 2 (MS-2), current edition, and shall meet the requirements of Table I below:

TABLE I
REQUIREMENTS FOR MARSHALL METHOD OF MIX DESIGN

Test Property	Mix #2	Mix #3	Mix #4	Mix #5
Number of Blows	75	75	75	75
Stability, lb (minimum number)	2,000	2,000	2,000	2,000
Flow, 0.01 in.	8 - 16	8 - 16	8 - 16	8 – 16
Percent air voids	4 - 6	4 - 6	4 - 6	4 – 6
Percent air voids in mineral aggregate (min.)	13	14	16	18

The job-mix formula for each mixture shall establish a single percentage of aggregate passing each required sieve size and a single percentage of bituminous material to be added to the aggregate.

After the job-mix formula is established, all mixtures furnished for the project shall conform thereto within the following ranges of tolerances in Table II below:

TABLE II
RANGE OF TOLERANCES FOR JOB-MIX FORMULA

Passing No. 4 and larger sieves	±7 percent
Passing No. 8 to No. 100 sieves (inclusive)	± 4 percent
Passing No. 200 sieve	± 2 percent
Bitumen	± 0.4 percent

Acceptance Sampling and Testing of the Bituminous Mixture.

A. The Contractor shall provide laboratory testing for control and acceptance functions during periods of mixture productions: One (1) field Marshall Test, asphalt content test, gradation analysis, and specific gravity test for each mixture.

B. The compacted mixtures of the in-place pavement shall not be less than 91% of the specific gravity (ASTM D2041, commonly called the Rice Method) of the combined mixture without voids.

C. Two (2) core or cut samples per street for the determination of the thickness and density of the completed pavements (or using nuclear gauge for determination of density) shall be obtained and/or tested by the Contractor at no extra cost (including that to restore the affected area). The size and locations of the samples will be directed by the Engineer.

D. All data for the control and the acceptance testing shall be submitted to the DHHL as specified in the general conditions.

PART 2 – PRODUCTS

2.01 MATERIALS: Materials for roads shall be in accordance with the following sections of the State of Hawaii Standard Specifications for Road, Bridge and Public Works Construction, except as amended on the plans and/or in the specifications herewith:

Excavation and Embankment .....Section 203

Aggregate Base Course .....Section 304

Aggregate Subbase Course .....Section 305

Hot Mix Asphalt Pavement .....Section 401

To include:

Recycled Glass Content ..... HRS 103D-407

Asphalt cement grade shall be PG 64-16.

PART 3 – EXECUTION

3.01 INSTALLATION: Stake out the areas to be paved using wooden stakes on which the final finish elevations, base course and subgrade elevations are clearly marked. All stakes and elevations shall be approved by the Engineer before any work is done.

Contractor shall fine grade the subgrade under the pavement and sidewalk by bringing the subbase or coralline material to the proper grade from the mass grade elevations to the proper shape before installing the base course or concrete sidewalk.

Install roadways in accordance with the applicable sections noted hereinbefore.

3.02 COMPACTION TESTING: The Contractor shall notify the Engineer at least 5 days prior to the start of fine grading for the roadway subgrade. Field density tests will be taken on the roadway subgrade, and aggregate base course by the Geotechnical Engineer retained by the Contractor. The Contractor shall be responsible for any corrective measures required as a result of inadequate compaction.

3.03 CLEANING OF SURFACES: Immediately before applying the prime coat or tack coat, the surface to be treated shall be swept clean of all loose material, dirt, excess dust or other objectionable material. No application shall be permitted when the surface to be treated is appreciably damp or when weather conditions are unsuitable.

3.04 ADJUSTMENT OF EXISTING UTILITY STRUCTURES TO FINISHED GRADE: Adjust existing utility structures to finished grade in accordance with the Hawaii Standard Specifications for Road and Bridge Construction, 2005.

3.05 REPAIRS OF EXISTING ASPHALT CONCRETE PAVEMENTS: Repair to the original conditions and to the satisfaction of the Engineer all existing asphaltic concrete pavements that have been damaged by construction activities, including damage done by heavy equipment.

3.06 PLACING ASPHALT CONCRETE PAVEMENT: Install asphalt concrete pavement as specified in Section 401 of the Hawaii Standard Specifications for Road and Bridge Construction, 2005.

END OF SECTION

SECTION 02610 – PIPE AND FITTINGS

PART 1 – GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Conditions preceding these specifications shall govern this section of the work.

1.02 GENERAL REQUIREMENTS

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

B. Whenever the Contractor is required by State or local laws or regulations to make a deposit and/or to pay for a permit before proceeding with any work called for under this part of the specification, the Contractor shall make the necessary deposit and/or pay for obtaining the required permit for the work.

1.03 REFERENCES

A. Conform to the requirements of the "Water System Standards, Department of Water Supply, ounty of Maui, State of Hawaii, 2002", including any amendments.

RELATED WORK IN OTHER SECTIONS

Valves and Cocks ..... Section 02610

Potable Water System ..... Section 02713

1.04 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 (6) sets of piping layout drawings. Drawings shall show all dimensions valves, piping, fittings, and appurtenances. Manifold piping layout drawings must be approved by the Engineer prior to ordering of the piping, valves, fittings and appurtenances.

PART 2 - PRODUCTS

2.01 PIPE

A. Pipe: Pipe materials shall meet County Standards.

B. Flanges: Flange materials shall meet County Standards. Bolt holes shall straddle the vertical centerline.

2.02 FITTINGS: Fittings shall meet County Standards.

2.03 CEMENT MORTAR LINING: All flanged pipe and fittings shall be cement mortar lined in accordance with ANSI A21.4. Interior linings shall have ends tapered and sealed with a bituminous coat.

2.04 GASKET

A. Gaskets shall be 1/16-inch thick duck inserted rubber packing, Garlock No.19 or approved equal.

B. A 1/8-inch thick gasket may be substituted for the 1/16-inch gasket specified above. If the thicker gasket is to be used, it must be noted on the piping layout drawings with the appropriate changes made in piping lengths. The design and materials of the substitute gasket must be approved by the Engineer prior to construction.

2.05 STEEL BOLTS AND NUTS

A. All bolts shall be hot dip galvanized steel machine bolts with cut threads and American Standard heavy hexagon heads.

B. All nuts shall be hot dip galvanized American Standard cold punched heavy hexagon nuts.

C. One coat of Inertol #49 as manufactured by Koppers Co., Inc., or approved equal, shall be applied to all buried bolts and nuts.

PART 3 - EXECUTION

3.01 INSTALLATION: Install pipe, fittings and appurtenances in strict accordance with the manufacturer's installation instructions.

END OF SECTION

SECTION 02640 – VALVES AND COCKS

PART 1 - GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Conditions preceding these specifications shall govern this section of the work.

1.02 REFERENCED DOCUMENTS: Work shall be governed by The Water System Standards, 2002, The Approved Material List and Standard Details for Water System Construction, 2002 and Water System Exterior Corrosion Control Standard, 1991, for the Department of Water Supply (DWS), County of Maui and all subsequent amendments, hereinafter referred to as the DWS Standards, and the Uniform Plumbing Code.

RELATED WORK IN OTHER SECTIONS:

Pipe and Fittings……Section 02610

Potable Water System……..Section 02713

1.03 DESCRIPTION OF WORK: This Section includes the furnishing and installation of a pressure reducing valve station which consists of a combination pressure reducing and pressure sustaining valve, pressure reducing valve, pressure relief valve, gate valves, ball valves, necessary piping, fittings and appurtenances as shown on the plans.

The equipment package shall include, but not limited to the following:

A. Combination Pressure Reducing and Pressure Sustaining Valve:

1. Number and size required:	1 – 6 inches
2. Main valve trim:	Bronze
3. End detail:	F.E., 150 lb.
4. Pressure rating:	250 psi
5. Temperature range:	180° F
6. Rubber material:	Buna-N
7. Coating:	Fusion bonded epoxy
8. Desired Options:	B: Pilot System Isolation cocks P: X141 Pressure Gauge S: Opening Speed Control Y: “Y” Pattern Strainer

B. Pilot Control System for Combination Pressure Reducing and Pressure Sustaining Valve:

1. Pressure rating:	300 psi
2. Trim:	Monel, Stainless Steel
3. Rubber material:	Buna-N

4. Tubing and Fittings: Brass, Bronze, Copper
5. Operating Fluids: Water
6. Pressure reducing adjustment range: CRD: 15-75 psi
7. Pressure sustaining adjustment range: CRL: 20-200 psi

C. Pressure Reducing Valve:

1. Number and size required: 1 – 2 inches
2. Main valve trim: Bronze
3. End detail: S.E.
4. Pressure rating: 400 psi
5. Temperature range: 180° F
6. Rubber material: Buna-N
7. Coating: Fusion bonded epoxy
8. Desired Options: A: Flow Clean Strainer
   B: Pilot System Isolation cocks
   S: Opening Speed Control

D. Pilot Control System for Pressure Reducing Valve:

1. Pressure rating: 300 psi
2. Trim: Monel, Stainless Steel
3. Rubber material: Buna-N
4. Tubing and Fittings: Brass, Bronze, Copper
5. Operating Fluids: Water
6. Pressure reducing adjustment range: CRD: 15-75 psi

E. Pressure Relief Valve:

1. Number and size required: 1 – 2 inches
2. Main valve trim: Bronze
3. End detail: S.E.
4. Pressure rating: 400 psi
5. Temperature range: 180° F
6. Rubber material: Buna-N
7. Coating: Fusion bonded epoxy
8. Desired Options: B: Pilot System Isolation cocks
   P: X141 Pressure Gauge

F. Pilot Control System for Pressure Relief Valve:

1. Pressure rating: 300 psi
2. Trim: Monel, Stainless Steel
3. Rubber material: Buna-N
4. Tubing and Fittings: Brass, Bronze, Copper
5. Operating Fluids: Water
6. Pressure reducing adjustment range: CRD: 15-75 psi

1.04 SUBMITTALS

A. Shop Drawings and Catalog Cuts: six (6) copies of dimensioned shop drawings of the valves and piping layout of the pressure reducing station.

B. Manufacturer's Installation, Operation and Maintenance Manual including spare parts list and ordering instructions.

PART 2 - PRODUCTS

2.01 COMBINATION PRESSURE REDUCING AND PRESSURE SUSTAINING VALVE

A. This valve shall maintain a constant downstream pressure regardless of changing flow rate and/or inlet pressure. When the upstream pressure becomes equal to the spring setting of the pressure sustaining control, the valve throttles to maintain a constant inlet pressure.

B. The valve shall be hydraulically operated, single diaphragm-actuated and globe pattern. The valve shall consist of three major components: the body with seat installed, the cover with bearings installed and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the main valve or pilot controls.

C. No separate chambers shall be allowed between the main valve cover and body. Valve body and cover shall be of cast material. No fabrication or welding shall be used in the manufacturing process.

D. The valve shall contain a resilient, synthetic rubber disc, with a rectangular cross-section contained on three and one-half sides by a disc retainer, forming a tight seal against a single removable seat insert. No O-ring type disc (circular, square or quad type) shall be permitted as the seating surface.

   The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks.

   It must have straight edge sides and a radius at the top edge to prevent excessive diaphragm wear as the diaphragm flexes across this surface. No hourglass-shaped disc retainers shall be permitted and no V-type or slotted type disc guides shall be used.

E. The diaphragm assembly containing a non-magnetic 303 stainless steel stem of sufficient diameter to withstand high hydraulic pressures, shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. The seat shall be a solid, one-piece design and shall have a minimum of five-degree taper on the seating surface for a positive, drip-tight shut off. No center guides shall be permitted.

The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve separating operating pressure from line pressure.

F. The diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The center hole for the main valve stem must be sealed by the vulcanized process or a rubber grommet sealing the center stem hole from the operating pressure. The diaphragm must withstand a Mullins Burst Test of a minimum of 600 psi per layer of nylon fabric and shall be cycle tested 100,000 times to insure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the valve body and cover by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully open or fully closed position.

G. The main valve seat and the stem bearing in the valve cover shall be removable. The cover bearing and seat shall be threaded into the cover and body. The lower bearing of the valve stem shall be contained concentrically within the seat and shall be exposed to the flow on all sides to avoid deposits.

   To insure proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip. No “pinned” covers to the valve body shall be permitted. Cover bearing, disc retainer and seat shall be made of the same material. All necessary repairs and/or modifications other than replacement of the main valve body shall be possible without removing the valve from the pipeline. Packing glands and/or stuffing boxes shall not be permitted and components including cast material shall be of North American manufacture.

H. The valve manufacturer shall be able to supply a complete line of equipment from 1 1/4” through 24” sizes and a complete selection of complementary equipment. The valve manufacturer shall also provide a computerized cavitation chart which shows flow rate, differential pressure, percentage of valve opening, C_v factor, system velocity and if there will be cavitation damage.

I. The valve shall be a Cla-Val Model No. 92-01 BYSP KCX X101 Combination Pressure Reducing and Pressure Sustaining Valve as manufactured by Cla-Val Co. or approved equal.

2.02 PILOT CONTROL SYSTEM

A. The pressure reducing pilot control shall be a direct-acting, adjustable, spring-loaded, normally open, diaphragm valve designed to permit flow when controlled pressure is less than the spring setting. The pilot control is held open by the force of the compression on the spring above the diaphragm and it closes when the delivery pressure acting on the underside of the diaphragm exceeds the spring setting. The pilot control system shall include a fixed orifice. No variable orifices shall be permitted.

B. The pilot control shall have a second downstream sensing port which can be utilized to install a pressure gauge.

C. The pressure sensing pilot control shall be a direct-acting adjustable spring-loaded control which opens when upstream pressure exceeds the spring setting on the pilot. The pilot control system shall include an X44A strainer and orifice assembly. A full range of spring settings shall be available in ranges of 0 to 450 psi.

D. A direct factory representative shall be made available for start-up service, inspection and necessary adjustments.

2.03 PRESSURE REDUCING VALVE

A. This valve shall maintain a constant downstream pressure regardless of changing flow rate and/or inlet pressure.

B. The valve shall be hydraulically operated, single diaphragm-actuated and globe pattern. The valve shall consist of three major components: the body with seat installed, the cover with bearings installed and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the main valve or pilot controls.

C. No separate chambers shall be allowed between the main valve cover and body. Valve body and cover shall be of cast material. No fabrication or welding shall be used in the manufacturing process.

D. The valve shall contain a resilient, synthetic rubber disc, with a rectangular cross-section contained on three and one-half sides by a disc retainer, forming a tight seal against a single removable seat insert. No O-ring type disc (circular, square or quad type) shall be permitted as the seating surface.

The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks.

It must have straight edge sides and a radius at the top edge to prevent excessive diaphragm wear as the diaphragm flexes across this surface. No hourglass-shaped disc retainers shall be permitted and no V-type or slotted type disc guides shall be used.

E. The diaphragm assembly containing a non-magnetic 303 stainless steel stem of sufficient diameter to withstand high hydraulic pressures, shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. No center guides shall be permitted. The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve separating operating pressure from line pressure.

F. The diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The center hole for the main valve stem must be sealed by the vulcanized process or a rubber grommet sealing the

center stem hole from the operating pressure. The diaphragm must withstand a Mullins Burst Test of a minimum of 600 psi per layer of nylon fabric and shall be cycle tested 100,000 times to insure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the valve body and cover by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully open or fully closed position.

G. The main valve seat and the stem bearing in the valve cover shall be removable. The cover bearing and seat shall be threaded into the cover and body. The lower bearing of the valve stem shall be contained concentrically within the seat and shall be exposed to the flow on all sides to avoid deposits.

   To insure proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip. No “pinned” covers to the valve body shall be permitted.

   Cover bearing, disc retainer and seat shall be made of the same material. All necessary repairs and/or modifications other than replacement of the main valve body shall be possible without removing the valve from the pipeline. Packing glands and/or stuffing boxes shall not be permitted and components including cast material shall be of North American manufacture.

H. The valve manufacturer shall be able to supply a complete line of equipment from 1 1/4” through 24” sizes and a complete selection of complementary equipment. The valve manufacturer shall also provide a computerized cavitation chart which shows flow rate, differential pressure, percentage of valve opening, Cv factor, system velocity and if there will be cavitation damage.

I. The valve shall be a Cla-Val Model No. 90-01 ABS KCX X101 Pressure Reducing Valve as manufactured by Cla-Val Co. or approved equal.

2.04 PILOT CONTROL SYSTEM

A. The pressure reducing pilot control shall be a direct-acting, adjustable, spring-loaded, normally open, diaphragm valve designed to permit flow when controlled pressure is less than the spring setting. The pilot control is held open by the force of the compression on the spring above the diaphragm and it closes when the delivery pressure acting on the underside of the diaphragm exceeds the spring setting. The pilot control system shall include a fixed orifice. No variable orifices shall be permitted. The pilot system shall include an opening speed control.

B. The pilot control shall have a second downstream sensing port which can be utilized to install a pressure gauge.

C. A full range of spring settings shall be available in ranges of 0 to 450 psi.

D. A direct factory representative shall be made available for start-up service, inspection and necessary adjustments.

2.05 PRESSURE RELIEF VALVE

A. This valve shall maintain a constant downstream pressure by bypassing or relieving excess pressure and shall maintain close pressure limits without causing surges. If upstream pressure decreases below the spring setting, the valve shall close.

B. The valve shall be hydraulically operated, single diaphragm-actuated and globe pattern. The valve shall consist of three major components: the body with seat installed, the cover with bearings installed and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the main valve or pilot controls.

C. No separate chambers shall be allowed between the main valve cover and body. Valve body and cover shall be of cast material. No fabrication or welding shall be used in the manufacturing process.

D. The valve shall contain a resilient, synthetic rubber disc, with a rectangular cross-section contained on three and one-half sides by a disc retainer, forming a tight seal against a single removable seat insert. No O-ring type disc (circular, square or quad type) shall be permitted as the seating surface.

   The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks.

   It must have straight edge sides and a radius at the top edge to prevent excessive diaphragm wear as the diaphragm flexes across this surface. No hourglass-shaped disc retainers shall be permitted and no V-type or slotted type disc guides shall be used.

E. The diaphragm assembly containing a non-magnetic 303 stainless steel stem of sufficient diameter to withstand high hydraulic pressures, shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. The seat shall be a solid, one-piece design and shall have a minimum of a five-degree taper on the seating surface for a positive, drip-tight shut off. No center guides shall be permitted. The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve separating operating pressure from line pressure.

F. The diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The center hole for the main valve stem must be sealed by the vulcanized process or a rubber grommet sealing the center stem hole from the operating pressure. The diaphragm must withstand a Mullins Burst Test of a minimum of 600 psi per layer of nylon fabric and shall be cycle tested 100,000 times to insure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the

valve body and cover by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully open or fully closed position.

G. The main valve seat and the stem bearing in the valve cover shall be removable. The cover bearing and seat shall be threaded into the cover and body. The lower bearing of the valve stem shall be contained concentrically within the seat and shall be exposed to the flow on all sides to avoid deposits. To insure proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip. No “pinned” covers to the valve body shall be permitted. Cover bearing, disc retainer and seat shall be made of the same material. All necessary repairs and/or modifications other than replacement of the main valve body shall be possible without removing the valve from the pipeline. Packing glands and/or stuffing boxes shall not be permitted and components including cast material shall be of North American manufacture.

H. The valve manufacturer shall be able to supply a complete line of equipment from 1 1/4” through 24” sizes and a complete selection of complementary equipment. The valve manufacturer shall also provide a computerized cavitation chart which shows flow rate, differential pressure, percentage of valve opening, Cv factor, system velocity and if there will be cavitation damage.

I. The valve shall be a Cla-Val Model No. 50-01 BP KCX X101 Pressure Reducing Valve as manufactured by Cla-Val Co. or approved equal.

2.06 PILOT CONTROL SYSTEM

A. The pressure relief pilot control shall be a direct-acting, adjustable, spring-loaded, normally open, diaphragm valve designed to permit flow when controlling pressure exceeds the adjustable spring setting. The pilot control is held closed by the force of the compression on the spring above the diaphragm and it opens when the pressure acting on the underside of the diaphragm exceeds the spring setting. Pilot control sensing shall be upstream of the pilot system strainer so accurate control may be maintained if the strainer is partially blocked.

B. A full range of spring settings shall be available in ranges of 0 to 450 psi.

C. A direct factory representative shall be made available for start-up service, inspection and necessary adjustments.

PART 3 - EXECUTION

3.01 Construction and installations shall conform to the applicable sections of the Water System Standards, Department of Water Supply, County of Hawaii, State of Hawaii, 2002.

END OF SECTION

SECTION 02713 – POTABLE WATER SYSTEM

PART 1 – GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Provisions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Furnish all labor, materials, tools, equipment and related items necessary to complete, in place, and ready for use, the potable water system in conformity with the dimensions, profiles, sections, and details shown on the plans.

1.03 REFERENCES: Work shall be governed by The Water System Standards, 2002, The Approved Material List and Standard Details for Water System Construction, 2002 and Water System Exterior Corrosion Control Standard, 1991, for the Department of Water Supply (DWS), County of Maui and all subsequent amendments, hereinafter referred to as the DWS Standards, and the Uniform Plumbing Code.

PART 2 – PRODUCTS

2.01 MATERIALS:

A. All materials shall conform to the approved Material List and Standard Details for Water System Construction, Department of Water Supply, County of Maui, 2002, except asbestos cement pipes and fittings shall not be used. Gate valves shall be cast iron, Class 200, with mechanical joints. Fire hydrants shall be wet-barrel type.

B. Asbestos Prohibition: No asbestos containing materials or equipment shall be used under this section. The Contractor shall ensure that all materials and equipment incorporated in the project are asbestos-free.

PART 3 – EXECUTION

3.01 INSTALLATION: The installation, testing, disinfection and acceptance of water lines shall be governed by the DWS Standards and the Uniform Plumbing Code.

The Contractor shall be responsible for precisely laying out the various utility lines shown on the contract plans as provided elsewhere in these specifications. The location shown on the contract plans of the various existing utility lines which the new lines are to cross over or under or connect to were determined on the basis of the best information available; however, no assurance can be provided that the actual locations will be precisely as shown on the contract plans.

In performing all work, the Contractor shall exercise due care and caution necessary to avoid any damage to and impairment in the use of any existing utility

lines. Any damage inflicted on existing lines resulting from the Contractor's operations shall be immediately repaired and restored as directed by the Engineer at the Contractor's expense.

Connections to or the lowering or relocation of existing mains shall be done by the Contractor in accordance with the DWS Standards. The Contractor shall furnish all necessary pipe, fittings, appurtenances and other incidental materials.

Trenching, pipe cushion and backfilling for the water main shall be in accordance with the DWS Standards.

The Contractor shall coordinate the connection of the new water line with the Engineer.

The Contractor shall inform the Engineer a minimum of one week prior to the date of the actual connection. The inverts shown on the plans are approximate only, and the Contractor shall adjust the slope of the new water line as necessary to construct a fully functional and acceptable system. The Contractor shall ensure that all piping, fittings, materials, tools, equipment and incidentals are at the site and ready for connection.

The installation, testing, disinfection and acceptance of water lines shall be governed by the DWS Standards.

END OF SECTION

SECTION 02731 – SANITARY SEWER SYSTEM

PART 1 – GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Provisions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Furnish all labor, materials, tools, equipment and related items necessary to complete, in place, the sewer system in conformity with the dimensions, profiles, sections, and details shown on the plans. Work relating to the sewer system shall be governed by the following sections of the Standard Specifications:

PVC Sewer Pipe and Appurtenances .....Section 21

Connection to Existing Sewer and Connecting Cesspool in

Direct Line of Sewer .....Section 22

Sewer Manholes.....Section 23

PART 2 – PRODUCTS

2.01 MATERIALS

A. Sewer Pipe: Sewer Pipe and Appurtenances shall meet County Standards.

B. Sewer Manholes: As specified in Section 23 - Sewer Manholes of the “Standard Specifications.”

C. Materials for the sewer system shall be in accordance with the sections of the Standard Specifications noted hereinafter.

PART 3 – EXECUTION

3.01 Install the sewer system in accordance with the sections of the Standard Specifications noted hereinbefore.

3.02 The Contractor shall be responsible for precisely laying out the sewer line shown on the contract plans. The location shown on the contract plans of the various existing utility lines which the new lines are to cross over or under or connect to were determined on the basis of the best information available; however, no assurance can be provided that the actual locations will be precisely as shown on the contract plans.

3.03 In performing all work, the Contractor shall exercise due care and caution necessary to avoid any damage to and impairment in the use of any existing utility lines. Any damage inflicted on existing lines resulting from the Contractor’s

operations shall be immediately repaired and restored as directed by the Engineer at the Contractor's expense.

3.04 The installation of sewer pipes and testing and acceptance shall be governed by the DPW Standard Specifications.

END OF SECTION

SECTION 02820 – CHAIN LINK FENCES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Furnish materials, labor and equipment necessary to install all chain link fences and gates to the limits shown and as detailed on the plan and as specified herein.

The State Division of Public Works, Design Branch's "Chain Link Fence Details" sheet shall be used.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Chain Link Fence Fabric shall be 2-inch mesh, 9 gauge with knuckled selvage at top and bottom unless otherwise shown or specified, be galvanized and conform to ASTM A392, Class 1. The hot-dipped galvanized fabric shall contain not less than 1.2 ounces per sq. ft. of uncoated wire surface as determined by stripping test ASTM A90 and under the PREECE Test (ASTM A239), shall withstand 6 or more 1-minute dips before reaching the end point. All fabric shall be free from barbs, icicles or other hazardous projections resulting from galvanizing. Aluminum clad fabric shall be an acceptable alternate to the hot-dipped galvanized fabric provided it is of the same gauge as the latter. Fabric may be standard Chin Link or Flat Link by Von Cypher Fence Products. Aluminum clad fabric conforming to ASTM A491 shall be an acceptable alternate to the hot-dipped galvanized fabric, provided it is of the same gauge as the latter.

B. Tie Wire shall be 12-gauge (9-gauge for gates) soft annealed galvanized steel wire as called for on plans.

C. Tension Bar shall be a 3/16" thick by 3/4" wide mild steel bar for attachment of a fabric to a terminal post.

D. Brace Band shall be formed from steel bands at least 12 gauge thick by 3/4" wide.

E. Tension Band shall be formed from steel bands at least 12 gauge thick by 3/4" wide.

F. Posts, Rails and Braces shall be standard weight, hot-dipped galvanized, welded and seamless steel pipes conforming to ASTM A120. Alternatively, hot-dipped galvanized pipes with chromate conversion and polyurethane coatings ("Tuf 40" by American Tube Co., Inc. or approved equal) are acceptable provided posts shall be sized in accordance with and have the minimum properties shown in the table below. Additionally, Tuf 40 type pipes shall not be use were welded pipe frames are called for.

Dimensions and weights of Tuf 40 Steel Pipe Posts

Post Type/Fence Ht. (*/ft)	Nom.Dim. (in.)	O.D. (in.)	I.D. (in.)	Weight (lbs/ft)
Rails Only	1-5/8	1.660	1.440	1.82
L/4	1-7/8	1.900	1.660	2.28
L/6-8; T/4	2-3/8	2.375	2.115	3.12
L/10,12: T/6-8	2-7/8	2.875	2.555	4.64

* L – Line Posts; T – Terminal Posts

G. Tension Wire shall be a 7-gauge coiled spring or 6-gauge plain galvanized wire.

H. Concrete for post footings shall be Class 2500.

I. Composition and Finish Metal Parts: All metal parts and fittings, including tracks, gate hardware, frames and fasteners shall be of steel, malleable iron or wrought iron and shall be galvanized by the hot-dip process, after fabrication, in conformance with ASTM A153.

J. Fence Gate Hardware: Padlock shall be 5-pin cylinder type with brass case and a 5/16" dia. Hardened steel shackle. Padlocks shall be keyed differently but master-keyed to the fence system. Two master keys shall be provided.

PART 3 - EXECUTION

3.01 INSTALLATION AND WORKMANSHIP

A. General:

1. Metal fencing and gates of the various types called for shall be erected in strict conformance with the plans and these specifications. The gates and hardware shall provide intended freedom of operation. Posts shall be plumb and in line. Welding shall be done in accordance with latest AWS Standards. However, no splicing of posts, rails or braces shall be accepted. Where changes in line occur with an angle of deflection of 30 degrees or more, the change point will be considered a corner and a corner post shall be installed thereat. End, corner, and gate posts for fences with 5-foot and wider fabric shall be braced to the nearest line post with horizontal braces and tension rods. The horizontal braces shall be spaced midway between top rail and ground and securely fastened to posts as shown on plans. Where fencing is placed along a curve with radius of 50 feet, or less, horizontal braces (and tension rods) shall be installed between all posts in like manner. Pull posts, at maximum intervals of 300 feet, shall be braced and trusses in both directions as specified above.

2. Field Touch-Ups: Field welds shall be cleaned of flux and spatter and all damaged galvanizing removed, all hazardous projections ground off, properly prepared, and then heavily coated with self-curing inorganic zinc coating. Manufactured coatings shall be applied in strict accordance with manufacturer's printed specifications. Damage to existing painted surfaces shall be touched up.

B. Fence Posts, except as otherwise indicated or specified, shall be spaced not more than 10 feet apart. In curved fence sections having a radius of 50 feet or less, the posts shall be spaced as shown on the plans. Line posts shall be set so that top of the eye tops shall be at the same height as the fence fabric.

C. Top Rails shall be 1-5/8" outside diameter and pass through and bear firmly on base of eye tops, form a continuous brace from end to end of each stretch of fence, and be securely fastened to terminal posts with rail ends and brace bands. Couplings for the top rails shall be installed at intervals of 24 feet maximum.

D. Chain Link Fabric shall be fastened on the side of the posts as designated and shall be mounted on the posts so that the bottom of the fabric will be no more above the finished grade than called for on the plans. High points of the ground shall be excavated as necessary. The fabric shall be stretched taut and securely fastened to the posts. Ends of wire ties shall be bent back so as not to be a hazard. Between posts the top edge of the fabric shall be fastened to the top rail and the lower edge to the tension wire with tie wire of size and at spacing as called for on the plans. Tension wire shall be stretched tight and shall be installed in a straight line between posts. Tension bars extending the full height of the fence and tension bar bands shall be used for fastening fabric to end, corner, pull and gate posts. Bolted tension bar bands shall be placed at top and bottom of tension bars and spaced at 12-inch intervals. Fastenings to line posts shall be made with tie wire of size and at spacing as called for on the plans.

3.02 FINAL CLEAN-UP

A. All exposed metal surfaces shall be clean and free of cement. All surplus earth resulting from metal fencing work that is not used in the grading work shall be cleaned up and disposed of off-site. All debris resulting from work of this section shall be removed from the site.

END OF SECTION

SECTION 03300 – CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Conditions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Cast-in-place concrete and reinforcing steel for concrete slabs and footings. Work shall be in conformance to State Specifications for Road and Bridge Construction, 2005, Section 411 – Portland Cement Concrete and Section 602 – Reinforcing Steel of the Standard Specifications.

1.03 QUALITY ASSURANCE:

A. Codes: Comply with the provisions of the following codes, specifications and standards, except as otherwise shown or specified.

1. Concrete Reinforcing Steel Institute, “Manual of Standard Practice”
2. ACI 318 “Building Code Requirements for Reinforced Concrete”
3. ACI 304, “Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete”
4. ACI 311, “Recommended Practice for Concrete Inspection”

B. Concrete Testing Service

1. The Contractor will employ, at his own expense, a testing laboratory experienced in the testing of concrete materials and mixes to perform material evaluation tests. This laboratory shall be the official testing agency for this project.
2. Materials and installed work may require testing and retesting, as directed by the Engineer, at any time during the progress of the work. Allow free access to material stockpiles and facilities at all times. Test, if not the retesting of rejected materials and installed work, shall be done at the Contractor’s expense.
3. Tests shall comply with ASTM Standards whenever applicable.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments. Indicate amounts of mixing water to be withheld for later addition at project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bend bar diagrams, bar arrangement, splices and

laps, mechanical connections, tie spacing, hoop spacing and supports concrete reinforcement.

D. Field quality-control test and inspection reports.

PART 2 – PRODUCTS

2.01 CONCRETE MATERIALS

A. Portland Cement: ASTM C150, Type I

B. Aggregates: ASTM C33

1. Fine Aggregates: Clean, Sharp, Natural sand or rock-sand as manufactured locally free from loan, clay, lumps or other deleterious substances.
2. Course Aggregates: Clean, uncoated, processed aggregate containing no clay, mud loam or foreign matter.

C. Reinforcing:

1. ASTM A615-51, Grade 60
2. ASTM A185, galvanized welded wire fabric

2.02 CONCRETE ADMIXTURES

A. Air-Entraining Admixtures: ASTM C260

B. Water-Reducing Admixtures: ASTM C494, Type D

C. Set Control Admixtures: ASTM C494, as follows:

1. Type B, retarding
2. Type D, water-reducing and retarding

2.03 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes for each type of concrete; 28-day compressive strengths shall be 3,000 psi (Class A); 2,500 psi (Class B); 2,000 psi (Class C) and in the Standard Specifications.

B. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the project for each class of concrete required. C. Unless otherwise noted, Class A concrete shall be used for all electrical ducts, reaction blocks, slabs and walls; Class B concrete for curb and gutter, and sidewalk applications.

2.04 JOINT MATERIALS

A. Pre-molded Joint Fillers: Pre-molded material of specified thickness composed of fiberboard impregnated with asphalt.

B. Joint Sealing Compound: Tremco Butyl Sealant or approved equal.

C. Epoxy-Resin Bonding Agent: Two component, mineral filled epoxy polysulfide polymer complying with FS MMM-G-650, Type I or Type II, Grade A.

2.05 MOISTURE BARRIER: Provide moisture barrier over prepared base material where shown on plans. Use only materials which are resistant to decay when tested in accordance with ASTM E154, as follows: Polyethylene sheet not less than 6 mils thick.

2.06 CURING MATERIALS

A. Curing compounds for membrane curing shall conform to ASTM C309.

B. Liquid Curing - Hardening Compound: Aqueous solution of sodium silicate with non-acid penetrating agent, reacting chemically with free lime in concrete to form a hard, non-dusting surface which will not inhibit bonding with future finishes. Products offered by manufacturers to comply with the requirements for liquid curing hardening compounds include the following:

1. Demicon: Castle Chemical Corp.
2. Eucosil: Euclid Chemical Co.
3. Chem Hard: L&M Construction Chemicals

2.07 EPOXY GROUT: Manufactured grout with built-in bonding material subject to approval of the Engineer.

PART 3 - EXECUTION

3.01 PREPARATION: Pre-Placement Inspection -- Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other crafts involved in ample time to permit the installation of their work; cooperate with other trades in setting such work, as required.

3.02 CONCRETE PLACEMENT

A. General: Place concrete in compliance with the practices and recommendations of ACI 304 and as herein specified.

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as herein specified. Perform concrete placing at such a rate that concrete which is being integrated with fresh concrete is still plastic. Deposit concrete as nearly as practicable to its final location to avoid segregation due to re-handling or flowing. Do not subject concrete to any procedure which will cause segregation.

2. Screen concrete which is to receive other construction to the proper level to avoid excessive skimming or grouting.

3. Do not use concrete which becomes non-plastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign materials. Do not use re-tempered concrete. Remove rejected concrete from the project site and dispose of it in an acceptable location.

B. Concrete Conveying

1. Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practicable by methods which will prevent segregation and loss of concrete mix materials.

2. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris water, and other deleterious materials.

C. Placing Concrete Slabs

1. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.

2. Consolidate concrete during placing operations using mechanical vibrating equipment, so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

3. Bring slab surfaces to the correct level with a straightedge and strike off. Use bull floats or darbies to smooth the surface, leaving it free of humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.

4. Maintain reinforcing steel in the proper position continuously during concrete placement operations.

D. Dowel installation where shown. Prepare for bonding of dowels and anchors to existing concrete by using drilled holes and a two-component epoxy which is manufactured for this specific purpose. Install in accordance with manufacturer's requirements to develop strength of dowels.

3.03 CONCRETE SLAB FINISHES

Slabs: Finish by tamping the concrete to force aggregate away from the surface and screen at the proper level. Float the surface and lightly trowel. When concrete has set sufficiently to ring under the trowel, give a second troweling to produce a smooth,

dense surface free from trowel marks and sweeps, air bubbles or other imperfections of troweling.

3.04 CONCRETE CURING AND PROTECTION

A. General

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperature, and maintain without drying at relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete.
2. Start initial curing as soon as free moisture has disappeared from the concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 72 hours.
3. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least 7 days and in accordance with ACI 301 procedures. Avoid rapid drying at the end of the final curing period.

B. Curing Methods

1. Perform curing of concrete by moist curing, or by moisture retaining cover curing, by membrane curing, or by combinations thereof, as herein specified for a continuous period of 14 days.
2. Liquid Curing-Hardening Compound: Apply to horizontal surfaces when concrete is dry to touch by means of power spray, hand spray, or hair broom in accordance with manufacturer’s directions.

C. Curing Unformed Surfaces

1. Initially cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by moist curing, whenever possible.
2. Moist cure surfaces to receive fluid applied waterproof membranes and composition flooring. Do not cure by membrane curing or curing compounds.
3. All slabs not receiving a finish floor material shall receive a liquid curing-hardening compound in accordance with the manufacturer’s recommendations.
4. Final cure unformed surfaces, unless otherwise specified, by any of the methods specified above, as applicable.

D. Protection from Mechanical Injury: During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration, and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

3.05 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures from the passage of work by other trades, unless otherwise shown or directed, after the work or other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide all other miscellaneous concrete filling shown or required to complete the work.

B. Epoxy Adhesive: For application on corrective work where the ordinary methods of remedy are deemed inadequate by the Engineer. Type of adhesive shall be subject to the approval of the Engineer.

3.06 CONCRETE SURFACE REPAIRS

A. Repair of Unformed Surfaces

1. Test unformed surfaces such as monolithic slabs, for smoothness and to verify surface plane to the tolerance specified for each surface and finish. Correct low and high areas as herein specified.
2. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having the required slope. Correct high and low areas as herein specified.
3. Repair finish unformed surfaces that contain defects which adversely affect the durability of the concrete. Surface defects, as such, include cracks in excess of 0.03-inch wide or which penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.
4. Correct high areas in unformed surfaces by grinding, after the concrete has cured sufficiently so that repairs can be made without damage to adjacent areas.
5. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out the low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Engineer.

B. Finishing of Formed Surfaces

1. Joint marks and fins shall be removed and surfaces left smooth and dense. Tie-holes and honeycombing shall be repaired with cement and sand mortar.
2. Exposed concrete surfaces shall be vigorously and thoroughly rubbed with a sand cement mortar the consistency of a thick paint to fill all voids and provide a smooth surface. There shall be no discernible thickness of mortar on the surface.

3.07 FIELD QUALITY CONTROL

A. Testing and Inspecting: Contractor shall engage, at his own expense, an independent qualified testing and inspecting agency to perform tests and inspections and to submit reports.

B. Inspections

1. Steel reinforcement placement
2. Steel reinforcement welding
3. Headed bolts and studs
4. Verification of use of required design mixture
5. Concrete placement, including conveying and depositing
6. Curing procedures and maintenance of curing temperature

C. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mix placed each day.
    a. When frequency of testing will provide fewer than five compressive strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40° F (4.4° C) and below and when 80° F (27° C) and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
    a. Cast and field cure one set of four standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days.
    a. Test two field-cured specimens at 7 days and two at 28 days.

b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.

7. When strength of field-cured cylinders is less than 85% of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mix will be satisfactory if every average of any three-consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi3.4 MPa.
9. Test results shall be reported in writing to the Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by the Engineer but will not be used as sole basis for acceptance or rejection of concrete.
11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by the Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Engineer.

END OF SECTION

SECTION 03310 - CAST-IN-PLACE CONCRETE (RESERVOIR)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Water System Standards, 2002, for the Department of Water Supply, County of Maui

1.2 WORK INCLUDED

A. Cast-in-place concrete and reinforcing steel for concrete slabs and footings. Work shall be in conformance to Section 39 - Portland Cement Concrete and Section 48 - Reinforcing Steel of the Standard Specifications.

1.3 QUALITY ASSURANCE

A. Codes: Comply with the provisions of the following codes, specifications and standards, except as otherwise shown or specified.

1. Concrete Reinforcing Steel Institute, “Manual of Standard Practice”
2. ACI 318 “Building Code Requirements for Reinforced Concrete”
3. ACI 304, “Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete”
4. ACI 311, “Recommended Practice for Concrete Inspection”
5. State of Hawaii, "Water System Standards – Department of Water Supply County of Maui" - 2002 applies to the concrete reservoir.
6. "Hawaii Standard Specifications for Road Bridge & Public Works Construction – 1994" applies to the bridge.

B. Concrete Testing Service

1. The Contractor will employ, at his own expense, a testing laboratory experienced in the testing of concrete materials and mixes to perform material evaluation tests. This laboratory shall be the official testing agency for this project.
2. Materials and installed work may require testing and retesting, as directed by the Engineer, at any time during the progress of the work. Allow free access to material stockpiles and facilities at all times. Test, if not specifically indicated to be done at the Department’s expense, including the retesting of rejected materials and installed work, shall be done at the Contractor’s expense.

3. Tests shall comply with ASTM Standards whenever applicable.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I

B. Aggregates: ASTM C 33

1. Fine Aggregates: Clean, sharp, natural sand or rock-sand as manufactured locally free from loam, clay, lumps or other deleterious substances.

2. Coarse Aggregates: Clean, uncoated, processed aggregate containing no clay, mud loam or foreign matter.

C. Reinforcing:

1. ASTM A 615, Grade 60

2. ASTM A 185, galvanized welded wire fabric

2.2 CONCRETE ADMIXTURES

A. Air-Entraining Admixtures: ASTM C 260

B. Water-Reducing Admixtures: ASTM C 494, Type D

C. Set Control Admixtures: ASTM C 494, as follows:

1. Type B, retarding

2. Type D, water-reducing and retarding

D. Calcium Chloride: Do not use calcium chloride in concrete.

2.3 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes for each type of concrete; 28-day compressive strengths shall be 4,000 psi (DWS4000), 3,500 (DWS3500), 3,000 psi (Class A or DWS3000M); 2,500 psi (Class B or DWS2500); 2,000 psi (Class C or DWS2000) in the Standard Specifications and Water System Standards.

B. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the project for each class of concrete required.

C. Unless otherwise noted, Class A concrete shall be used for all electrical ducts, reaction blocks, slabs and walls; Class B concrete for curb and gutter, and sidewalk applications.

2.4 JOINT MATERIALS

A. Pre-molded Joint Fillers: Pre-molded material of specified thickness composed of fiberboard impregnated with asphalt.

B. Joint Sealing Compound: Tremco Butyl Sealant or approved equal.

C. Epoxy-Resin Bonding Agent: Two component, mineral filled epoxy polysulfide polymer complying with FS MMM-G-650, Type I or Type II, Grade A.

D. Construction Joint Water-stop: Rubber or neoprene complying with the requirements in section 212.09 of the Water System Standards.

E. Roof Sliding Joint: Neoprene complying with requirements of section 303.06 of the Water System Standards.

2.5 MOISTURE BARRIER

A. Provide moisture barrier over prepared base material where shown on plans. Use only materials which are resistant to decay when tested in accordance with ASTM E 154, as follows: Polyethylene sheet not less than 6 mils thick.

2.6 CURING MATERIALS

A. Curing compounds for membrane curing shall conform to ASTM C 309.

B. Liquid Curing - Hardening Compound: Aqueous solution of sodium silicate with non-acid penetrating agent, reacting chemically with free lime in concrete to form a hard, non-dusting surface which will not inhibit bonding with future finishes. Products offered by manufacturers to comply with the requirements for liquid curing hardening compounds include the following:

1. Demicon: Castle Chemical Corp.
2. Eucosil: Euclid Chemical Co.
3. Chem Hard: L&M Construction Chemicals

2.7 EPOXY GROUT

A. Manufactured grout with built-in bonding material subject to approval of the Engineer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Pre-Placement Inspection -- Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other crafts involved in ample time to permit the installation of their work; cooperate with other trades in setting such work, as required.

3.2 CONCRETE PLACEMENT

A. General: Place concrete in compliance with the practices and recommendations of ACI 304 and as herein specified.

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as

herein specified. Perform concrete placing at such a rate that concrete which is being integrated with fresh concrete is still plastic. Deposit concrete as nearly as practicable to its final location to avoid segregation due to re-handling or flowing. Do not subject concrete to any procedure which will cause segregation.

2. Screen concrete which is to receive other construction to the proper level to avoid excessive skimming or grouting.

3. Do not use concrete which becomes non-plastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign materials. Do not use re-tempered concrete. Remove rejected concrete from the project site and dispose of it in an acceptable location.

B. Concrete Conveying

1. Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practicable by methods which will prevent segregation and loss of concrete mix materials.

2. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris water, and other deleterious materials.

C. Placing Concrete Slabs

1. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.

2. Consolidate concrete during placing operations using mechanical vibrating equipment, so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

3. Bring slab surfaces to the correct level with a straightedge and strike off. Use bull floats or darbies to smooth the surface, leaving it free of humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.

4. Maintain reinforcing steel in the proper position continuously during concrete placement operations.

D. Dowel installation where shown. Prepare for bonding of dowels and anchors to existing concrete by using drilled holes and a two-component epoxy which is manufactured for this specific purpose. Install in accordance with manufacturer’s requirements to develop strength of dowels.

3.3 CONCRETE SLAB FINISHES

A. Slabs: Finish by tamping the concrete to force aggregate away from the surface and screen at the proper level. Float the surface and lightly trowel. When concrete has set sufficiently to ring under the trowel, give a second troweling to produce a smooth, dense surface free from trowel marks and sweeps, air bubbles or other imperfections of troweling.

B. Bridge Deck: Class 6 float finish with machine finishing as specified in the Standard Specifications.

C. Reservoir Floor: Integral floor finish as specified in section 303.03 S of the Water System Standards.

3.4 CONCRETE CURING AND PROTECTION

A. General

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperature, and maintain without drying at relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete.
2. Start initial curing as soon as free moisture has disappeared from the concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 72 hours.
3. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least 7 days and in accordance with ACI 301 procedures. Avoid rapid drying at the end of the final curing period.

B. Curing Methods

1. Perform curing of concrete by moist curing, or by moisture retaining cover curing, by membrane curing, or by combinations thereof, as herein specified for a continuous period of 14 days.
2. Liquid Curing-Hardening Compound: Apply to horizontal surfaces when concrete is dry to touch by means of power spray, hand spray, or hair broom in accordance with manufacturer’s directions.

C. Curing Unformed Surfaces

1. Initially cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by moist curing, whenever possible.
2. Moist cure surfaces to receive fluid applied waterproof membranes and composition flooring. Do not cure by membrane curing or curing compounds.
3. All slabs not receiving a finish floor material shall receive a liquid curing-hardening compound in accordance with the manufacturer’s recommendations.

4. Final cure unformed surfaces, unless otherwise specified, by any of the methods specified above, as applicable.

D. Protection from Mechanical Injury: During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration, and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

3.5 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures from the passage of work by other trades, unless otherwise shown or directed, after the work or other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide all other miscellaneous concrete filling shown or required to complete the work.

B. Epoxy Adhesive: For application on corrective work where the ordinary methods of remedy are deemed inadequate by the Engineer. Type of adhesive shall be subject to the approval of the Engineer.

3.6 CONCRETE SURFACE REPAIRS

A. Repair of Unformed Surfaces

1. Test unformed surfaces such as monolithic slabs, for smoothness and to verify surface plane to the tolerance specified for each surface and finish. Correct low and high areas as herein specified.

2. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having the required slope. Correct high and low areas as herein specified.

3. Repair finish unformed surfaces that contain defects which adversely affect the durability of the concrete. Surface defects, as such, include cracks in excess of 0.03 inch wide or which penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.

4. Correct high areas in unformed surfaces by grinding, after the concrete has cured sufficiently so that repairs can be made without damage to adjacent areas.

5. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out the low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Engineer.

B. Finishing of Formed Surfaces

1. Joint marks and fins shall be removed and surfaces left smooth and dense. Tieholes and honeycombing shall be repaired with cement and sand mortar.
2. Exposed concrete surfaces shall be vigorously and thoroughly rubbed with a sand cement mortar the consistency of a thick paint to fill all voids and provide a smooth surface. There shall be no discernible thickness of mortar on the surface.
3. Reservoir walls and columns shall be surface finished as specified in section 303.06 C of the Water System Standards.
4. Bridge structure surface finishes shall be in accordance with the Standard Specifications.

END OF SECTION

SECTION 03320 - CONCRETE REPAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 01 Specification Sections, apply to this Section.

B. Water System Standard, 2002, for the Department of Water Supply, County of Maui

1.2 DESCRIPTION OF WORK

A. Restoring damaged and spalled concrete.

B. Replacing damaged rebar.

1.3 SUBMITTALS

A. Submit under the procedures of Section 01330 – SUBMITTAL PROCEDURES.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Structural Bonding Agent shall be Sika Armatec 110 EpoCem.

B. Vertical and Overhead Repair Mortar without Formwork shall be Sikatop 123 Plus Non-sag Repair Mortar.

C. Horizontal and Formed Repair Mortar shall be Sikatop 122 Plus Polymer Modified Trowel Grade Mortar.

D. Cure repair mortar per Manufacturer's recommendation. See 3.02D, hereinafter.

PART 3 - EXECUTION

3.1 PREPARATION

A. Chipping & Removing -- Mechanically remove all loose and delaminated concrete to exposed sound concrete. At edge of sound concrete measure an additional 3 inches outward and beyond the perimeter. Saw cut at a 60 degree angled undercut at outer perimeter to a depth of 3/4-inch. Chip out remaining surface concrete within saw cut perimeter. Where reinforcing steel is exposed chip completely around bar to provide a minimum of 1-inch clear from concrete surface.

B. Cleaning Reinforcement -- If exposed rebar is corroded, remove all loose rust and scales and clean to bare metal.

C. Rebar Replacement -- If steel area loss due to corrosion is 20% or more of the original cross section, replace by weld splicing. Replacing the reinforcing by doweling or lapping may be permitted on a case by case basis when approved by the Contracting Officer.

D. Bonding Agent -- With water, dampen area to be repaired to provide a saturated surface dry condition. Apply bonding agent to concrete surface and exposed reinforcing steel in accordance with the manufacturer's recommendations. Place repair mortar within in 24 hours of application of bonding agent.

3.2 PATCHING

A. Repairs with Formwork -- For vertical and overhead repairs larger than one square foot use formwork. Mix repair mortar according to the manufacturer's instructions to achieve a flowable consistency for placement in formwork.

B. Horizontal Surfaces -- Apply horizontal repair mortar as directed by the manufacturer.

C. Vertical Surfaces -- For vertical and overhead repairs without formwork, apply vertical repair mortar in lifts as directed by the manufacturer.

D. Finishing and Curing -- The formed surface shall be kept moist continuously through curing period of 7 days. The contractor shall take reasonable care to match repairs with the surrounding existing surfaces.

3.3 FIELD QUALITY CONTROL

A. Monitor spread rates of materials by means of:
   1. Visual inspection of uniformity during application.
   2. Exact recording of the amount of material used in a defined area.

3.4 FIELD INSPECTION

A. Quantities of repair material shall be examined at the job site by the Contracting Officer to verify that the quantities are consistent with those reported by the Contractor.

B. Surface preparation and application procedures will be examined by the Contracting Officer to determine conformance with the specified requirements.

3.5 OCCUPANT SAFETY

A. The contractor shall be responsible for the safety of the building occupants during the construction period by providing required railings, fencing, bracing, netting, etc. in accordance with all applicable national, state and local safety ordinances.

END OF SECTION

SECTION 05500 - STEEL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Water System Standard, 2002, for the Department of Water Supply, County of Maui

1.2 WORK INCLUDED: This Section includes but is not limited to:

A. Miscellaneous steel angels, plates, pipes, bars and tubing not specified elsewhere.

B. Ferrous metal anchors, bolts, expansion shields, and other accessories indicated and/or required for the complete installation of all work.

1.3 GENERAL REQUIREMENTS

A. Reference Specifications: Unless otherwise indicated, the “Specification for the Design, Fabrication and Erection of Structural Steel for Buildings” of the American Institute of Steel Construction (AISC) and the American Welding Society (AWS) Standard Code shall govern the work.

B. Coordinate with other trades so that all inserts and attachments are properly set and that adequate provision is made for embedding this work, where required, in the concrete.

C. Submittals: Submit the following in accordance with the Special Provisions.

1. Prequalification of “or approved equal” materials.

2. Shop Plans: Submit shop plans for approval.

PART 2 - PRODUCTS

2.1 MATERIALS: All new, with physical and chemical characteristics equal to or better than those required herein.

A. Steel: ASTM A 36 and A 283, new, straight and true; manufactured by reputable mills.

B. Reservoir Plates, Bars, Pipe: Stainless steel type 316.

C. Bolts, Nuts, and Washers: ASTM A 307, Grade “A”, hot-dipped galvanized. High strength bolts: ASTM A 325. AISI Type 302 stainless steel

D. Expansion Bolts: Hilti Kwik BoltII expansion anchor carbon steel (stainless steel for reservoir) or approved equal.

E. Drop in Anchors: Hilti HDI-L drop in anchor carbon steel or approved equal.

F. Paint for Shop Priming and Field Touch-Up of Non-Galvanized Steel: Zinc Chromate-Iron Oxide Primer, Fuller #621-04, Sinclair #15, or approved equal.

G. Cold Galvanizing Compound for Shop and Field Touch-Up of Galvanized Ferrous Metal Work: The ZRC Chemical Products Co. “ZRC Compound”, applied in strict accordance with manufacturer’s specifications.

2.2 FABRICATION AND WORKMANSHIP

A. Insofar as possible, fit and shop assemble the work, ready for installation. Fabricate and erect all work square, plumb, straight and true. Provide all supports and anchors required for proper installation.

B. Connections: Weld, blindrivet, or attach with screws, countersink and finish flush where exposed, unless otherwise indicated. Make joints and intersections accurately in true planes; tightly fit and draw up, with end threads nicked to prevent loosening.

C. Welding: Use the referenced AWS Standards for general procedure, with all welders certified for the classification of work involved. Grind all exposed welds smooth.

D. Connections: Provide holes and connections for the work of other trades and connect thereto as required.
   1. Isolate metals from contact with concrete and stone work, and different metals from contact with each other, where necessary to prevent corrosion.
   2. Bolting: Use proper size bolts. Draw nuts tight with end threads upset. Metal shall be clean and free from mill-scale, rust and/or pitting.

E. Painting
   1. Shop paint all ferrous metal work except stainless steel, zinc-coated surfaces and work to be embedded in concrete or mortar. Do not coat surfaces to be welded closer than three inches from the weld, prior to welding. Thoroughly dry and clean surfaces; then paint in a workmanlike manner, with all joints and crevices coated thoroughly. Prior to assembly, paint all surfaces which will be concealed or inaccessible after assembly.
      a. Cleaning: Remove all scale, rust, dirt, grease and other deleterious materials prior to coating.

b. Priming: As soon as possible after cleaning, prime coat all exposed surfaces to a uniform dried film thickness of not less than 1.5 mil, Damaged coating shall be promptly repaired with the primer.

2. Field Painting: After installation, clean welds, bolts, and abraded portions and give an additional spot coat of the same materials. Leave the entire work in condition to receive the finish paint, or to provide complete protection of exposed metal if finish painting is not required.

F. Galvanizing: Where so specified, galvanize ferrous metal items using ASTM A123 hot dip process, to an average weight of not less than 2.0 ounces per square foot of surface (coating thickness 0.0034") with no individual specimen having less than 1.8 ounces (coating thickness 0.0030").

1. In the event of doubt of compliance with the weight of zinc coating, test the weight of the coating using test method ASTM A90.

2. Repair of Galvanizing: Where damaged by welding after galvanizing, or by any other cause in shop or field, clean surfaces thoroughly by wire brushing or other approved means, then touch up with the specified cold galvanizing compound. Prepare surfaces, apply material and fuse onto the surface in accordance with manufacturer's instructions. Repair shall provide protection equal to the original coating.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Assemble and install shop fabricated work plumb, square and unwarped. Movable parts shall operate smoothly upon completion. Galvanizing repaired after welding as specified above.

B. Secure anchor bolts with cinch anchors set in holes drilled under this section, in concrete and stone work. At the Contractor's option, attachments may be made with bolts installed in the forms and embedded in the concrete, wherever practical.

C. Protect finish metal surfaces installed in contact with stone, concrete or non-compatible metals with a heavy coat of asphalt or zinc chromate paint, unless specified otherwise.

D. Finished work shall be complete in every detail, strong and rigid, neat in appearance, free from defects, and acceptable to Engineer.

E. Clean all surfaces after installation and leave free of all oil, grease and dirt.

3.2 CLEANUP

A. Clean up and remove all debris accumulated from construction operations from time to time, when and as directed by the Engineer. Upon completion of the construction work and before final acceptance of work, remove all surplus materials, equipment, etc.

END OF SECTION

SECTION 13125 - METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Work Includes: This Section includes metal building systems that consist of integrated sets of mutually dependent components including structural framing, wall panels and accessories. This specification is intended to be a part of a Design-Build (DB) proposal which requires the DB Contractor to provide a completed set of construction drawings to demonstrate compliance to associated performance, building and DHHL standards. DB contractor shall also submit, monitor and be issued a grading, site and building permit for the proposed work, to include payment of all associated design and permitting fees.

1.02 DEFINITIONS

A. Bay: Dimension between main frames measured normal to frame (at centerline of frame) for interior bays, and dimension from centerline of first interior main frame measured normal to end wall (outside face of end-wall girt) for end bays.

B. Building Length: Dimension of the building measured perpendicular to main framing from end wall to end wall (outside face of girt to outside face of girt).

C. Building Width: Dimension of the building measured parallel to main framing from sidewall to sidewall (outside face of girt to outside face of girt).

D. Clear Span: Distance between supports of beams, girders, or trusses (measured from lowest level of connecting area of a column and a rafter frame or knee).

E. Eave Height: Vertical dimension from finished floor to eave (the line along the sidewall formed by intersection of the planes of the roof and wall).

F. Clear Height under Structure: Vertical dimension from finished floor to lowest point of any part of primary or secondary structure, not including crane supports, located within clear span.

G. Terminology Standard: Refer to MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in referenced standards.

1.03 SYSTEM DESCRIPTION

A. General: Provide a complete, integrated set of metal building system manufacturer's custom mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior. Include primary and secondary framing, metal wall panels, and accessories complying with requirements indicated. Provide metal building system of size and with spacings, slopes, and spans indicated.

B. Primary Frame Type Rigid Clear Span: Solid-member, structural-framing system without interior columns.

C. Secondary Frame Type: Manufacturer's standard purlins and joists and exterior-framed (bypass) girts.

D. Eave Height: As indicated by nominal height on Drawings.

E. Bay Spacing: As indicated.

F. Roof Slope: Minimum, 3 inches per 12 inches unless indicated otherwise.

G. Exterior Wall System: Manufacturer's standard field-assembled, uninsulated metal wall panels.

1.04 SYSTEM PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal building systems capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. The design of all primary and secondary framing shall comply with the 2006 International Building Code as amended by the County of Maui. Design shall also comply with the American Institute of Steel; Construction(AISC) “Specification for the Design, Fabrication and Erection of Structural Steel For Buildings”, American Iron and Steel Institute (AISI) “Specification for the Design of Cold-Formed Steel Structural Members” and “Design of Light Gauge Steel Diaphragms” and American Welding Society (AWS) “Standard Code for Arc and Gas Welding in Building Construction”.

2. Design Loads: Minimum to meet 2006 International Building Code or as indicated on Drawings.

3. Live Loads: Include vertical loads induced by the building occupancy indicated on Drawings. Include loads induced by maintenance workers, materials, and equipment for roof live loads.

    a. Building Occupancy: As indicated on Drawings.

4. Wind Loads: Minimum 105 MPH per 2006 International Building Code or as indicated on drawings.

5. Collateral Loads: Include additional dead loads other than the weight of metal building system for permanent items such as sprinklers, mechanical systems, electrical systems, and ceilings.

6. Load Combinations: Design metal building systems to withstand the most critical effects of load factors and load combinations as required by ASCE 7, "Minimum Design Loads for Buildings and Other Structures" and 2003 International Building Code as adopted by the City and County of Honolulu, whichever is more stringent.

7. Deflection Limits: Engineer assemblies to withstand design loads with deflections no greater than the following:

a. Purlins and Rafters: Vertical deflection of 1/240 of the span. Maximum vertical deflection due to live load shall not exceed 1/360 of span.

b. Girts: Horizontal deflection of 1/240 of the span.

c. Metal Wall Panels: Horizontal deflection of 1/240 of the span.

d. Building Drift: 1/200 x Mean Roof Height.

8. Design secondary framing system to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings.

9. Provide metal panel assemblies capable of withstanding the effects of loads and stresses indicated, based on testing according to ASTM E 1592.

10. All rigid frames shall be considered pinned at the base of columns.

11. Anchor bolts shall be designed and provided by the manufacturer.

B. Wind and Seismic Performance: Design and engineer metal building systems capable of withstanding the effects of earthquake motions determined according to the building code in effect for the project site or ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6 “Windloads” and Section 9, "Earthquake Loads", whichever is more stringent.

C. Thermal Movements: Provide metal panel systems that allow for thermal movements resulting from the following maximum change (range) in ambient' and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss for a temperature change (range) of 120 deg F, ambient; for material surfaces.

D. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for Class 90.

1.05 SUBMITTALS

A. Submit as follows.

1. Manufacturer's Data: Submit manufacturer's technical product data to include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of the following metal building system components:

a. Structural-framing system.

b. Metal wall panels.

c. Metal roofing

d. Concrete mix design and reinforcing

e. Overhead coiling doors

f. Steel doors and frames

g. Gypsum board and assemblies

h. Interior finishes

i. Insulation.

j. Flashing and trim.

k. Accessories.

2. Shop Drawings: Submit shop drawings for the following metal building system components. Include plans, elevations, sections, details, and attachments to other work.

   a. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer registered in the State of Hawaii responsible for their preparation.

   b. Anchor-Bolt Plans: Submit anchor-bolt plans before foundation work begins. Include location, diameter, and projection of anchor bolts required to attach metal building to foundation. Indicate column reactions at each location.

   c. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.

   d. Metal Wall Panel Layout Drawings: Show layouts of metal panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners. Show wall-mounted items including doors, windows, louvers, and lighting fixtures.

   e. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:

      i. Flashing and trim.

      ii. Louvers.

3. Samples for Initial Selection: For each type of building component with factory-applied color finish.

4. Samples for Verification: For each type of exposed finish required, prepared on Samples of sizes indicated below.

   a. Metal Wall Panels: Nominal 12 inches long by actual panel width. Include fasteners, closures, and other exposed panel accessories.

   b. Flashing and Trim: Nominal 12 inches long. Include fasteners and other exposed accessories.

   c. Accessories: Nominal 12-inch-long Samples for each type of accessory.

5. Product Certificates: For each type of metal building system, signed by product manufacturer.

a. Letter of Design Certification: Signed and sealed by a qualified professional engineer registered in the State of Hawaii. Include the following:

i. Name and location of Project.

ii. Order number.

iii. Name of manufacturer.

iv. Name of Contractor.

v. Building dimensions including width, length, height, and roof slope.

vi. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.

vii. Governing building code and year of edition.

viii. Design Loads: Include dead load, roof live load, collateral loads, deflection, wind loads/speeds and exposure, seismic zone or effective peak velocity-related acceleration/peak acceleration.

ix. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.

x. Building-Use Category: Indicate category of building use and its effect on load importance factors.

xi. AISC Certification for Category MB: Include statement that metal building system and components were designed and produced in an AISC-Certified Facility by an AISC-Certified Manufacturer.

xii. Two sets of complete structural calculations showing adequacy of all structural members, bracing, connections, etc. for approval. Calculations shall be stamped by a structural engineer registered in the State of Hawaii.

6. Welding Certificates: Copies of certificates for welding procedures and personnel. Comply with applicable provisions of AWS D1.1 “Structural Welding Code – Steel.

7. Erector Certificate: Signed by manufacturer certifying that erector complies with requirements.

8. Manufacturer Certificate: Signed by manufacturer certifying that products comply with requirements. Include evidence of manufacturing experience.

9. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, name and addresses of architects and owners, and other information specified.

10. Material Test Reports: Signed by manufacturers certifying that the following products comply with requirements:

a. Structural steel including chemical and physical properties.

b. Bolts, nuts, and washers including mechanical properties and chemical analysis.

c. Tension-control, high-strength, bolt-nut-washer assemblies.

d. Shop primers.

e. Nonshrink grout.

11. Source quality-control test reports.

12. Field quality-control test reports.

13. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for insulation. Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.

14. Maintenance Data: For metal panel finishes to include in maintenance manuals.

15. Warranties: Special warranties specified in this Section.

1.06 QUALITY ASSURANCE

A. Erector Qualifications: An experienced erector who has specialized in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

B. Manufacturer Qualifications: A firm experienced in manufacturing rigid frame systems similar to those indicated for this Project and with a record of successful in-service performance.

1. A qualified manufacturer and member of MBMA.

2. AISC Certification for Category MB: An AISC-Certified Manufacturer that designs and produces metal building systems and components in an AISC-Certified Facility.

3. Engineering Responsibility: Preparation of Shop Drawings, testing program development, test result interpretation, and comprehensive engineering analysis by a licensed structural engineer registered in the State of Hawaii.

C. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated; as documented according to ASTM E 548.

D. Source Limitations: Obtain primary metal building system components, including structural framing and metal panel assemblies, through one source from a single manufacturer.

E. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal building system and are based on the specific system indicated. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

F. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

G. Regulatory Requirements: Fabricate and label structural framing to comply with special inspection requirements at point of fabrication for welding and other connections required by authorities having jurisdiction.

H. Structural Steel: Comply with AISC S335 "Specification for Structural Steel Buildings--Allowable Stress Design, Plastic Design," for design requirements and allowable stresses.

I. Cold-Formed Steel: Comply with AISI SG-671 "Specification for the Design of Cold-Formed Steel Structural Members," and AISI SG-911 "Load and Resistance Factor Design Specification for Steel Structural Members," for design requirements and allowable stresses.

J. Surface-Burning Characteristics: Provide field-insulated insulation having thermal insulation materials with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Spread Index: 25 or less, unless otherwise indicated.
2. Smoke-Developed Index: 450 or less, unless otherwise indicated.

K. Pre-Erection Conference: Conduct conference at Project site to comply with requirements in Section 01200 - PROJECT MEETINGS. Review methods and procedures related to metal building systems including, but not limited to, the following:

1. Inspect and discuss condition of foundations and other preparatory work performed by other trades.
2. Review structural load limitations.
3. Review and finalize construction schedule and verify availability of materials, Erector's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review required testing, inspecting, and certifying procedures.
5. Review weather and forecasted weather conditions and procedures for unfavorable conditions.

L. Preinstallation Roof Assembly Conference: Conduct conference at Project site to comply with requirements in Section 07410 - PREFORMED METAL ROOFING. Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:

1. Examine purlin and rafter conditions for compliance with requirements, including flatness and attachment to structural members.
2. Review structural limitations of purlins and rafters during and after roofing.
3. Review special roof details, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.

M. Preinstallation Wall Assembly Conference: Conduct conference at Project site. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:

1. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
2. Review structural limitations of girts and columns during and after wall panel installation.
3. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
4. Review temporary protection requirements for metal wall panel assembly during and after installation.
5. Review wall observation and repair procedures after metal wall panel installation.

1.07 DELIVERY. STORAGE, AND HANDLING

A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness and with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

1.08 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify rigid frame system foundations by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions for Foundations: Comply with established dimensions on approved anchor-bolt plans, establishing foundation dimensions and proceeding with fabricating structural framing without field measurements. Coordinate anchor-bolt installation to ensure that actual anchorage dimensions correspond to established dimensions.
2. Established Dimensions for Metal Panels: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal panels without field measurements, or allow for field trimming metal panels. Coordinate construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.09 COORDINATION

A. Coordinate size and location of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in DIVISION 3 – CONCRETE

B. .Coordinate installation of roof curbs and roof penetrations, which work provided in DIVISION 15 - MECHANICAL.

C. Coordinate metal panel assemblies with flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty on Metal Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.

b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.

c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Butler Manufacturing Company.

2. Garco Building Systems.

3. VP Buildings, Inc.; a United Dominion Company.

4. UCI Steel Building Systems, Inc.

2.02 STRUCTURAL-FRAMING MATERIALS

A. W-Shapes: ASTM A 992/A 992M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.

B. Channels, Angles, M-Shapes. and S-Shapes: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.

C. Plate and Bar: ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.

D. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

F. Structural-Steel Sheet: Hot-rolled, ASTM A 1011/A 1011 M, Structural Steel (SS), Grades 30 through 55, or High-Strength Low Alloy Steel (HSLAS), Grades 45 through 70; or cold-rolled, ASTM A 1008/A 1008M, Structural Steel (SS), Grades 25 through 80, or High-Strength Low Alloy Steel (HSLAS), Grades 45 through 70.

G. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 50; with G90 coating designation; mill phosphatized.

H. Non-High-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A, carbon-steel, hex-head bolts; ASTM A 563 carbon-steel hex nuts; and ASTM F 844 plain (flat) steel washers.

1. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

I. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

2. Tension-Control, High-Strength Bolt-Nut-Was her Assemblies: ASTM F 1852, Type 1, heavy-hex-head steel structural bolts with splined ends.

a. Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50.

J. Unheaded Anchor Rods: ASTM A 572/A 572M, Grade 50.

1. Configuration: Straight.

2. Nuts: ASTM A 563 heavy hex carbon steel.

3. Plate Washers: ASTM A 36/A 36M carbon steel.

4. Washers: ASTM F 436 hardened carbon steel.

5. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

K. Headed Anchor Rods: ASTM F 1554, Grade 36 and ASTM A 307, Grade A, straight.

1. Nuts: ASTM A 563 heavy hex carbon steel.

2. Plate Washers: ASTM A 36/A 36M carbon steel.

3. Washers: ASTM F 436 hardened carbon steel.

4. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

L. Threaded Rods: ASTM A 572/A 572M, Grade 50.

1. Nuts: ASTM A 563 heavy hex carbon steel.

2. Washers: ASTM F 436 hardened and ASTM A 36/A 36M carbon steel.

3. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

M. Primer: SSPC-Paint 15, Type I, red oxide.

2.03 MATERIALS FOR FIELD-ASSEMBLED METAL PANELS AND ROOF

A. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Structural Steel (SS), Grade 50 or 80; with Class AZ50 coating designation.

2. Surface: Smooth, flat finish.

3. Exposed Finishes: Apply the following coil coating, as specified or indicated on Drawing. High-performance organic finish (2-Coat Fluoropolymer), manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions, except as modified below:

   a. Humidity Resistance: 2000 hours.

   b. Salt-Spray Resistance: 2000 hours.

4. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored backer finish, consisting of prime coat and wash coat with a total minimum dry film thickness of 0.5 mil.

2.04 THERMAL INSULATION FOR FIELD-ASSEMBLED METAL PANELS

A. Metal Building Insulation: ASTM C 991, Type II, glass-fiber-blanket insulation; 0.5-lb/cu. ft. density; 2-inch-wide, continuous, vapor-tight edge tabs; and with a flame-spread index of 25 or less. Provide R=19 for roof and R=11 for walls unless indicated otherwise. Insulation exposed to view shall have white vinyl scrim face.

B. Retainer Strips: 0.019-inch-thick, formed, galvanized steel or PVC retainer clips colored to match insulation facing.

2.05 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.

1. Fasteners for Metal Wall Panels: Self-drilling Type 410 stainless-steel or self-tapping Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal panels.

2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.

3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

C. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

D. Metal Panel Sealants: As specified in Section 07920 - SEALANTS and as recommended by metal building system manufacturer.

E. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.

2.06 CAST-IN-PLACE CONCRETE

A. Provide reinforced concrete foundations, slabs, and anchor-bolt installation per applicable building code(s) to include Special Inspection for the projects design.
   1. Concrete shall be 2,500 psi minimum and increased as needed for interior vehicular loads.
   2. Provide a vapor barrier such as Stego Wrap 15 mils and Seal all concrete floors

2.07 OVERHEAD COILING DOORS

A. Provide minimum insulated R-6.5 automaticwiht manual back up overhead coiling doors with manufacters finish and 5 year warranty. Provide electgrical and automatic stop device. Design based on Raynor, DuraCoil, Standard Service Door Model: Insulated Flat Slat, or approved equal.

2.08 STEEL FRAMES AND DOORS

A. Provide G90 galvanized heavy duty rating steel doors and frames with heavy duty stainless steel hardware.

2.09 FABRICATION, GENERAL

A. General: Design components and field connections required for erection to permit easy assembly.

   1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.

   2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

B. Tolerances: Comply with MBMA's "Metal Building Systems Manual": Chapter IV, Section 9, "Fabrication and Erection Tolerances."

C. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to

fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

2.10 STRUCTURAL FRAMING

A. General:

1. Primary Framing: Shop fabricate framing components to indicated size and section with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

    a. Make shop connections by welding or by using high-strength bolts.

    b. Join flanges to webs of built-up members by a continuous submerged arc-welding process.

    c. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin or girt web, so flange compressive strength is within allowable limits for any combination of loadings.

    d. Weld clips to frames for attaching secondary framing members.

    e. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary structural members with specified primer after fabrication.

2. Secondary Framing: Shop fabricate framing components to indicated size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

    a. Make shop connections by welding or by using non-high-strength bolts.

    b. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary structural members with specified primer after fabrication.

B. Primary Framing: Manufacturer's standard structural primary framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafter, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.

1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated. Slight variations in span and spacing may be acceptable if necessary to meet manufacturer's standard, as approved by Architect.

2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.

3. Frame Configuration: As indicated on drawings.

4. Exterior Column Type: Uniform depth.

5. Rafter Type: Uniform depth.

C. Secondary Framing: Manufacturer's standard secondary framing members, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Fabricate framing from cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet prepainted with coil coating, unless otherwise indicated, to comply with the following:

1. Purlins: C- or Z- shaped sections; fabricated from steel sheet, built-up steel plates, or structural-steel shapes; minimum 3-inche-wide flanges.

   a. Thickness and Depth: As indicated on Drawings and as required to comply with system performance requirements.

2. Girts: C- or Z-shaped sections; fabricated from steel sheet, built-up steel plates, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees to flange and with minimum 3-inch-wide flanges.

   a. Thickness and Depth: As indicated on the Drawings and as required to comply with system performance requirements.

3. Eave Struts: Unequal-flange, C-shaped sections; fabricated steel sheet, built-up steel plates, or structural-steel shapes; to provide adequate backup for metal panels.

   a. Thickness: As indicated on the Drawings and as required to comply with system performance requirements.

4. Flange Bracing: Minimum 2-by-2-by-1/4-inch structural-steel angles.

5. Sag Bracing: Minimum 1-1/2 by 1-1/2 by 3/16-inch structural-steel angles.

6. Base or Sill Angles: As indicated.

7. Purlin and Girt Clips: Plate 5/16-inch thick, as indicated on drawings.

8. Secondary End-Wall Framing: Manufacturer's standard sections fabricated from minimum 0.0598-inch-thick, zinc-coated (galvanized) steel sheet.

9. Framing for Openings: Channel shapes; fabricated from minimum 0.1046-inch-thick, cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings, and head, jamb, and sill of other openings.

10. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

D. Bracing: Provide bracing as follows:

1. Rods: ASTM A 572/A 572M, Grade 50; or ASTM A 529/A 529M, Grade 50; minimum 5/8-inch-diameter steel; threaded full length or threaded a minimum of 6 inches at each end.

2. Angles: Fabricated from structural-steel shapes as indicated or of size required to withstand design loads, whichever is more stringent.

3. Diaphragm Action of Metal Decking: Design metal building to resist wind forces through diaphragm action of metal decking.

E. Bolts: Provide hot-dipped galvanized bolts for structural-framing components.

F. Factory-Primed Finish: Apply specified primer immediately after cleaning and pretreating.

1. Prime primary, secondary, and end-wall structural-framing members to a minimum dry film thickness of 1 mil. Prime secondary steel framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil on each side.

2. Prime galvanized members with specified primer, after phosphoric acid pretreatment.

2.11 METAL ROOF PANELS

A. Provide manufacturers roofing panels to match wall panels construction, finish with associated gutters, downspouts and pre-cast splash blocks.

2.12 FIELD-ASSEMBLED METAL WALL PANELS

A. Wall Panels: Panel Rib; 36-inch wide net coverage, with 1-3/16 inch high major ribs at 12-inches on center with minor ribs spaced between the major ribs.

1. Material: Galvanized steel, with G90 coating.

2. Thickness: 0.022-inch min. design base metal or thicker as required by design.

3. Side Laps: Two fully overlapping major ribs secured together with 1/4-inch diameter color-matched carbon steel fasteners.

4. Length: Continuous from sill to eave up to 41-feet in length.

5. Endlaps. Where Required: 4-inches wide, located at a support member

6. Cut panels square at each end; provide base trim at sill.

7. Finish: KXL pre-painted finish as selected by the Architect.

2.13 ACCESSORIES

A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

B. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fascia, mullions, sills, corner units, clips,

sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or cross linked-, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Formed from minimum 0.0159-inch-thick, aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match adjacent metal panels.

1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fascia, and fillers.
2. Opening Trim: Minimum 0.0239-inch thick, aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.

D. Louvers: 18 gage galvalume, self-framing, self-flashing with integral head gutter, with paint finish.

1. Type: Fixed blade.
2. Screen: Interior mounted, removable stain steel bird screen.
3. Minimum Free Area: 65 percent.
4. Size: 4 by 3-feet.
5. Color: Manufacturer's standard color.

E. Air Infiltration Barrier: Air infiltration barrier and weather resistive membrane, ASTM E 96 when applied on exterior walls. Tyvek Commercial Wrap as manufactured by Dupont Co. or approved equal. Material shall be Class A tested in accordance with the procedures of ASTM E 84.

2.14 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.15 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform the following tests and inspections and to submit reports.

B. Special Inspector: Owner will engage a qualified special inspector to perform the following tests and inspections and to submit reports. Special Inspector will verify that manufacturer maintains detailed fabrication and quality-control procedures and will review the completeness and adequacy of those procedures to perform the Work. Special inspections will not be required if fabrication is performed by a manufacturer registered and approved by authorities having jurisdiction to perform such Work without special inspection. After fabrication, submit certificate of compliance with copy to authorities having jurisdiction certifying that Work was performed according to Contract requirements.

C. Tests and Inspections:

1. Bolted Connections: Shop-bolted connections shall be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

2. Welded Connections: In addition to visual inspection, shop-welded connections shall be tested and inspected according to AWS D1.1 and the following inspection procedures, at inspector's option:

a. Liquid Penetrant Inspection: ASTM E 165.

b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

c. Ultrasonic Inspection: ASTM E 164.

d. Radiographic Inspection: ASTM E 94.

D. Correct deficiencies in Work that test reports and inspections indicate do not comply with the Contract Documents.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Special Inspector shall examine substrates, areas, and conditions, with Erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. For the record, prepare written report, endorsed by Erector, listing conditions detrimental to performance of work.

B. Before erection proceeds, survey elevations and locations of concrete-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with Erector present, for compliance with requirements and metal building system manufacturer's tolerances.

C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.

B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place, unless otherwise indicated.

3.03 ERECTION OF STRUCTURAL FRAMING

A. Erect metal building system according to manufacturer's written erection instructions and erection drawings.

B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

C. Set structural framing accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

D. Baseplates and Bearing Plates: Clean concrete-bearing surfaces of bond-reducing materials, and roughen surfaces-prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.

2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.

3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.

2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.

F. Primary Framing and End Walls: Erect framing true to line, level, plumb, rigid, and secure. Level base plates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist cure grout for not less than seven days after placement. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened or pretensioned.

G. Secondary Framing: Erect framing true to line, level, plumb, rigid, and secure. Fasten secondary framing to primary framing using clips with field connections using non-high-strength bolts.

1. Provide rake or gable purlins with tight-fitting closure channels and fascia.
2. Locate and space wall girts to suit openings such as doors and windows.
3. Locate canopy framing as indicated.
4. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

H. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.

1. Tighten rod bracing to avoid sag.
2. Locate interior end-bay bracing only where indicated.

I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.04 METAL PANEL INSTALLATION GENERAL

A. Examination: Examine primary and secondary framing to verify that structural panel support members and anchorages have been installed within alignment tolerances required by manufacturer. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before metal panel installation.

B. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
2. Install metal panels perpendicular to structural supports, unless otherwise indicated.
3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Locate metal panel splices over, but not attached to, structural supports with end laps in alignment. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
6. Lap metal flashing over metal panels to allow moisture to run over and off the material.

C. Lap-Seam Metal Panels: Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or metal panels. Install screws in predrilled holes. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

D. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

E. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal panel manufacturer.

1. Seal metal panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal panel manufacturer.

2. Prepare joints and apply sealants to comply with requirements in Section 07920 - SEALANTS.

3.05 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.

2. Shim or otherwise plumb substrates receiving metal wall panels.

3. When two rows of metal panels are required, lap panels 4 inches minimum.

4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.

5. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.

6. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.

7. Install screw fasteners in predrilled holes.

8. Install flashing and trim as metal wall panel work proceeds.

9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated, or if not indicated, as necessary for waterproofing.

10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws.

11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Field-Assembled. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

C. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet, nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.06 THERMAL INSULATION INSTALLATION FOR FIELD-ASSEMBLED METAL PANELS

A. General: Install insulation concurrently with metal wall panel installation, in thickness indicated to cover entire wall, according to manufacturer's written instructions. Facing will not serve as a building vapor barrier.

1. Set units with vapor retarder facing to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.

2. Tape ruptures in vapor retarder.

3. Install blankets straight and true in one-piece lengths.

B. Blanket Roof Insulation: Comply with the following installation method:

1. Over-Framing Installation: Extend insulation' over and perpendicular to top flange of secondary framing members. Hold in place by metal roof panels fastened to secondary framing.

2. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

C. Blanket Wall Insulation: Extend insulation over and perpendicular to top flange of secondary framing members. Hold in place by metal wall panels fastened to secondary framing.

3.07 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

2. Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with

bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.

2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

C. Louvers: Locate and place louver units level, plumb, and at indicated alignment with adjacent work.

1. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

2. Provide perimeter reveals and openings of uniform width for sealants and joint fillers.

3. Protect galvanized- and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with dissimilar metals.

4. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07920 - SEALANTS for sealants applied during louver installation.

3.08 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform the following tests and inspections and to submit reports.

B. Special Inspector: Owner will engage a qualified special inspector to perform the following tests and inspections and to submit reports.

C. Tests and Inspections:

1. High-Strength, Field-Bolted Connections: Connections shall be tested and inspected during installation according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

2. Welded Connections: In addition to visual inspection, field-welded connections shall be tested and inspected according to AWS D1.1 and the following inspection procedures, at inspector's option:

   a. Liquid Penetrant Inspection: ASTM E 165.

   b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

   c. Ultrasonic Inspection: ASTM E 164.

   d. Radiographic Inspection: ASTM E 94.

D. Correct deficiencies in Work that test reports and inspections indicate do not comply with the Contract Documents.

3.09 CLEANING AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

C. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.

1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or SSPC-SP 3, "Power Tool Cleaning."

2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

D. Touchup Painting: Cleaning and touchup painting are specified in Section 09900 - PAINTING.

E. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

F. Louvers: Clean exposed surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning. Restore louvers damaged during installation and construction period so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END SECTION

SECTION 15011 - GENERAL MECHANICAL PROVISIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: Applies to all work of DIVISION 15 - MECHANICAL.

1.02 PLANS

A. The plans and specifications direct attention to certain required features of the materials and equipment but do not purport to cover all details entering into its design and construction. Nevertheless, the Contractor shall furnish and install the mechanical systems complete in all details and ready for operation. The mechanical systems shall be installed substantially as shown on the plans and as specified herein and shall be designed for installation in the area designated with proper space allowed for clearance and maintenance access.

B. Attention is directed to the fact that the plans are based upon certain equipment configurations and that equipment components of other approved equal manufacturers may differ from the arrangement indicated on the plans. If other approved equipment is accepted which require an arrangement different from that indicated on the plans or specified, the Contractor shall prepare and submit for approval, detailed civil, architectural, structural, environmental, mechanical and electrical drawings, layouts, calculations, and equipment lists showing all necessary changes and embodying all special features of the equipment which the Contractor proposes to furnish. The cost of such changes shall be borne by the Contractor at no increase in contract price or extension of contract time for the project.

1.03 SUBMITTALS

A. Submit in accordance with SECTION 01330 - SUBMITTAL PROCEDURES.

B. General Requirements

1. Data Required with the Submittal: The Contractor shall submit all data sufficient to demonstrate conformance to the requirements of the DIVISION 15 - MECHANICAL Technical Specifications. The submittal shall include, but not be limited to, manufacturer's name, catalog number or designation, and the electrical and physical characteristics of the equipment. The submittal shall be in the form of printed data sheets, catalog cuts and shop drawings. Reference to manufacturer's literature without enclosing a copy of the referenced document will be considered insufficient.

   Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal. Incomplete packages will be returned without a review.

2. Approval Requirements: Approval of material and equipment will be based on manufacturer's published data. Where materials or equipment are specified to be constructed and/or tested in accordance with the Standards of the American Society of Mechanical Engineers, National Electrical Manufacturers Association, or Underwriters' Laboratories, Inc.; the Contractor shall submit proof that the items furnished under the contract drawings and specifications conform to such requirements. The ASME stamp will be acceptable as sufficient evidence that the items conform to the requirements of the American Society of Mechanical Engineers. A certificate or published statement that the items are in accordance with the referenced Standard by the manufacturer will be sufficient evidence that the items conform to the requirements of the Standard. In lieu of such stamp, certificate, or statement, the Contractor may submit a written certificate from any nationally recognized testing agency that the items have been tested and that the units conform to the requirements listed hereinbefore, including methods of testing of the specified agencies.

3. Identification: All submittals covering equipment shall be identified with the equipment numbers shown on the contract drawings and the system served.

4. Substitutions

    a. Substitutions shall be subject to the requirements of the SPECIAL PROVISIONS. Supporting data shall be furnished for all substitutions. Redesign of civil, architectural, structural, mechanical, electrical, or any other feature made necessary by the use of substitutions shall be the responsibility of and at the expense of the Contractor, and subject to approval by the Engineer.

    b. Where such approved deviation requires a different quantity and arrangement of ductwork, piping, wiring, conduit, or equipment from that specified or indicated on the drawings, the Contractor shall furnish and install any such ductwork, piping, structural supports, insulation, controllers, motors, starters, electrical wiring and conduit, and any other additional equipment required by the system, or hazardous material abatement at no additional cost to the State.

5. Samples: When called for in the DIVISION 15 - MECHANICAL Technical Specifications, furnish samples of materials that truly represent the materials to be used. Where samples are specified to demonstrate method of installation, furnish all materials and tools. Samples shall also be furnished when materials are proposed as substitutions for those specified. Materials used in the work shall be identical to samples that have been approved by the Engineer.

C. List of Material and Equipment: The Contractor shall submit to the Engineer for approval six (6) sets of a complete list of proposed material or equipment. This list shall include manufacturer's name and material or equipment identification such as styles, types, or catalog numbers, to permit ready and complete

identification. Catalog numbers specified herein are given for reference only. The Contractor shall furnish the latest model manufactured.

D. Shop Drawings: The Contractor shall submit to the Engineer for approval six (6) sets of prints of shop drawings in accordance with the requirements of the SPECIAL PROVISIONS. Shop drawings shall be submitted for equipment not completely identifiable by information contained in the list of materials and equipment.

1. The Contractor shall submit detailed shop drawings of all equipment and all materials required to complete the project. No material or equipment may be delivered to the job site or installed until the Contractor has in his possession the approved shop drawings for the particular material or equipment. The shop drawings shall be complete as described herein.

2. 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 mean that drawings have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the contract drawings and specifications.

3. Failure of the Contractor to submit shop drawings in ample time for checking shall not entitle him to an extension of contract time, and no claim for extension by reason of such default will be allowed.

4. Shop drawings shall be submitted for, but not limited to, the following:

   a. Fuel Systems (Diesel).

   b. All items described in specifications and on drawings.

   c. Other items as the Engineer may direct.

5. Shop drawings shall include as applicable:

   a. Identification of each piece of equipment and component.

   b. Dimensioned layouts and arrangement of equipment.

   c. Operating performance and electrical characteristics.

   d. Foundation and mounting data.

E. MSDS: The Contractor shall submit to the Engineer for approval six (6) sets of MSDS for materials used in this project. Contractor shall perform all work in accordance with the recommendations of the MSDS, including all tests.

F. As-Built Drawings: The Contractor shall submit to the Engineer one (1) reproducible set of all Contract Drawings corrected to reflect the "AS-BUILT"

conditions of the installation. The drawings shall be kept up to date as the job progresses and shall be available for inspection at all times.

H. Certificates: The Contractor shall submit to the Engineer for approval six (6) copies of certificates, acceptance and compliance with regulations of agencies having jurisdiction. Work shall not be deemed complete until such certificates have been delivered to the Engineer. Certificates shall include the following:

1. Pressure testing of aboveground storage tank.

I. One Year Guarantee

1. Contractor shall submit six (6) copies of a written Guarantee that all work is as specified, and shall be bound to replace material or equipment defective due to workmanship or materials. Contractor shall not be responsible, however, for defects proven to the Engineer's satisfaction to be due to misuse, accident, lack of maintenance, improper operation, or negligence by other parties.

2. Further, Contractor shall be held responsible for all damages to any part of the premises, building or contents caused by leaks or other defect in pipe, equipment or materials provided under the contract drawings and specifications.

3. Terms of this Guarantee are in addition to other guarantee provisions of the specifications, and do not substitute for other more stringent terms, if any.

4. The Guarantee shall commence immediately after the system/equipment startup date or Project Acceptance Date, whichever occurs first, and extend for a period of one (1) year commencing after thirty (30) consecutive days of trouble-free operation after the Project Acceptance Date. The Guarantee shall include all labor, materials, equipment and parts necessary to service the complete system, so as to assure proper operation and function of the system. All costs for the periodic maintenance, including emergency calls, shall be borne by the Contractor. Should equipment fail and require repair, the entire guarantee shall be extended by the period of time it takes to repair the equipment. Furthermore, the Engineer has the option to reject any installed equipment if the Contractor violates any of the corresponding equipment manufacturer's guarantee or warranty terms including maintenance requirements. All rejected equipment shall be replaced with new equipment at no cost to the State.

6. Trouble-free operation is defined as a non-disabling condition or a non-recurring failure or disruption and the following:

a. The system shall be free of all discrepancies, contamination and debris, which require correction.

b. The system is maintaining operational conditions and other parameters as measured during the acceptance test.

J. Operation and Maintenance Manual

1. The Contractor shall submit to the Engineer for approval six (6) hardbound (heavy-duty, "D" type, 3-ring binder) copies and a compact disk (CD-R) of the Operation and Maintenance Manual on all equipment and the system as a whole. Operation and Maintenance Manual files on CD-R shall be searchable PDF files. The manual shall identify project name and number, contractor, consultant, date and all equipment provided. It shall include the equipment, manufacturer's name and contact information (phone, facsimile, e-mail, website, and address), model and serial number, tag number, capacity, quantity of units, and startup date,.

2. Operation and Maintenance Manual shall be submitted for, but not limited to, the following:

   a. Fuel Systems (Diesel).

   b. All items described in specifications and on drawings.

   c. Other items as the Engineer may direct.

3. Operation and Maintenance Manual shall be submitted to the Engineer for approval prior to acceptance of each installation. Manual shall include the following:

   a. Manufacturer's Literature: Adequately indicate, highlight, arrow, etc. project related information and delete, "X" or cross out non-applicable information.

   b. Parts List: Submit a parts list and assembly diagrams showing location, number required and identification for each part and subassembly. Submit source of service and replacement parts.

   c. Control and Wiring Diagrams: Submit control and wiring diagrams.

   d. Operation Instructions: Submit a brief description of the system(s) with information on the proper control of the system(s) by the operator.

   e. Maintenance Instructions: Submit a list of each item requiring inspection, lubrication or service with the description of the proper performance of such maintenance.

   f. Maintenance Schedule: Submit a recommended schedule of maintenance activity broken down by recommended frequency of performance (i.e. weekly, monthly, quarterly, semi annually, annually).

   g. Installation Instructions: Submit installation instructions.

1.04 MANUFACTURER'S INSTRUCTIONS

A. General: Furnish manufacturer's instructions and data covering installation, operation and maintenance of all materials and equipment. Submittals shall be in six (6) bound copies each.

B. Installation instructions for materials shall include precautions for handling, storage and preparation for field application. Description of other materials and tools required to complete the installation shall be included. Installation instructions for equipment shall include assembly, recommended supports, aligning and connecting for service. The instructions shall include illustrations, diagrams and step-by-step procedures.

C. Operation and maintenance instructions shall include instructions for operation, maintenance, repair, recommended inspection points and periods for inspection in a practical, complete and comprehensive manner. The information shall be arranged in a logical, orderly sequence, including a general description of the equipment and significant technical characteristics. Test, adjustment and calibration information shall be furnished and identified to specific equipment. The instructions shall include illustrations, diagrams, and step-by-step procedures.

D. Spare Parts Data: Spare parts data shall be furnished for each item of equipment. The data shall include a complete list of parts and supplies, to assure efficient operation for a period of one (1) year, current unit prices and source of supply. Components not manufactured by the equipment company such as bearings, seals, and packing shall be identified as to trade name and part and identification number. The foregoing shall not relieve the manufacturer of any responsibilities under the guarantee specified hereinbefore.

E. Identification: The data shall have complete identification throughout using equipment numbers shown on the drawings and indicating the system to which the data pertains.

PART 2 - PRODUCTS

2.01 ASBESTOS PROHIBITION

A. No asbestos containing materials may be used. The Contractor shall insure that all materials incorporated in the project are asbestos-free unless specifically approved.

2.02 MATERIALS AND EQUIPMENT

A. Materials and equipment shall conform to the requirements of applicable Technical Specifications and publications specified therein and shall be as shown. Materials and equipment shall be new and shall be the products of manufacturers regularly engaged in the manufacture of such products. All items shall essentially duplicate materials and equipment that have been in satisfactory use at least two (2) years prior to bid opening and shall be supported by a service

organization that is, in the opinion of the Engineer, reasonably convenient to the site of installation.

2.03 NAMEPLATES

A. Each item of equipment shall have manufacturer's nameplate of corrosion resistant metal attached in a conspicuous location. Nameplate data shall include manufacturer's name, address, model number, capacity, rating and such other performance data as required to completely identify the item. In addition, the Contractor shall provide a separate corrosion resistant metal tag to carry the equipment designation as shown on drawings and the installation date. Except as otherwise specified nameplate lettering shall be stamped upper case. Nameplate shall be fastened by means of corrosion resistant metal screws or wire, 14-gage.

2.04 TOOLS AND SUPPLIES

A. Where specified in the DIVISION 15 - MECHANICAL Technical Specifications, special tools and supplies shall be provided. The items shall be packaged or boxed to provide protection in storage, and shall be identified as to use. Tools and supplies shall be accompanied by information as to source of supply.

PART 3 - EXECUTION

3.01 QUALITY CONTROL

A. The work shall be performed by workmen skilled in the type of work involved under experienced supervision. Where methods of application or installation are specified by commercial standards in the DIVISION 15 - MECHANICAL Technical Specifications, no departures will be permitted except as specified or as directed by the Engineer.

3.02 INSPECTION AND TESTS

A. The Contractor shall give the Engineer written notice a minimum of seven (7) calendar days prior to inspection and tests. Tests shall be performed as required in the DIVISION 15 - MECHANICAL Technical Specifications. All work rejected by the Engineer shall be repaired or replaced by the Contractor at no additional cost to the State.

3.03 VERIFICATION OF DIMENSIONS

A. The Contractor shall check all dimensions at the site and shall establish all lines and levels. Equipment shall be located to assure proper grade for piping. The Contractor shall be responsible for correctness of all dimensions and fitting of piping and equipment into the available space. Should field measurements show conditions that require relocation of any work, such conditions shall be reported to the Engineer in advance of installation, and the work shall proceed in accordance with his decision.

3.04 PROTECTION DURING STORAGE

A. All materials and equipment shall be stored in a safe manner, secured from weather. All materials shall be stored above the ground or floor level to avoid damage by moisture.

3.05 PROTECTION OF WORK IN PROGRESS

A. Pipe openings shall be closed with caps or plugs until connections are made. Equipment shall be securely covered for protection against physical or chemical damage. In areas exposed to weather, materials unused at the end of each day's work shall be stored in weather-protected locations. Damage to materials or equipment due to the Contractor's neglect shall be repaired or replaced to the satisfaction of the Engineer by, and at the expense of, the Contractor. Trenches and excavations shall be properly shored, protected and covered if left open.

3.06 PROGRESS OF WORK AND COORDINATION

A. The work shall be coordinated with the work of other contractors and other trades to avoid interferences, preserve headroom and operating clearances, and to expedite completion of the project.

3.07 INSTALLATION OF EQUIPMENT

A. Installation and adjustments shall be in accordance with the equipment supplier's written instructions. All accessories required shall be properly installed and connected. Supports shall be adequately anchored and vibration isolation shall be installed where required.

3.08 PERMITS, LICENSES AND INSPECTIONS

A. The Contractor shall obtain all permits and licenses required to perform the work, pay all required fees, and shall cooperate with all inspections required by authorities having jurisdiction. Inspections specified in the DIVISION 15 - MECHANICAL Technical Specifications shall be permitted without interference. Corrections to work as a result of inspections shall be made promptly.

3.09 LOCAL TECHNICAL SUPPORT

A. The mechanical equipment supplier shall have a Hawaii Office, staffed with factory trained representatives fully capable of providing instruction on routine and emergency maintenance service on all system components supplied for this project.

3.10 FIELD TESTS

A. The Contractor shall be responsible for testing of the installed work, shall provide all labor, equipment and instruments, and shall conduct pressure tests and operating tests on the piping systems and equipment. During pressure tests, all items in piping systems not designed for test pressures shall be removed from, or

isolated from the system and shall be reconnected or unblocked after tests are completed. Should operating tests require the presence of manufacturer's representatives, the Contractor shall cooperate with them and shall place at their disposal all assistance, materials and services required to perform such tests. Testing shall be as specified hereinafter.

3.11 TESTING

A. Prior Tests: Leave concealed or insulated work uncovered until required tests have been completed, but if construction schedule requires it, arrange for prior tests on parts of system as approved.

B. Preliminary Tests: As soon as conditions permit, conduct preliminary or "turn-over" tests of certain equipment as directed to ascertain compliance with specified requirements. Make needed changes, adjustments or replacements as preliminary tests may indicate, prior to acceptance tests.

C. Acceptance Tests: Conduct pressure, performance and operating tests as specified for each system or equipment unit, in the presence of the Engineer [or other accredited representative of the State], as well as representatives of agencies having jurisdiction.

D. Costs: Furnish labor, materials, instruments and bear other costs in connection with all tests. Installed instruments may be used for tests, if calibrated and approved for the purpose.

E. Defects: All defects disclosed as a result of the following or other tests or operations shall be promptly repaired by and at the expense of the Contractor and to the Engineer's satisfaction. Contractor shall supply all instruments, labor and tools required by tests. Any defective material and/or equipment shall be repaired, adjusted and replaced by new, like materials and equipment, and retested before acceptance. Caulking of screwed joints or holes will not be accepted.

F. Certificates: Obtain certificates of approval, acceptance and compliance with regulations of agencies having jurisdiction. Work shall not be deemed complete until such certificates have been delivered to the Engineer.

G. Instructing Operating Personnel: When equipment have been placed in permanent operation, instruct operating personnel in operation and maintenance of equipment. Instruction shall include all normal operations of the system, troubleshooting, review of the Operation and Maintenance Manual and how to obtain replacement parts. Instruction shall also include answering all questions posed by staff.

H. Pressure Tests: Before testing piped systems, remove, or otherwise protect from damage, control devices, air vents and other parts, which are not designed to stand pressures used in testing piping.

I. Do not paint, cover or conceal piping, nor connect fixtures or equipment before testing and obtaining approval.

K. Test piping that will be concealed, in sections as approved. Perform tests in a manner that will not leave any pipe or joint untested.

L. Testing procedures and conditions stated above shall also apply to all of the following tests:

1. Fuel Systems Test

2. Operating Test

3.12 OPERATING TEST

A. After installation work has been completed, tested and approved, test equipment under normal operating conditions for periods as directed to check capacities and other details as required demonstrating that they fulfill requirements of the plans and specifications, and that they operate satisfactorily.

B. Where evidence of stoppage appears in piping or equipment, disconnect, clean, repair, and reconnect obstructed parts. Contractor shall bear costs of cutting, patching adjoining work necessitated by such cleaning and repairing.

END OF SECTION

ATTACHMENT NO. 1

SCHEDULE OF MAINTENANCE SERVICE

PART 1 – EQUIPMENT MAINTENANCE

1.01 SUMMARY

A. All services performed by the Contractor shall include applicable items listed but shall not be limited to the following maintenance tasks. Contractor shall also be responsible for performing all maintenance tasks recommended by the equipment manufacturer(s) whether listed below or not.

1.02 FANS

A. Monthly Service

1. Certify performance of monthly fan maintenance service. Correct and report all discrepancies.

B. Quarterly Service

1. Check motor-controlled and back-draft dampers for proper operation; lubricate linkage for free movement.

2. Lubricate fan motors and bearings.

3. Check fan collar, bearings and shaft for wear, repair as needed.

4. Remove and wash intake grille.

5. Certify performance of quarterly fan maintenance service. Correct and report all discrepancies.

C. Semi-Annual Service

1. Check and clean fan wheels and housings of dust, dirt and grease.

2. Remove and wash all intake grilles and dampers and repair or replace deteriorated bird screens.

3. Examine flex connections for cracks or leaks. Repair or replace damaged material.

4. Certify performance of semi-annual fan maintenance service. Correct and report all discrepancies.

D. Annual Service

1. Submit maintenance report in writing to the Contract Administrator.

1.03 VALVES, PIPES, EQUIPMENT AND SUPPORTS

A. Monthly Service

1. Wirebrush, prime and paint rust from valves, pipes, equipment and support surfaces, then prime and paint to prevent further rusting. Paint rust immediately upon discovery or notification.

2. Certify performance of monthly valves, pipes, equipment and supports maintenance service. Correct and report all discrepancies.

B. Annual Service

1. Exercise all equipment shut-off valves for proper operation and tightness.

2. Certify performance of annual valves, pipes, equipment and supports maintenance service. Correct and report all discrepancies. Submit maintenance report in writing to the Contract Administrator.

1.04 CEILING FANS

A. Quarterly Service

1. Dust the fan housing and blade.

2. Check and rebalance fan blades where necessary to eliminate wobbling or shaking, etc.

3. Check and examine that the safety cable is properly installed.

4. Certify performance of quarterly ceiling fan maintenance service. Correct and report all discrepancies.

B. Annual Service

1. Check and examine that the safety cable is properly installed.

2. Verify that the mounting hardware is securely fastened to the outlet box.

3. Verify that the hardware securing the fan blades to the fan hub is securely fastened.

4. Clean the fan blades with a damp cloth and ordinary soap and water.

5. Verify that the wire nuts are secure and the ground wire is securely connected.

6. Certify performance of annual ceiling fan maintenance service. Correct and report all discrepancies. Submit maintenance report in writing to the Engineer.

PART 2 – MAINTENANCE SCHEDULE AND REPORTING

2.01 WORK SCHEDULE

A. All maintenance work shall be performed between the hours of 7:30 a.m. and 4:00 p.m. on normal working days, Monday through Friday, excluding State Holidays.

2.02 TROUBLE CALLS

A. Emergency service and repairs required between regular service calls shall be rendered within 24 hours after the Contractor is notified, State non-work days excluded. The Contractor shall call the facility representative the next working day after being notified of the problem and report the status of repairs.

2.03 MAINTENANCE REPORT/CHECKLIST

A. The Contractor shall prepare and maintain a maintenance service report/checklist, which shall include the following:

1. Date maintenance service was performed.

2. Type of maintenance (i.e., monthly, quarterly, semi-annual, annual).

3. The name of the mechanic who performed said maintenance.

4. The type and cost (labor, materials, parts and equipment) of repair work performed on the unit, if any.

5. Documents and other data pertaining to the maintenance performed.

a. It shall be the responsibility of the Contractor to maintain the report/checklist by recording the above noted data after each scheduled maintenance and emergency repair, and have the checklist available for inspection at the building site. The report shall be sufficiently detailed to properly reflect the past maintenance history of the equipment.

b. Reports shall be certified by a representative of the facility being served and shall be submitted to DAGS Central Services Division immediately after the completion of the maintenance service or service trouble call.

2.04 CLEANUP AND WORK PRACTICES

A. The Contractor shall keep the job site free of debris, litter, discarded parts, etc. and shall clean all oil drippings during the daily progress of work. The Contractor shall remove all tools, parts and equipment from the service areas upon completion of the work.

B. The Contractor shall exercise caution during the progress of his maintenance and repair work to prevent damage to roof, roofing, or other existing building elements

and equipment. The Contractor shall restore all damages, caused by his negligence, to its original condition at his own expense.

END OF ATTACHMENT

SECTION 15130 – BOOSTER PUMP UNITS

PART 1 - GENERAL

1.01 DESCRIPTION: The following requirements are for the furnishing and installation of the pumps, motors, and appurtenances of the Booster Pump Units for the project at Site 1 – Kauluwai Well Site. The booster pump units shall include the pump bowl assembly, pump column, discharge head, and motor. The pumps shall be of proper dimensions to fit within the existing suction cans.

1.02 SUBMITTALS: Furnish six (6) copies of submittals per specification requirements for review and approved by the Engineer.

1.03 INTENT OF SPECIFICATIONS AND DRAWINGS: Unless otherwise specified herein materials, equipment, and construction shall be in accordance with the appropriate portions of the Water System Standards 2002, as amended.

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 bidding, 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 Engineer at least fourteen (14) days before the bid 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.

1.04 SANITARY SURVEY: To comply with water sanitary requirements, upon removal of pumps and any components that expose the system, the Contractor shall immediately seal (temporarily) all openings to the system piping, cap or plug all open pipe nipples or fittings with threaded pipe plugs or caps and seal all flanged openings through bolted and gasketed covers to prevent contamination. All new components shall be disinfected prior to making permanent reconnections of piping systems.

PART 2 - PRODUCTS

2.01 VERTICAL TURBINE CAN – TYPE BOOSTER PUMP: The pumps shall be manufactured by Goulds Pumps or approved equal, and shall be as specified below.
Note: Since the pumps will be installed within the existing suction cans, the Contractor shall ensure the pumps will fit and operate satisfactorily in accordance with these specifications.

A. Booster Pump Characteristics:

1. Number required: Two (2).

2. Pump rated capacity and head: 540 gpm at 473 ft. head (Bowl efficiency not less than 83%).

3. Pump performance characteristics:

0 gpm at 631 ft. head maximum (shut-off head).
250 gpm at 594 ft. head (bowl efficiency not less than 65%).
400 gpm at 542 ft. head (bowl efficiency not less than 80%).
540 gpm at 473 ft. head (bowl efficiency not less than 83%).
600 gpm at 437 ft. head (bowl efficiency not less than 82%).
750 gpm at 357 ft. head (bowl efficiency not less than 77%).

Pump used to dimension plans and specify pump performance characteristics:
Goulds, 1,770 rpm, Model VIC-FLTM (12WALC – 7 Stages) modified diameter impeller (8.75-inch diameter).

B. Motor Characteristics:

1. Number Required: Two (2).

2. Electrical Motor Horsepower Rating: 100 hp.

3. Power: 3 phase, 60 cycle, 460 volts.

4. Minimum Full Load Motor Efficiency: 95% (Premium-efficiency).

5. Enclosure: WP1.

6. Minimum Motor Speed: 1750 rpm.

7. Service Factor: 1.15.

8. NEMA Code Letter: G.

9. 120 Volts Internal Space Heaters.

C. Discharge Head Characteristics:

1. Number required: Two (2).

2. Size and Class of Discharge Flange: 6 inches, 300 lbs., ASA.

3. Maximum Height of Discharge Head: 29 inches.

4. Height of Centerline of Discharge Flange from Baseplate: 9 inches.

5. Shall be able to remove and replace mechanical seal without removing the motor.

D. Suction Barrel Dimensions: Suction barrels (cans) are existing. Dimensions are taken from the best reliable source. It is the Contractor's responsibility to verify all dimensions and to ensure the pump will be compatible with the barrels.

E. Line Shafting:

1. Minimum Shaft Size: 1-3/16 inches.

2. Shaft Material: High chrome stainless steel ASTM A 582, Grade 416.

3. Coupling Material: High chrome stainless steel ASTM A 582, Grade 416.

F. Pumping Unit Requirements:

Minimum Guaranteed Overall Efficiency of Pumping Unit
at Rated Capacity and Head: 75%.

G. Bowls:

The pump bowl shall be of close-grained cast iron having a minimum tensile strength of 30,000 pounds per square inch, free from blowholes, sand holes, and all other faults; accurately machined and fitted to close dimensions. The bowl shall be porcelain enamel lined, nominal 8 mils thick, finished smooth, and free of defects. Bowls shall conform to ASTM A48, Class 30. Bowl shall be able to withstand twice the pressure at rated flow or 1.5 times the shut-off head, whichever is greater. Provide stainless steel bowl cap screws.

H. Impeller Shaft:

The impeller shaft shall be of polished ASTM A582, Grade 416 stainless steel and shall be supported by suitable noncorrosive bearings on both sides of each impeller, and positive means shall be provided for water lubricating each bearing. The shaft shall be threaded at the lower end to receive an assembly nut to accurately locate the shaft with respect to the bowls during assembly of the unit. The bottom base bearing shall be bronze or other approved material. All shaft couplings, impeller collet, and all nuts exposed to the elements shall be stainless steel.

I. Impellers:

Impellers shall be enclosed type of ASTM A744, Grade 316 stainless steel, finished all over, accurately fitted, and perfectly balanced both mechanically and statically. They shall be locked securely to the impeller shaft with a tapered 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 manufacturer of the pump must provide sufficient clearance in the bowl of the pump he supplies to take care of any stretching of the shaft under shut-off head conditions without the impeller making contact with the bottom surface of the bowl.

J. Motor Description:

The motor shall be a normal torque, premium efficiency, low starting current, vertical, hollow shaft, Weather Protected Type 1 enclosure, squirrel cage induction motor or approved equal and shall conform to the standards of the National Electrical Manufacturers Association, American National Standards Institute and the Institute of Electrical and Electronics Engineers. The motor shall be designed for full voltage starting.

The motor shall have a horsepower rating of not less than specified, and shall be General Electric Tri-Class Vertical Hollow Shaft Induction Motor; U.S. Vertical Hollow Shaft Induction Motor; Westinghouse Vertical Hollow Shaft; or approved equal. The motor shall have adequate capacity to drive the pump continuously under the head specified with a temperature rise of not more than 40 degrees C. The maximum starting current shall not exceed that of a motor having a locked rotor current of that specified.

Modifications to the motor shall include 120-volt internal space heaters and noise reduction.

Motor shall have an efficiency of not less than that specified when operating under full load conditions. The bearings of the motor shall be oil lubricated. The motor thrust bearing shall have ample capacity for the thrust loads of the pump thrust and weights of the pump shaft and pump rotating element with pump operating at shut-off head conditions. The thrust bearing shall be of such size that the average life rating is based on

five years of continuous operation. It shall also have ample capacity to permit the pump to operate for 10-minute periods with the discharge valve closed. The motor shall be capable of reverse rotation when the unit is shutdown. However, if required by the pump manufacturer, nonreversing ratchets shall be provided.

The selection of the motor shall be the responsibility of the Contractor and Pump Manufacturer and must meet the approval of the Engineer or his designated representative before it is ordered.

Manufacturer's certified copies of tests run on a motor of the same type, size and model as the one being furnished shall be forwarded to the pump supplier for inclusion in the bound sets for submittal to the Engineer or his designated representative.
Test data shall include:

1. A.C. winding resistance.

2. No load current.

3. Full load current.

4. Locked rotor current.

5. Starting torque.

6. Motor efficiency at 50, 75 and 100% full load.

7. Power factor at 50, 75 and 100% full load.

8. Power factor at full load with 90 and 110% rated voltage.

K. Discharge Head:

The discharge head shall be fabricated steel with discharge flange located above the ground. The existing suction flange is located on the suction barrel and is below ground. The mechanical seal in the discharge head shall be a Chesterton 155 Single Cartridge Mechanical Seal, or approved equal. All discharge heads shall be furnished by the pump manufacturer. The pump nameplate shall be securely fastened in a conspicuous place showing the manufacturer's name, serial number, capacity in gpm at rated head in feet, speed in rpm and the number of stages for each pump. The discharge head assembly shall be approved by the Engineer before it is ordered by the Contractor.

L. Spare Parts:

One (1) set mechanical seals for each pump.

2.02 SUBSTITUTION OF SPECIFIED PUMP: The pumping units to be furnished are those used to specify pump performance characteristics or their approved equal.

These specific models have been used to dimension plans. Substitute pumps can be used only if the following conditions are met:

A. All changes in dimensions resulting from the substitution of the specified pump shall be the responsibility of the Contractor and such changes must be approved by the Engineer fourteen (14) days prior to bid opening date.

B. The substitute pump must have performance characteristics equal to or better than the specified pump. Specific performance characteristics that shall be compared are the required horsepower, efficiency and head capacity curve.

2.03 PRELIMINARY PUMP CHARACTERISTIC CURVE: The Contractor shall submit six (6) copies of the Preliminary pump characteristic curve to the Engineer for approval prior to ordering and shipping the units. The curve shall show the proposed head, efficiency and brake horsepower versus capacity characteristics of the pump to be furnished. The Contractor shall furnish the pump shaft size, pump requirements, number of stages, bowl dimensions, and specifications.

2.04 FACTORY PUMP TESTS: The Contractor shall submit six (6) copies of a certified performance curve for the pumps which he proposes to furnish, based on a factory witnessed running test for each unit made in accordance with the recommended practices of the Hydraulic Institute and the American Water Works Association to show that the specified conditions can be met by his equipment. The curve and data sheet must be approved by the Engineer. The performance curve shall show the head-capacity at rated speed, efficiency-capacity, and required brake horsepower-capacity curves for each pump. The pump shall be operated at shut-off condition and at a minimum of five (5) capacity points, including one (1) within $\pm$ 2% of the design capacity. Six (6) copies of the data sheet used to plot the curves shall be submitted by the Contractor to the Engineer.

PART 3 - EXECUTION

3.01 INSTALLATION INSTRUCTIONS AND MAINTENANCE MANUAL: The pump manufacturer shall also provide at least six (6) copies of the instructions for the installation of the pumping units and proper maintenance of the same in bound folders.

3.02 EQUIPMENT ASSEMBLY: Installation of the pumping units shall be made for the Contractor by a subcontractor possessing a current C-57 Well Drilling Contractor License and/or a C-57a Pump Installation Contractor License or a C-68 Pump Specialty License at the time of bidding and throughout the project and shall be under the direction of the supplier of the pumping units. The units shall be installed in the presence of the Engineer or his designated representative. The Contractor installing the pump units shall have at least five (5) years experience in installing pumps in the State of Hawaii.

All equipment shall be located, leveled and aligned to accurately maintain all lines and grades shown on the applicable drawings. Where assembly tolerances are established by written instructions provided by the equipment manufacturer,

such tolerances shall govern. If assembly tolerances are not provided by the equipment manufacturer, such tolerance shall be normal for the class of fit and the type of work involved. Alignment of rotating shaft centers at couplings shall not exceed proper allowance for the expansions of the driving and driven units when operating; and faces of coupling halves, with coupling square on their shafts, shall be parallel. In any case, tolerances and alignments must be approved and witnessed by the Engineer or his designated representative.

Grouting of equipment bases and supports shall be performed after final positioning at proper elevation, with all plumbing, leveling and aligning completed and with anchors tightened. Grouting of equipment bases and supports shall be in accordance with the appropriate paragraphs of Section 03300, CAST-IN-PLACE CONCRETE. Once grouted, the item shall not be operated or subjected to other vibration or stresses until the grout has reached an age of 7 days minimum.

Shimming of equipment bases and supports shall be performed after final positioning at proper elevation, with all plumbing, leveling and aligning completed and with anchors tightened.

Lubrication of all moving parts shall be done by the Contractor with the lubricants recommended by the manufacturers. Rotating equipment, which has been shipped dismantled for assembly in the field or is not shipped with lubricants, shall have the bearings flushed clean and lubricated when erection is complete.

The following requirements and instructions of equipment manufacturers shall be followed precisely regarding lubrications.

All sleeve bearing motor and driven equipment bearings shall be opened and inspected by the Contractor before equipment is lubricated or placed in operation, unless such inspection is waived by the Engineer or his designated representative. All lube oil reservoirs shall be cleaned and filled with oil of the proper type following inspection of reservoirs by the Engineer or his designated representative.

All surfaces of equipment shall be cleaned prior to assembling and erecting. All internal surfaces shall be maintained clean and free of dirt, water, loose scale and all other foreign materials during assembling and erecting, and shall subsequently be thoroughly cleaned prior to initial operation or use.

3.03 PAINTING: Painting of new booster pump units, all exposed pipes, fittings, and valves shall be as specified herein and in Section 09910, PAINTING. Paint shall be delivered to the site in factory-sealed containers and applied in accordance with the manufacturer’s instructions. All surfaces to be painted shall be thoroughly cleaned of dirt, dust, oil, or grease with clean, dry rags and solvents. Rust, mill scale, stain and any other injurious materials shall be removed by scraping, chipping, wire brushing or sand blasting. Drop cloths and other suitable covering shall be used to eliminate paint drips or overspray beyond the painted surfaces.

Pump motor and valves with shop-coated enamel or primer shall be given one coat of Dupont No. 823 Corlar Epoxy Enamel guaranteed to provide 2 mils dry film thickness, and one coat of Dupont No. 326 Imron Polyurethane, 2 mils dry film thickness, color selection by the Engineer or his designated representative.

3.04 LAYOUT DRAWINGS: Six (6) sets of the pump and piping layout drawings shall be submitted for approval to the Engineer prior to construction. All dimensions of the pumps, valves, piping, fittings, and appurtenances shall be shown.

3.05 FIELD TESTING OF PUMP UNIT: After installation of all equipment and before any field tests are conducted, the pumps shall be operated continuously for a period as directed by the Engineer or his designated representative. The Contractor shall conduct the final field testing and necessary adjustments (i.e., final axial clearance between bowl and impellers, etc.). Vibration testing shall be made for the pump and the motor with vibration limit at the top motor bearings not more than 2.0 mils peak to peak at 1770 rpm.

Throughout the operating test, the pumping units shall run smoothly without vibration or heating of the bearings. If, during or as a result of this test, any structural or mechanical defect or weakness develops, or if the equipment fails to deliver its required discharge at the respective head under required conditions, the Department reserves the rights to reject any part or all of the equipment and demand reconstruction or replacement to meet the requirements of these specifications at no cost to the Department of Hawaiian Home Lands.

After the operating test has been completed to the satisfaction of the Engineer or his designated representative, an efficiency test shall be made for the pumping units covering a period of not less than 2 hours. This efficiency test shall be made by the Contractor in the presence of the Engineer or his designated representative and in accordance with the recommended practices of the Hydraulic Institute and American Water Works Association. The capacity of the pumping units will be tested under the head capacity conditions specified.

All gages and equipment required for tests which are not available in the permanent equipment will be furnished, installed and tested by the Contractor. All gages shall be calibrated and calibration curves shall be submitted.

The overall efficiency of the pumping unit shall be the ratio of the water horsepower delivered by the pumping units as measured at the pump discharge head to the total electrical power consumed by the unit. Overall efficiency shall include all pump and motor losses.

The quantity of water delivered shall be based on the readings of the flow meter. No special calibration will be made. Tests shall be made with the electrical current normally furnished by Maui Electric Company. No adjustment of the electrical power will be allowed.

Should the test for efficiency for the pumping units result in an overall efficiency of less than that specified in the guaranteed capacity and head point, the Contractor shall make the necessary changes and replacements. All such changes and replacements and any additional tests required shall be paid by the

Contractor. During the period between the first test and the final acceptance of the pumping units by the Department of Hawaiian Home Lands, the units shall be left in place and in good working condition for use by the Department in order to provide service, if required and at no additional cost to the Department of Hawaiian Home Lands.

3.06 AS-BUILT DRAWINGS: One (1) set of red marked as-built drawings shall be submitted to the Department of Hawaiian Home Lands by the Contractor at no additional cost.

3.07 PACKING AND SHIPMENT: Pump equipment shall be packed in substantial containers to protect them adequately from damages during normal handling in transit.

3.08 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 weathertightness. Any closures which are punctured or missing shall be replaced with temporary closures and made weathertight. All closures shall be maintained weathertight and left in place until removal is authorized by the Engineer or his designated representative.

3.09 COORDINATION OF WORK: The Contractor's work and installation of equipment and materials shall be closely coordinated with the Engineer or his designated representative and other contractors working on the project to avoid all possible interferences, delays, omissions and overlapping of responsibilities.

3.10 WARRANTY: The Contractor shall guarantee the equipment covered by these specifications against any defective material and workmanship for one (1) year after the date of acceptance of the installed pump units. 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.

3.11 PAYMENT: Payment for booster pump units and appurtenances will be made at the lump sum price bid in the Bid. The lump sum price shall represent full compensation for furnishing and installing all materials and for all labor, tools, equipment and incidentals required to furnish and install the booster pump units and appurtenances in place complete as shown on the plans fully tested and ready for use.

END OF SECTION

SECTION 15193 - FUEL SYSTEMS (DIESEL)

PART 1 - GENERAL

1.01 SUMMARY

A. This Section covers the following items:

1. Aboveground Diesel fuel system.

1.02 GENERAL REQUIREMENTS

A. Contractor shall inform Engineer of testing date 48 hours prior to testing system and backfilling of trenches.

B. Provide all necessary labor, materials, operations, tools and techniques required to furnish and install complete the fuel systems as and within the limits indicated.

C. Submit written request for interruption of the existing fuel system not less than seven (7) calendar days prior to the time for which the interruption is requested.

D. Existing conditions, materials, sizes and dimensions shown on these drawings represent the best available information obtained from existing drawings and field investigations. Prospective bidders shall visit the premises and familiarize themselves with all work details and conditions before submitting a bid. Reasonable modifications to indicated arrangements to suit actual conditions shall not constitute a basis for requesting additional funds from the State.

E. Prior to ordering materials and equipment, the Contractor shall field verify all existing conditions, materials, sizes and dimensions that affect their work, and shall coordinate their work with all trades involved.

F. Obtain all permits and pay the costs thereof. Arrange for inspections in sufficient time to avoid delay to the project. Provide copies of inspection reports.

1.03 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. SECTION 15011 - GENERAL MECHANICAL PROVISIONS

B. DIVISION 16 - ELECTRICAL

1.04 LAWS, RULES, REGULATIONS AND REFERENCES

A. The entire installation shall comply with the latest applicable rules and regulations of the County of Maui, the State of Hawaii, and any other applicable laws, codes, rules and regulations whether or not specifically mentioned hereinafter.

B. Codes:

1. Building Code, County of Maui.
2. Fire Code, County of Maui.

C. References:

1. American Petroleum Institute (API) Publications

a.	Spec 5L-12	Line Pipe
b.	Spec 6D-14	Specification for Pipeline Valves

2. American Society of Mechanical Engineers (ASME) Publications

a.	BPVC -13	Boiler and Pressure Vessel Code: Section VIII Pressure Vessels, Division 1.
b.	B16.11-11	Forged Fittings, Socket-Welding and Threaded
c.	B16.15-13	Cast Copper Alloy Threaded Fittings Classes 125 and 250
d.	B16.21-13	Nonmetallic Flat Gaskets for Pipe Flanges
e.	B16.39-14	Malleable Iron Threaded Pipe Unions: Classes 150, 250, and 300

3. American Society for Testing and Materials (ASTM) Publications

a.	A53-12	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
b.	A312-14	Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

4. U.S. National Archives and Records Administration (NARA) Publications

a.	29 CFR 1910.1200	Hazard Communication
b.	40 CFR 280	Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks/USTs

5. U.S. General Services Administration (GSA) Publications

a.	FS A-A-52557	Fuel Oil, Diesel; for Posts, Camps and Stations
b.	FS A-A-60005	Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole
c.	FS L-C-530 (Rev. C)	Coating, Pipe, Thermoplastic Resin

6. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Publications

a.	SP-80-13	Bronze Gate, Globe, Angle, and Check Valves

7. NACE International (NACE) Publications

a.	RP0274-04	High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation

8. National Fire Protection Association (NFPA) Publications

a.	30-12	Flammable and Combustible Liquids Code
b.	30A-12	Code for Motor Fuel Dispensing Facilities and Repair Garages
c.	31-11	Standard for the Installation of Oil-Burning Equipment
d.	70-14	National Electrical Code

9. Society for Protective Coatings (SSPC) Publications

a.	SP-5-07	White Metal Blast Cleaning

10. Steel Tank Institute (STI)

a.	STI P3	Underground Steel Storage Tank Protection

11. Underwriters Laboratories (UL) Publications

a.	58-96	Standard for Steel Underground Tanks for Flammable and Combustible Liquids
b.	330-09	Standard for Hose and Hose Assemblies for Dispensing Flammable Liquids
c.	567-03	Standard for Emergency Breakaway Fittings, Swivel Connectors and Pipe-Connection Fittings for Petroleum Products and LP-Gas
d.	674-11	Standard for Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations
e.	698A-12	Standard for Industrial Control Panels Relating to Hazardous (Classified) Locations
f.	1203-13	Standard for Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for use in Hazardous (Classified) Locations
g.	1316-94	Standard for Glass-Fiber Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols, and Alcohol-Gasoline Mixtures
h.	1746-93	Standard for External Corrosion Protection Systems for Steel Underground Storage Tanks

1.05 SUBMITTALS

A. General

1. The Contractor shall submit submittals in accordance with the SECTION 15011 - GENERAL MECHANICAL PROVISIONS.

B. Shop Drawings

1. The Contractor shall submit shop drawings showing the entire work with inverts, sleeves and dimensions. Contractor shall check project drawings to avoid interferences. No fuel system work shall commence until such plans have been approved and accepted by the Engineer. Any deviations from the shop drawings shall require approval by the Engineer.

C. Certificates: Furnish certificates for evidence of proper installation and performance in compliance with code and certificate of warranty for the following:

1. Performance warranty of tank inventory monitoring system in accordance with 40CFR280.
2. Primary and secondary containment piping system warranty.

D. Submit the following:

1. Manufacturer's product data
2. Shop drawings
3. MSDS
4. Test reports
5. As-built drawings
6. Certificates
7. One-Year Maintenance and Guarantee Contract
8. Operation and Maintenance Manual

1.06 NOTICES AND OTHER REQUIREMENTS

A. The Contractor shall submit to the State of Hawaii, Health Department, Solid and Hazardous Waste Branch, the following:

1. Site or plot plan (Correlate tank number on Appendix I with the tank in the plot plan)
2. Tax map key
3. Pertinent street name and exact tank location and other appropriate structure

B. The Contractor shall submit to the Fire Prevention Bureau the following:

1. Fuel storage tank permit application with one (1) set of installation and upgrade drawings.

PART 2 - PRODUCTS

2.01 PRODUCT CARRIER PIPE AND FITTINGS

A. Steel Pipe (Aboveground): Provide ASTM A 53, Schedule 40, hot-dip galvanized, threaded end connections; with ASME B16.11 hot-dip galvanized or ASME B16.15 bronze threaded fittings above grade at dispensers.

B. Stainless Steel Pipe (Aboveground): Type 316 stainless steel, ASTM A312, Schedule 40.

C. Fiberglass Pipe: Products shall be listed by Underwriters Laboratories for service intended. Limit fiberglass piping to buried service only and at pressures not exceeding that marked on pipe. Fiberglass pipe shall be Ameron Dualoy 3000L or approved equal.

D. Flexible Pipe: Products shall be listed by Underwriters Laboratories for service intended. Limit flexible piping to buried service only and at pressures not exceeding that marked on pipe. Flexible pipe shall be double wall Environ Geoflex or approved equal.

E. Fiberglass Pipe Fittings: Provide fiberglass pipe fittings supplied by pipe manufacturer with adhesives compatible with product. Threading of fiberglass pipe or mechanical pipe couplings will not be permitted.

F. Flexible Pipe Fittings: Provide couplings supplied by pipe manufacturer.

G. Joint Compound: Joint compound for piping system shall be resistant to water and be suitable for use with fuel containing 40 percent aromatics.

H. Flexible Connectors: Flexible metal hose, corrugated type with braided wire sheath covering, close-pitch annular corrugations, rated for working pressure of at least 125 psig, 12 inch minimum live length, threaded end connections and shall conform to requirements of UL 567. Metal for hose and braided wire sheath shall be ANSI 300 series stainless steel.

2.02 DOUBLE-WALL SECONDARY CONTAINMENT PIPING (FOR FRP)

A. Provide double-wall containment piping system. Exterior containment pipe shall be compatible with transported fluid and sized to contain 110 percent of the total volume of the primary inner pipe or pipes and additional equipment required, such as leak detection cables. Containment pipe containing multiple product carrying pipes shall have adequate spacing and supports for the product carrying piping to ensure unhindered performance of the leak detection system. Steel secondary containment piping shall be factory coated. Coating shall consist of thermoplastic resin conforming to FS L-C-530.

2.03 VALVES

A. Ball Valve: Valve shall be the non-lubricated, double seated, ball type taht conforms to API Spec 6D. Valve shall operate from fully open to fully closed with 90 degree rotation of the ball. Valve shall be capable of 2-way shutoff. Valve shall be constructed of Type 316 stainless steel. Valves shall have one piece bodies

and shall have a minimum bore not less than 55 percent of the internal cross sectional area of a pipe of the same nominal diameter.

B. Solenoid Valve (Antisiphoning): 2-way, normally closed, solenoid operated valve with stainless steel body and viton elastomeric seal. 24 volt AC, 60 Hz, Type 7, explosion proof Class 1, Division 1, Group A, B, C, D enclosure. Valve shall be ASCO 8210 series, Magna-Trol or approved equal.

2.04 UNIONS

A. Unions shall conform to ASME B16.39, Class 150. Unions materials shall conform to ASTM A312, Grade 316. Dielectric unions shall conform to dimensional, strength, and pressure requirements of ASME B16.39, Class 150. Steel parts shall be plated. Union shall have a water-impervious insulation barrier capable of limiting galvanic current to one percent of the short-circuit current in a corresponding bimetallic joint. When dry, union shall be able to withstand a 600-volt breakdown test.

2.05 FLEXIBLE PIPE CONNECTOR

A. Connector shall be the flexible, close pitch, metal hose type that is constructed with exterior annular corrugations and provided with a single layer of braided wire sheath covering. Connectors shall be constructed entirely of stainless steel and be rated for the system working pressure and temperature.

2.06 PACKAGED FUEL TRANSFER PUMP SET

A. Provide a packaged duplex fuel oil pump system and duplex pump controller with automatic alternator for supply of fuel from the UL 2085 listed aboveground fuel storage tank to the existing generator base fuel tank.

B. Duplex pumps shall be motor driven, direct drive, positive displacement, internal gear type with mechanical shaft seal and cast iron body, machined steel gears.

C. Motors shall be TEFC construction, HP as required for pump at 50 PSI NEMA Type B, continuous duty, 1725 RPM, 120V AC, 60 hertz, 1.15 service factor.

D. Tank level controller shall be a UL listed, integrated design, digital level controller, which provides differential level control for activation of pumps, duplex pump alternator, base tank level indication, system alarms and manual operating controls. Level controller shall be self-contained as a unit within a NEMA 4X enclosure integral with the duplex pump assembly.

E. Packaged system shall be designed and manufactured by a single supplier and be a standard product. The manufacturer shall have at least 10 years experience in the design and manufacture of these products. System shall be a Model SPS Series Packaged Pump Set, as manufactured by Simplex, Inc., or approved equal.

2.07 AUTOMATED FUEL POLISHING SYSTEM

A. Provide a stand-alone, packaged system that removes water, bacterial growth, and other particulates from the diesel fuel stored in a fuel storage tank. System shall have an integrated controller to automatically process fuel on a user programmed schedule. System shall be rated at a flow rate of 150 gallons per hour, with integral multistage filtration and water separation functions. Controller shall provide shutdown and alarm features for water level, high vacuum, high pressure, and spill conditions. Fuel pump shall be industrial positive displacement gear pump, 100% duty cycle, motor driven, 115V, 60 hertz motor.

B. Unit shall be designed and manufactured by a single supplier. Unit shall be factory assembled , either wall mounted or provided with enclosures and support accessories suitable for indoor and/ or outdoor installations. Systems shall be provided with installation kits with stainless fluid tubes and tank entry flanges and fittings suitable for aboveground fuel tanks.

2.08 BURIED WARNING AND IDENTIFICATION TAPE

A. Provide detectable aluminum foil plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by electronic detection instrument. Provide tape in rolls, 3 inches minimum width, color coded for utility involved, with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall read "CAUTION BURIED FUEL PIPING BELOW" or similar wording. Provide permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material. Bury tape with printed side up at a depth 12 inches below top surface of earth or top surface of subgrade under pavements.

2.09 FUEL STORAGE TANK

A. Fuel storage tank shall be an insulated, protected steel double wall aboveground storage tank, horizontal type, conforming to NFPA 30, NFPA 30A, and NFPA 31, capacity as indicated. Design and construction of the tank shall comply with UL 142 and UL 2085. Outer tank shall enclose and provide leak containment across the total surface of the inner main storage tank by being physically separated from the inner primary containment tank by 3-inches of a UL-2085 listed light-weight insulation material, providing thermal insulation and interstitial monitoring capabilities. Both inner and outer tanks shall have openings of sufficient size to meet normal and emergency venting requirements stated in UL 142, UFC and NFPA. Tank shall bear the UL 2085 label for "Insulated Secondary Containment Aboveground Tank for Flammable Liquids-Protected Type".

2.10 FUEL STORAGE TANK ACCESSORIES

A. Fill Connection: Provide an overfill protection device which automatically shuts off fuel supply into the tank when the tank is 95 percent full, and shall enter at the top of the tank. Fill line shall extend to within 6 inches of tank bottom. Provide a tight fit fill adapter with a locking type cap. Tight fit fill adapter shall be bronze, fitted with a fluoroelastomer gasket suitable for fuel being provided. Adapter shall match the fill elbow on the deliver hose to prevent vapor emissions at the fill

connection. Provide a 3 gallon minimum fill port containment unit for the fill adapter.

B. Suction Connection: Provide suction line located at the opposite end of tank from fill line. Suction line shall be 1-inch minimum diameter and extend to within 4 inches of the tank bottom unless indicated otherwise.

C. Atmospheric Vent: Provide an atmospheric vent conforming to applicable requirement of NFPA 30 or NFPA 30A. Vent pipe shall terminate at least 12 feet above grade or 2 feet above roofs of adjacent buildings, and located so that discharged vapors will not enter building openings, under building eaves, or downspouts.

D. Audible Overfill Alarm: Provide an audible overfill alarm. Alarm shall be a fully mechanical alarm that does not require electricity or batteries. Alarm level shall be set to activate at 90% of the storage tank's liquid level capacity, and shall be field adjustable.

E. Dielectric Bushings: Provide nylon dielectric bushings on metallic piping connections to steel tanks.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General

1. All piping, tank, and equipment shall be properly installed in accordance with the manufacturer's recommendations.
2. Installation shall comply with the requirements set forth in 40CFR280, NFPA 30 and NFPA 31.
3. No work of any kind shall be undertaken until all necessary materials are available at the job site for this project.

B. Protection of Materials and Equipment: Pipe and tank openings shall be closed with caps or plugs during installation. Equipment shall be tightly covered and protected against entry of dirt, water and chemical or mechanical injury.

C. Excavation and Backfill: All excavation and backfill in connection with the work of this Section shall be in accordance with SECTION 02221 - TRENCH EXCAVATION AND BACKFILL and comply with the acceptable industry standards. Provide a minimum of 6-inches of well compacted bedding material. Coral shall not be used as backfill material for underground piping. Pipes shall be buried with a minimum cover of 18-inches below grade unless shown otherwise on the plans.

D. Pipe Installation

1. General: Piping system shall be steel or nonmetallic. Nonmetallic pipe shall be used for buried lines only. Buried lines which carry product shall have double-walled containment system. Each section of underground pipe shall rest solidly on pipe bed. Piping connections to equipment shall be as required by equipment manufacturer. Threaded or mechanical joints shall be allowed at termination points of product carrying lines only. Test plug connections of secondary containment piping may be threaded. Clean pipe interior of foreign matter before lowering into trench and keep clean during installation. Pipe shall not be laid in water or when trench or weather conditions are unsuitable. When work is not in progress, close open ends of pipe and fittings so that water, earth, or other substances cannot enter. Replace pipe, fittings, or appurtenances found defective after installation. Make threaded joints with tapered threads and make tight with joint compound; compatible with intended petroleum products, applied to male threads only.

2. Handle pipe and accessories to ensure sound, undamaged condition. Take care not to damage coating when lowering pipe into trench and when backfilling. Install nonmetallic pipe in accordance with pipe manufacturer's instructions. Horizontal sections shall have a minimum coverage of 18 inches. Piping shall be free of traps and shall drain toward tank. Where steel piping is to be anchored, weld pipe to structural steel member of anchor and patch abraded areas with protective coating or covering as specified. Fit piping passing through concrete or masonry construction with sleeves. Each sleeve shall be of sufficient length to pass through entire thickness of associated structural member and large enough to provide a minimum clear distance of l/2 inch between pipe and sleeve, except where otherwise indicated. Sleeves through concrete may be 20-gage metal, fiber, or other approved material. Sleeves shall be located on center with piping and fastened in place. Space between sleeves and pipe shall be calked and filled with bituminous plastic cement or mechanical calking units designed for such use.

3. No pipe shall be buried or otherwise hidden until it has been pressure tested, inspected and approved by the Engineer.

4. Secondary containment pipe shall be installed in strict accordance with manufacturer’s instruction. The secondary containment system shall undergo a 5 psi air pressure/soap test or hydrostatic test upon completion to determine its secondary containment integrity. This testing shall be incompliance with the manufacturer’s published installation instructions.

6. All threaded joints shall be made liquid tight with suitable sealant.

7. All piping shall be inspected inside and out before installation and no obstructions shall be allowed. Pipe ends shall be taper reamed to full I.D. and all burrs removed.

E. The Contractor shall fill the tank with #2 diesel fuel. After all tests and inspections have been conducted, the Contractor shall refill the tank prior to final acceptance.]

3.02 TANKS

A. Tank installation shall be in accordance with NFPA 30, NFPA 30A, and NFPA 31 and performed by personnel certified by the tank manufacturer and State Regulations.

3.03 ELECTRICAL WORK

A. Wiring, equipment, and fittings shall be explosion-proof in conformance with applicable requirements of UL 674, UL 698, and UL 1203 for Class I, Division I, Group C and D hazardous locations. Submit proof of such conformance. Electrical installations shall conform to requirements of NFPA 70.

3.04 TESTING AND INSPECTION

A. Contractor shall furnish all labor, equipment and instruments for tests and any required retests and pay for all cost of repairing any damage resulting from such tests. contractor shall adjust systems until they are approved. Tests shall be performed in the presence of, and to the satisfaction of, the Engineer, and a representative of the State. Qualified manufacturer's representatives shall conduct all tests and inspections for the tank piping, inventory control system, and daytank.

B. The Contractor shall notify the Engineer no less than two weeks in advance of any equipment testing so that arrangements can be made with the State to monitor the equipment tests.

3.05 PNEUMATIC TEST

A. Piping: Test product carrier piping under pneumatic pressure of at least 1-1/4 times designed working pressure of the particular piping system, but not less than 50 psig. Test secondary piping under pneumatic pressure of 5 psig. Joints in secondary piping shall not be made until product carrier pipe is successfully pressure tested. Take care not to exceed pressure rating of various fittings. Maintain pressure in product carrier piping for at least 2 hours during which there shall be no drop in pressure in each line greater than that allowed for thermal expansion and contraction. Maintain pressure in secondary piping for at least one hour. To facilitate this test, various sections of each piping system may be isolated to test each separately. Furnish tapped test adapted fittings that can be attached to each end of the section of line being tested that will permit direct connection to the piping from air compressor. No taps in line will be permitted. Furnish necessary equipment for testing. Gauges shall be subject to testing and approval. In event leaks are detected, repair and repeat tests. Upon satisfactory completion of tests, relieve pressure and seal line. Make provisions to prevent displacement of piping during testing. Keep personnel clear of piping during pneumatic testing. Isolate equipment such as pumps, tanks, and meters from piping system during tests.

B. Tank: Test the interstitial space of each tank to 1 psig. Maintain this pressure and apply soapsuds or equivalent material to the exterior of the tank. Visually inspect for leaks. Repair leaks in accordance with the manufacturer's instructions.

3.06 HIGH LEVEL ALARM TEST

A. Fill each tank with appropriate product and verify the high level alarm functions. Verify overfill protection device functions.

3.07 CLEAN UP

A. Upon completion of this work, remove all debris and excess materials, tools, etc. resulting from this work from the job site and leave the location of this work broom-clean in an acceptable manner as approved by the Engineer. All mechanical equipment shall be thoroughly cleaned and ready for use.

END OF SECTION

SECTION 15400 - PLUMBING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section covers the following items:

1. Water, waste and vent piping within the building to a point five (5) feet from the building.

2. Plumbing fixtures and trim.

1.02 GENERAL REQUIREMENTS

A. Contractor shall inform Engineer of testing date a minimum of seven (7) calendar days prior to testing system and closing in walls and/or trenches.

B. Provide all necessary labor, materials, operations, equipment, tools and techniques required to furnish and install complete the plumbing systems as and within the limits indicated.

C. Submit written request for interruption of the existing plumbing system not less than seven (7) calendar days prior to the time for which the interruption is requested.

D. Existing conditions, materials, sizes and dimensions shown on these drawings represent the best available information obtained from existing drawings and field investigations. Prospective bidders shall visit the premises and familiarize themselves with all work details and conditions before submitting a bid. Reasonable modifications to indicated arrangements to suit actual conditions shall not constitute a basis for requesting additional funds from the State.

E. Prior to ordering materials and equipment, the Contractor shall field verify all existing conditions, materials, sizes and dimensions that affect their work, and shall coordinate their work with all trades involved.

F. Obtain all permits and pay the costs thereof. Arrange for inspections in sufficient time to avoid delay to the project. Provide copies of inspection reports and disinfection certificates.

1.03 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. SECTION 15011 - GENERAL MECHANICAL PROVISIONS

B. SECTION 15653 - VENTILATION

C. DIVISION 16 - ELECTRICAL

1.04 LAWS, RULES, REGULATIONS AND REFERENCES

A. The entire installation shall comply with the latest applicable rules and regulations of the County of Maui, the State of Hawaii, and any other applicable laws, codes, rules and regulations whether or not specifically mentioned hereinafter.

B. Codes

1. Plumbing Code, County of Maui.

2. Building Code, County of Maui.

3. Maui County Code, Chapter 16.16A - Energy Code.

4. Hawaii Administrative Rules, Title 11, Chapter 11, Sanitation

5. Wastewater Management Regulations, County

6. Water System Standards, 2002

7. Americans With Disabilities Act Accessibility Guidelines (ADAAG), 36 CFR Part 1191

C. References

1. American National Standards Institute (ANSI) Publications

a.	Z358.1-14	Standard for Emergency Eyewash and Shower Equipment

2. American Society for Testing and Materials (ASTM) Publications

a.	A53-12	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
b.	B88-16	Standard Specification for Seamless Copper Water Tube
c.	C564-14	Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
d.	C1540-15	Standard Specification for Heavy Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings
e.	D2661-14	Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.

f. D2665-14 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

g. D2680-01(2014) Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping

h. F628-12e2 Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core

i. F891-16 Standard Specification for Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core

3. American Society of Heating Refrigerating and Air-Conditioning Engineers (ASHRAE) Publications

a. 90.1-16 Energy Standard for Buildings Except Low-Rise Residential Buildings

4. American Society of Mechanical Engineers (ASME) Publications

a. B16.1-15 Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250

b. B16.18-12 Cast Copper Alloy Solder Joint Pressure Fittings

c. B16.22-13 Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

d. B16.23-16 Cast Copper Alloy Solder Joint Drainage Fittings - DWV

e. B16.26-13 Cast Copper Alloy Fittings for Flared Copper Tubes

f. B16.50-13 Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings

5. American Society of Sanitary Engineering (ASSE) Publications

a. 1003-2009 Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems

6. American Water Works Association (AWWA) Publications

a. C105-10 Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems

b. C511-17 Standard for Reduced-Pressure Principal Backflow Prevention Assembly

7. Cast-Iron Soil Pipe Institute (CISPI) Publications

a. 301-12 Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications

8. Factory Mutual (FM) Publications

a. 1680-89 Approval Standard for Couplings Used in Hubless Cast Iron Systems for Drain, Waste or Vent Sewer, Rainwater or Storm Drain System Above and Below Ground, Industrial / Commercial and Residential

9. International Association of Plumbing & Mechanical Officials (IAPMO) Publications

a. PS 117-2016 Press and Nail Connections

10. International Safety Equipment Association (ISEA) Publications

a. Z358.1-2014 American National Standard for Emergency Eyewash and Shower Equipment

11. Manufacturers Standardization Society (MSS) Publications

a. SP 58-09 Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation

b. SP 110-10 Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

12. National Fire Protection Association (NFPA) Publications

a. 255-06 Standard Method of Test of Surface Burning Characteristics of Building Materials

13. NSF International (NSF) Publications

a. 61-16 Drinking Water System Components - Health Effects

1.05 SUBMITTALS

A. General: The Contractor shall submit submittals in accordance with the SECTION 15011 - GENERAL MECHANICAL PROVISIONS.

B. Shop Drawings: The Contractor shall submit shop drawings showing the entire work with inverts, sleeves and dimensions. Contractor shall field verify and check project drawings to avoid interferences with structural features and with work of other trades. No plumbing or piping work shall commence until such plans have been approved and accepted by the Engineer. Any deviations from the shop drawings shall require approval by the Engineer.

C. Submit the following:

1. Manufacturer's product data
2. Shop drawings
3. MSDS
4. Test reports
5. As-built drawings
6. Certificates
7. One-Year Guarantee and Maintenance Service Contract
8. Operation and Maintenance Manual

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PART 2 - PRODUCTS

2.01 SOIL, WASTE, DRAIN AND VENT PIPING, BURIED

A. Cast Iron Pipe: CISPI 301, hubless, service weight, with ASTM C564 neoprene gaskets, ASTM C1540 and FM 1680 Class 1, IAPMO listed, Type 304 stainless steel corrugated shield with a minimum thickness of 0.015 inches, Type 304 stainless steel clamps, and Type 305 stainless steel screws.

B. ABS Pipe: ASTM D2661, D2680 or F628 with solvent weld joints.

C. PVC Pipe: ASTM D2665 or F891 with solvent weld joints.

2.02 SOIL, WASTE, DRAIN AND VENT PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight, with ASTM C564 neoprene gaskets, ASTM C1540 and FM 1680 Class 1, IAPMO listed, Type 304 stainless steel corrugated shield (minimum thickness [0.015 inches), Type 304 stainless steel clamps, and Type 305 stainless steel screws.

B. ABS Pipe: ASTM D2661, D2680 or F628 with solvent weld joints. [In Buildings 2 stories of less]

C. PVC Pipe: ASTM D2665 or F891 with solvent weld joints. [In Buildings 2 stories or less]

2.03 WATER PIPING, BURIED

A. Copper Tubing: ASTM B88, NSF 61, Type K, annealed with ASME B16.18 or ASME B16.22 solder joint copper fittings. Provide lead free solder joints.

2.04 WATER PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B88, NSF 61, Type L, hard drawn, with ASME B16.18 or ASME B16.22 solder joint, ASME B16.26 flared joint, or IAPMO PS 117 press fit copper fittings. Solder joints shall be lead free. Sealing elements for press fittings shall be EPDM.

2.05 POLYETHYLENE ENCASEMENT

A. Polyethylene Encasement shall be AWWA C105 polyethylene tube or sheet.

2.06 UNIONS, AND COUPLINGS

A. Pipe Size 2-Inches and Under: Malleable iron unions for threaded ferrous piping; bronze unions for soldered copper pipe joints.

B. Dielectric Connection: Union, with galvanized or plated steel threaded end and copper solder end, with water impervious isolation barrier. Epco model FX or approved equal. Flange, with full faced isolation gasket and bolt sleeves. Watts or approved equal.

2.07 BALL VALVES

A. Up to 2-Inches: Two piece silicon bronze body, 600 psi nonshock cold working pressure, 100 psi at 300 degrees F maximum pressure/temperature, full port, stainless steel ball, stainless steel trim, Teflon seats and stuffing box ring, blowout-proof stems, lever handle, solder or threaded ends. Valves shall comply with MSS SP-110.

2.08 WATER PRESSURE REDUCING VALVES

A. Up to 2-Inches: ANSI/ASSE 1003, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer and threaded and single union ends.

2.09 FIRE EXTINGUISHER CABINETS AND FIRE HOSE/EXTINGUISHER CABINETS:

A. Fire extinguisher cabinets shall be sized to house fire extinguisher required for this project. Provide cabinets with 20 gage white glossy polyester coated steel box. 18 gauge No. 304 stainless steel door and frame with continuous stainless steel hinge. Door panel shall be furnished with clear polycarbonate bubble, and

keyed alike cylinder lock with internal trip device. The cabinets shall be semi-recessed wall mounted (Potter-Roemer SS-1772-BB or equal) in finished areas and surface mounted (Potter-Roemer SS-1776-BB or equal) in unfinished areas.

B. Fire Extinguisher: Provide 10 lb. U.L. listed Potter-Roemer or equal 4A:80B:C multi-purpose dry chemical fire extinguisher with squeeze grip activator, gauge and hose within fire extinguisher cabinets.

2.10 PLUMBING FIXTURES

A. All exposed piping at fixtures and equipment shall be chrome plated.

B. Furnish all traps, stop valves, escutcheons, tail pieces, trap arms and other items as required for installation and connection of fixtures and equipment furnished under this or other sections. Coordinate with other trades and disciplines as required.

C. For each item specified, products of one manufacturer are identified to establish a standard of comparison. Products of other manufacturers will be considered if submitted for approval.

D. Installation of accessible fixtures and equipment shall conform to ADAAG.

E. Controls and operating mechanisms shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. Maximum allowable force shall be 5-pounds per ADAAG 309.4.

F. Fixtures List:

1. Water Closet (WC-1, Accessible) shall be vitreous china, anti-microbial finish, elongated, pressure assisted, floor mounted water closet combination with close-coupled tank, siphon jet fixture, rim height above finished floor shall be 17-1/2 inches, with white solid plastic open front seat less cover. Provide bolt covers, angle compression supply, and no-seep wax gasket. Exposed metal parts shall be chrome plated brass. Fixture shall discharge not more than 1.6 gallons per flush. Water closet installation shall comply with ADAAG 604.

Item	Manufacturer	Model
fixture	Kohler	K-3493-SS
seat	Beneke	523 SS
supplies	Brasscraft	OCR1912DL

2. Lavatory (L-1, Accessible) shall be vitreous china, wall hung type, drilled for concealed carrier, approximate size 21-inches by 18-inches, with front overflow and deck with 2 faucet holes. Faucet shall be a deck mounted, concealed single supply faucet with aerator, and 4-inch metal lever handle. Wrist blade handle shall open within one-quarter turn. Provide trap with arm to wall with flange, offset tailpiece with grid drain, loose key angle

compression supply, covers, and floor mounted concealed carrier. Provide flow control to limit discharge to not more than 2.5 gallons per minute. All exposed metal parts shall be chrome plated. Lavatory installation shall comply with ADAAG 606.3 (adult's height) clear space.

Item	Manufacturer	Model
fixture	Kohler	K-2007-R
faucet	Chicago	404-HZCW317ABCP
offset drain	Kohler	K-7131-A-CP
angle	Brasscraft	SCR1912AX C
carrier	Jay R. Smith	700-Z
covers	ProFlo	PF202WH / F205WH

3. Mop Sink (MS-1) shall be enameled cast iron, floor mounted with 2-inch grid strainer, wire rim guard, and backsplash mounted rough brass threaded hose faucet with stops, pail hook, and integral vacuum breaker.

Item	Manufacturer	Model
fixture	Kohler	K-6710
faucet (cold water only)	Chicago	952-CP
rim guard	Kohler	K-8940-NA
strainer	Kohler	K-9142

4. Emergency Eyewash and Shower (EWS-1) shall be a factory-built and tested, barrier-free combination shower and eye/face wash. Shower shall be activated by a pull rod with a triangular handle. Heads shall be ABS plastic. Eye wash shall have a stainless steel receptor, plastic pop-off dust cover, and activated by a push handle. Unit shall also include schedule 40 hot-dipped galvanized steel pipe and fittings, powder-coated cast iron floor flange, self-adhesive high visibility safety green and bright yellow stripes, and universal sign. Combination emergency eye wash/shower shall meet the requirements of ANSI/ISEA Z358.1.

Item	Manufacturer	Model
eye wash/shower	Haws	8309WC
sign	Haws	SP178LG

5. Floor Drain (FD-1) shall be cast iron with flashing ring and clamping device, flat round polished strainer fastened with screws, adjustable top, threaded outlet, and trap primer connection.

Item	Manufacturer	Model
floor drain	Jay R. Smith	2010T(A)-P050

6. Trap primer shall feature lead free construction, with 1/2-inch threaded ends and integral vacuum breaker. Provide isolation ball valve for maintenance. Provide wall access panel for trap primer inside or behind a wall.

Item	Manufacturer	Model
trap primer	Watts	LFTP300T

7. Access panel panel shall be 16 gage, type 304 stainless steel door, frame and mounting flange, brushed satin finish, with vandal resistant latch. Size as indicated on drawings.

Item	Manufacturer	Model
access panel	Mifab	UASS-VP

8. Interior Hose Bib (HB-1) shall be shall be solid brass construction sill faucet, chrome finish, 1/2-inch FIP inlet, 3/4-inch hose connection outlet with integral vacuum breaker and removable loose key lock shield. Provide chrome plated concealed loose key stop.

Item	Manufacturer	Model
hose bib	Arrowhead	255LKBFPCHRLF
stop	Chicago	1771-CP

9. Exterior Hose Bib (HB-2) shall be rough chrome plated solid brass, wall mounted, 3/4 inch hose thread outlet, equipped with non-removal type vacuum breaker, loose key handle, and square head stop cock.

Item	Manufacturer	Model
hosebibb	Chicago	998-RCF
cock	A Y McDonald	9802W

2.11 CLEANOUTS

A. Floor cleanouts shall be cast iron floor cleanout with flange and flashing clamp, gasket seal bronze plug, polished bronze or nickel bronze rim and scoriated floor

plate with “CO” cast in the plate. Secure floor plate with countersunk screws for installation flush with finished floor.

B. Wall cleanouts shall be cast iron ferrule with threaded countersunk cleanout plug. Cleanout shall be furnished with polished stainless steel or chromium plated bronze cover plate secured to cleanout plug with countersunk screw.

C. Cleanouts exterior to buildings shall be cast iron cleanouts with round adjustable scoriated secure cast iron cover and taper thread bronze countersunk plugs. Provide 12 by 12 by 4-inch thick concrete slab with top 1-inch above grade with cleanout located in center of slab.

2.12 PIPING IDENTIFICATION AND WARNING

A. Aboveground Piping: For pipes 3/4 inch OD and larger, provide printed legends to identify contents of pipes and arrows to show direction of flow. Color code label backgrounds to signify levels of hazard. Make labels of plastic sheet with pressure-sensitive adhesive suitable for the intended application. For pipes smaller than 3/4 inch OD, provide brass identification tags 1-1/2 inches in diameter with legends in depressed black-filled characters.

B. Buried Piping: Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility line. Provide tape in rolls, 6-inches minimum width, color coded as stated below for the intended utility with warning and identification imprinted in bold black letters continuously and repeatedly over the entire tape length. Warning and identification to read, "CAUTION BURIED (intended service) LINE BELOW" or similar working. Color and printing are to be permanent, unaffected by moisture or soil.

Warning Tape Color Code

Blue: Potable water.
Green: Sewer and drain lines.

2.13 MISCELLANEOUS METALS

A. Interior Installation: Preformed slotted channel system components used in supports and brackets shall be Unistrut Corporation P 1000 DS or approved equal, galvanized. Touch-up cut portions with zinc rich coating. Prepare surface and apply coating in accordance with coating manufacturer's printed instructions.

B. Exterior Installation: Preformed slotted channel system components used in supports and brackets shall be Type 316 stainless steel, Unistrut Corporation or approved equal.

PART 3 - EXECUTION

3.01 WORKMANSHIP

A. Comply with applicable codes of the County of Maui and with regulations of the State of Hawaii.

B. Defective work or materials shall be removed by the Contractor and corrected without extra compensation.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside piping before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Coordinate cutting or forming of roof or floor construction to receive drains to required invert elevations.

E. Review millwork shop drawings. Verify location and size of fixtures and openings before rough-in and installation.

F. Verify adjacent construction is ready to receive rough-in work of this Section.

G. Locate water and sewer lines and proposed points of connection thereto, and verify that the lines can be connected to the existing piping.

3.03 INSTALLATION

A. Install all plumbing work as indicated and as specified herein.

B. Installation of plumbing systems including fixtures, equipment, materials and workmanship shall be in accordance with the Plumbing Code.

C. Review manufacturer's rough-in sketches to verify pipe connection sizes and locations of all fixtures and equipment. Make final connection to all equipment furnished and/or installed under other sections.

D. Provide traps, tailpieces, stops, escutcheons and all other items required to complete installation. Install items furnished under other sections but specified for installation under this section.

E. Completely encase buried copper water piping and cast iron DWV piping with polyethylene tube or sheet in accordance with AWWA C105.

F. Copper pipe shall be insulated from direct contact with ferrous piping connections by approved insulating (dielectric) unions or couplings.

G. Plastic piping shall not penetrate fire walls or fire floors and shall not be used closer than 6-inches to the penetration.

H. Vent thru roof shall protrude no less than 6-inches above the roofline. All joints shall have a completely watertight seal. Use Master Flash EPDM flashing with aluminum ring.

I. Install piping to conserve building space and not interfere with use of space. Group piping whenever practical at common elevations.

J. Install piping to allow for expansion and contraction without stressing pipes, joints, or connected equipment.

K. Provide clearance for access to valves and fittings.

L. Slope water piping and arrange to drain at low points.

M. Install specialties in accordance with manufacturer's instructions.

N. Extend cleanouts to be flush with finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

O. Air chambers shall be provided on each cold water fixture supply extending to a minimum of 12-inches above fixture outlet. Each air chamber shall be located where it will empty and refill with air when the water is drained from piping. Chamber shall be the same size as the piping.

P. Install each fixture with chrome plated rigid or flexible supplies with screwdriver stops, reducers, and escutcheons.

Q. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

R. Install valves with stems above horizontal.

S. Have piping treated, inspected and approved before it is furred in, buried or otherwise hidden.

T. Slope soil, waste and drain lines at 1/4-inch per foot unless otherwise indicated. Install hubless cast-iron pipe accordance with CISPI pamphlet 100, stainless steel couplings shall be installed in accordance with manufacturer's written instructions.

U. Vent pipes shall be sloped to expel water.

V. Escutcheons: Shall be installed around all exposed pipe passing through a finished floor, wall or ceiling. Escutcheons shall be of sufficient outside diameter to cover the sleeve opening and shall fit snugly around the pipe.

W. Excavation, Backfill and Concrete Work: All excavation and backfill in connection with plumbing work shall be accomplished in accordance with the Plumbing Code. Provide proper support along the pipe length and where rocks are encountered, provide a minimum of 3-inches of backfill properly tamped for pipe. Pipes shall be buried a minimum of 12-inches below and 3-feet horizontally from all footings.

X. Hose Bibbs: Hose bibbs shall be installed 18-inches above grade or floor unless otherwise indicated. Locate a service cock on the hose bibb supply, on exterior hose bibbs only.

Y. Identification of Piping: Identify piping aboveground using adhesive-backed or snap-on plastic labels and arrows. In lieu of labels, identification tags may be used. Apply labels or tags to finished paint at intervals of not more than 50 feet.

3.04 APPLICATION

A. Use dielectric connections only in accessible locations.

B. Install unions downstream of valves and at equipment connections.

C. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.

D. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

E. Provide access panels for trap primers.

F. Provide fire stop material for pipe thru fire rated walls and slabs.

G. PVC and ABS pipe shall not be used in fire rated plenums.

3.05 PIPE SLEEVES

A. Provide where piping passes through walls, floors, roofs, and partitions. Secure sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs and partitions. Provide not less than 0.25-inch space between exterior of pipe or pipe insulation and interior of sleeve. Firmly pack space with an approved fire stop material in rated walls and install in accordance with the manufacturer's recommended instructions. Space between pipe and sleeves (both ends) shall be firmly packed with mineral wool insulation. Seal both ends with plastic water proof cement.

B. Sleeves in masonry and concrete walls and floors shall be ASTM A53, Schedule 40 or standard weight, hot-dip galvanized steel pipe. Extend sleeves in floor slabs 2-inches above the finished floor.

C. Sleeves in partitions and other than masonry and concrete walls shall be hot-dip galvanized steel sheet having a nominal weight of not less than 0.90 ounces per square foot.

D. Sleeves for piping that pass through foundations and are below the ground shall be cast iron pipe. Space between pipe and floor sleeves shall be caulked with cement.

E. Spaces between pipe and floor sleeves shall be caulked with cement.

F. No cutting or drilling of any structural members will be permitted without the approval of the Engineer.

3.06 PLUMBING FIXTURES

A. Furnish, install and properly connect all plumbing fixtures and fittings and/or trims herein specified.

B. Setting of all fixtures shall be done in an approved workmanlike manner. Special attention shall be exercised to the fixture heights, especially for lavatories. See architectural drawings and elevations for mounting location and height. Joints between fixtures and wall shall be neatly pointed up with plaster of paris.

C. Fastenings: Where trimmings and fixtures are secured to concrete, they shall be fastened with 1/4-inch minimum brass machine screw type expansion bolts sufficiently long to insure that the shield shall be wholly within sound concrete. Where trimmings and fixtures are to be mounted on concrete block, each fixture shall have the proper cast iron fixture bracket set anchored to the masonry wall with 1/4-inch diameter toggle bolts. Where fixtures are mounted on metal stud walls, provide 1/4-inch x 5-inch steel backing plates, spot welded to at least 2 studs. All exposed bolt heads and nuts shall be chrome plated hexagon brass with round tops. All escutcheons on walls and floors shall be chrome plated cast brass with chrome plated set screws.

D. No wood grounds shall be used for supports of plumbing fixtures.

E. Accessible Fixture Installation: Fixture location and pipe installation shall maintain all heights and clearances in accordance ADAAG.

3.07 PIPE SUPPORTS, HANGERS AND INSERTS

A. Install hangers and supports for all piping to provide for expansion and contraction, prevent vibration and maintain required grading by proper adjustment.

B. Field verify type of construction from which piping and/or equipment is to be supported.

C. Support horizontal overhead pipes with clevis hangers, adjustable turnbuckle, rods, inserts, clamps, on suspension suitable for type of building construction. Trapazee hangers may be used where multiple pipes are grouped. Pipe hangers and supports shall conform to MSS SP-58.

D. Support horizontal pipes from walls with "J" hooks, hangers suspended from wall brackets or struts.

E. Provide additional hanger pipe supports at concentrated loads in piping between supports. Maximum of 5 -feet apart at valves.

F. Grind and smooth all sharp metal edges including struts and fabricated metal supports. Install end caps on the ends of all struts.

G. Horizontal Piping Support Schedule:

1. Support horizontal lines of copper tubing per following schedule. pipes shall be supported at all elbows, branches and risers. Support straps shall be copper, brass or copper plated. Copper pipe shall be insulated from contact with dissimilar metals outside of system by taping at point of contact with two (2) layers of 10 mil, PVC, UPC pipe tape.

Pipe Size	Rod Diameter	Maximum Spacing
(Inch)	(Inch)	(Feet)
1/4 to 3/4	3/8	5-0
1 to 1-1/2	3/8	6-0

2. Support horizontal cast iron hubless soil pipe with shielded couplings at every joint. Pipe exceeding 4-feet in length shall be supported at every joint. Support spacing adjacent to joint shall not exceed 18-inches. Brace pipe at maximum 40-foot intervals to prevent horizontal movement. Support at each horizontal branch connection. Hangers shall not be placed at the coupling.

Pipe Size	Rod Diameter	Maximum Spacing
(Inch)	(Inch)	(Feet)
1-1/2 to 2	3/8	10-0
3	1/2	10-0
4	5/8	10-0

3. Support horizontal PVC and ABS pipe with solvent cemented joints no more than 4-feet center-to-center. Allow for expansion every 30-feet. Pipes shall be supported at all elbows, branches and risers.

3.08 DOMESTIC WATER LINES

A. All domestic cold and hot water lines shall be thoroughly flushed and drained after installation. Sterilization accomplished by opening taps at the end of all branches and slowly filling the system adding liquid chlorine, or hypochlorite solution to the water until water flowing from all branches indicates not less than 500 PPM residual chlorine; the system allowed to stand for not less than eight

(8) hours, with all valves opened and closed several times during this period then drained and thoroughly flushed until all traces of chlorine are eliminated (less than 0.2 PPM). Contractor shall submit Certificate of Disinfection completed by a licensed testing laboratory to the Engineer.

3.09 PROTECTION

A. Provide planking, plastic sheeting, or other protective covering as required to prevent damage during construction to roof, roofing, or other existing building elements and equipment. Damage to materials, equipment or building due to the Contractor's neglect shall be repaired or replaced to the satisfaction of the Engineer by, and at the expense of, the Contractor. Be prepared to immediately repair any damage that does occur during any operations, so as to avoid damage to building or contents or interruption of State’s operations.

3.10 INSPECTION

A. Acceptance of the work will not take place until after discrepancies noted by the Engineer have been corrected to the satisfaction of the Engineer.

3.11 PAINTING

A. General: Painting of interior and exterior metal surfaces shall be in accordance with SECTION 09901 - PAINTING.

1. All piping, hangers and supports, and mechanical equipment installed under this Section where exposed to view shall be prime coated and also have one finish coat by Contractor providing the equipment. Equipment enclosed in drop ceilings and enclosed in pipe spaces are not considered as being exposed to view.

3.12 TECHNICAL SUPPORT

A. The plumbing equipment supplier shall be staffed with factory trained representatives fully capable of providing instruction on routine and emergency maintenance service on all system components supplied for this project.

B. Suppliers shall provide on-site instruction, when requested by the Contractor or the Engineer, at no additional cost to the State.

3.13 CLEANUP

A. Upon completion of this work, remove all debris and excess materials, tools, etc., resulting from this work from the job site and leave the location of this work broom-clean in an acceptable manner as per the Engineer. All work including plumbing fixtures, traps and mechanical equipment shall be thoroughly cleaned and ready for use.

END OF SECTION

SECTION 15653 - VENTILATION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section covers the following items:

1. Install new ventilation system.

1.02 GENERAL REQUIREMENTS

A. Provide all necessary labor, materials, operations, equipment, tools and techniques required to furnish and install complete the ventilation work as and within the limits indicated.

B. Prospective bidders shall visit the premises and familiarize themselves with all work details and conditions before submitting a bid. Reasonable modifications to indicated arrangements to suit actual conditions shall not constitute a basis for requesting additional funds from the State.

D. Prior to ordering materials and equipment, the Contractor shall field verify all existing conditions, materials, sizes and dimensions that affect their work, and shall coordinate their work with all trades involved.

E. Obtain all permits and pay the costs thereof. Arrange for inspections in sufficient time to avoid delay to the project. Provide copies of inspection reports.

1.03 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. SECTION 15011 - GENERAL MECHANICAL PROVISIONS

B. SECTION 15400 - PLUMBING

C. DIVISION 16 - ELECTRICAL

1.04 LAWS, RULES, REGULATIONS AND REFERENCES

A. The entire installation shall comply with the latest applicable rules and regulations of the Maui, the State of Hawaii, and any other applicable laws, codes, rules and regulations whether or not specifically mentioned hereinafter.

B. Codes

1. Maui County Code, Chapter 16.16A - Energy Code.

2. Hawaii Administrative Rules, Title 11, Chapter 39, Air Conditioning and Ventilation.

3. Americans With Disabilities Act Accessibility Guidelines (ADAAG), 36 CFR Part 1191

C. References

1. Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Publications

a.	885-08	Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets

2. Air Movement and Control Association (AMCA) Publications

a.	99-16	Standards Handbook
b.	211-13 R16	Certified Ratings Program - Product Rating Manual for Fan Air Performance
c.	300-14	Reverberant Room Method for Sound Testing of Fans

4. American Society of Heating Refrigerating and Air-Conditioning Engineers (ASHRAE) Publications

a.	70-06(RA 2011)	Method of Testing the Performance of Air Outlets and Air Inlets

1.05 SUBMITTALS

A. General: The Contractor shall submit submittals in accordance with the SECTION 15011 - GENERAL MECHANICAL PROVISIONS.

B. Submit three (3) sets of color schedule and sample chart for all exposed air distribution devices.

C. Submit catalog cuts along with equipment submittals or piping shop drawings, showing vibration isolators selected for each location.

D. Submit the following:

1. Manufacturer’s product data

2. Shop drawings

3. MSDS

4. Test reports

5. As-built drawings

6. Certificates

7. One-Year Guarantee and Maintenance Service Contract

8. Operation and Maintenance Manual

9. Corrosion Protection Coating Warranty (3-year). The Surety and the Contractor shall not be held liable beyond two (2) years from Project Acceptance Date.

10. Corrosion protection coating repair applicator name and qualifications.

1.06 AIR CONDITIONING AND VENTILATING UNIT MANUFACTURER'S REPRESENTATIVE AND SERVICE CAPABILITIES

A. Furnish the services of a manufacturer's representative who is factory authorized and trained to perform the services specified. Manufacturer's representative shall be Hawaii-based unless none are available. The manufacturer's representative shall furnish recommendations and shall be on-site to provide assistance on the following matters:

1. Technical direction of the erection including disassembly and reassembly if required, alignment and testing.

2. Starting equipment and furnish instruction as to its proper care, operation and maintenance.

1.07 ELECTRICAL WORK

A. Contractor shall supply and mount all motors and provide all wiring, conduits, controls, and disconnects for equipment. Contractor is responsible for coordination of size, voltage, phase, auxiliary contacts, etc. For 1/2 HP and smaller motors, the control shall include thermal overload protection consisting of an external thermal trip switch mounted in an easily accessible location. For motors larger than 1/2 HP the control shall include magnetic starter with low voltage release and thermal cutouts sized on full load motor current. Should any equipment require electrical service or wiring other than as shown on the electrical drawings, inform the Contracting Officer and advise the Electrical Contractor of such changes. All control devices must be installed to operate within the manufacturer's rated current and voltage. All control circuits must be through the respective equipment's disconnect to insure the control circuit being off when equipment disconnect is off. All motors, switches, starters, wiring devices and controls mounted where exposed to weather shall have NEMA 4X enclosures. Wiring materials and methods shall conform to DIVISION 16 - ELECTRICAL Technical Specifications, applicable National Electrical Codes, and NEMA standards.

B. Motor characteristics and Drives: Electrical motor voltages shall be as indicated and to be verified with the electrical drawings and Contractor. Motors shall be furnished in accordance with the IEEE-841-2009 Standard and the NEMA Premium Efficiency Standard, service factor of 1.15 not to exceed 1,800 RPM, unless otherwise indicated. Non-contacting bearing isolators conforming to IP 55

shall be supplied for all motor ball bearings. V-belt drives shall be designed for 150 percent of motor horsepower with provisions made to adjust belt tension.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Air conditioning and ventilation equipment to be considered for bid purposes shall be from a manufacturer that has other units of comparable type, size and capacity installed and operating satisfactorily in the State of Hawaii for a minimum of 2 years prior to bid opening.

2.02 FANS

A. General: Fans, AMCA 99, statically and dynamically balanced, with air capacities, fan types, fan arrangement and pressure ratings as indicated. Fans shall be sound rated in accordance with AMCA 300. Provide bird screens for outdoor inlets/outlets. Equip with automatic backdraft dampers. Provide thermal overload protection and disconnect switches. Housing and fan wheels shall be aluminum, except as specified otherwise. Exterior of fan shall be painted to resist corrosion as specified in the CORROSION PROTECTION paragraph. Fans shall be tested and rated in accordance with AMCA 211/311.

B. Power Roof Ventilator shall be belt driven centrifugal type, with spun aluminum housing for roof top curb mounting. Fan shall be the backwardly inclined type with centrifugal wheel that has been statically and dynamically balanced at the factory. The motor shall be installed in a totally enclosed weatherproof housing outside of the air stream. The electrical characteristic for the motor shall be as shown on the drawings. Motor shall be non-overloading over the entire range of operation. The drive belt shall be oil resistance. An adjustable sheave shall be provided to allow changes in the fan speed. Penn Domex or approved equal.

C. In-Line Centrifugal Fans (Direct Driven) – Direct driven in-line fans shall be centrifugal type. Fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone matched to the inlet cone. Fan housing shall be constructed of heavy gauge galvanized steel and shall include duct mounting collars and access panels. Motors shall be permanently lubricated and shall be readily accessible for maintenance. Motors shall have TEFC enclosures. Fans shall be UL listed and shall have published ratings based on tests performed in accordance with AMCA.

2.03 DUCTWORK

A. Interior ductwork shall be constructed from galvanized steel sheets. Exterior ductwork shall be constructed from Type 316 stainless steel, copper or aluminum sheets. Gages, details of construction, and supports shall be in accordance with the latest edition of the Sheet Metal and Air Conditioning Contractors National Association, Inc. "HVAC Duct Construction Standards," referred to hereinafter as "Duct Manual". Sizes indicated are net clear inside; increase dimensions as required for duct lining.

B. Provide turning vanes at changes in direction of flow. Provide external stiffening at cross breaking as indicated in the Duct Manual.

C. All exterior ductwork shall have tops sloped to drain water.

D. Provide dielectric connections between dissimilar metals.

E. Seal all ducts in accordance with the following seal classifications. See Duct Manual for seal definitions:

	Duct Type			
Duct Location	Supply <=2-inch	Supply >2-inch	Return / Exhaust	Outside Air
Outdoors	A	A	C	A
Unconditioned Spaces	B	A	C	B
Conditioned Spaces	C	B	B	C

F. Ductwork

1. Rectangular Duct: Construct in accordance with the requirements of the Duct Manual. Duct board duct construction system will not be allowed.

2. Ductwork Design Pressures:

Ductwork Design Pressure (In. W.G.)
Variable Air Volume = (+) 2-inches; (-) 1-inch
Constant Air Volume = (+/-) 1-inch
Exhaust = (+/-) 1-inch

G. Flexible Duct Connections: Flexible connections of neoprene-coated 30-oz. glass fabric to prevent the transmission of vibration through the ducts, shall be installed on both the supply and return sides of all fans, ventilating units, and approximately where shown on drawings. Cloth used for flexible connections shall be UL approved, of proper weight and strength for the service required, and shall be properly fitted to render it relatively tight. Fabric shall be of sufficient width to provide a minimum space of 3-inches between connected items, and shall be fabricated with two 3-inch wide galvanized metal strips. Glass fabric connections shall be Ventfabrics, Inc. "Metaledge Ventglas", Elgen "Silent Duct-Neoprene", or approved equal.

2.04 AIR DISTRIBUTION DEVICES

A. Diffusers, Registers and Grilles

1. Material and Finishes: Construct diffusers, registers and grilles of aluminum Exterior and exposed edges shall be rolled, or otherwise stiffened and rounded. Diffusers, registers and grilles shall be finished to match surrounding ceiling or wall. Submit color schedule and sample chart with all diffusers, registers and grilles identified and colors indicated. Total

pressure loss of each air distribution device shall not exceed 0.15-inch w.g. at the indicated airflows unless otherwise specified herein. Air distribution device mounting system shall be compatible with type of ceiling/surface installed. Provide tool for adjustment of volume control damper.

2. Sound Pressure Level: diffusers and registers shall be sound rated in accordance with ANSI/ASHRAE 70 and AHRI 885, in dB of noise criterion (NC) based on sound power octave band. Conform with the following permissible room sound pressure levels:

Maximum NC, dB	Typical Application
30	Library, Gallery
35	Workshop, Resource Center, Gift Shop, Dining lounge
45	Conference, Storage, Dining Hall

3. Drop: Maximum drop of air stream shall not be so great that it is within five (5) feet of the floor at the end of the throw.

4. Performance: Air devices shall be tested in accordance with ANSI/ASHRAE 70.

5. Device Types
   a. Supply Air Registers (SAR): Surface mounted supply air registers shall have surface mount border type, rectangular inlet, opposed blade damper and double deflection blades. Damper shall be operable from the face of the register. Blades shall be parallel to the short dimension, spaced 3/4-inch on center and shall be individually adjusted. Plastic blade pivots aren't acceptable. Titus Model 300FS or approved equal.

   b. Exhaust Registers, Surface Mount (RAR, ER): Surface mounted return air/exhaust registers shall have surface mount border type, opposed blade damper and fixed blades. Damper shall be operable from the face of the register. Blades shall be parallel to the short dimension, spaced 1/2[or 2/3]-inch on center and have a deflection angle of 35 degrees. Titus Model 355 FS or approved equal.

   c. Provide dampers, turning vanes, other directional and volume control devices as indicated and as required to balance the system to the air quantities indicated without objectionable noise.

B. Volumetric Dampers

1. Furnish and install volumetric damper, with indicating quadrant in an accessible location and a locking device. Damper shall be galvanized steel

and rated for the specified ductwork design pressure. Ruskin Model MD 25/35, Ruskin Model MDR S25, or approved equal.

2.05 TURNING VANES

A. Turning vanes shall be installed at each rectangular elbow and tee.

2.06 VIBRATION ISOLATORS

A. Ceiling mounted vibration isolators shall be spring or rubber vibration control hanger with hanger rods.

B. Springs shall have neoprene dipped finish.

C. Isolators shall be the products of a manufacturer specializing in the control of vibration transmission and shall be one of the following unless otherwise approved by the Engineer: Mason Industries, Vibration Mounting & Controls, Korfund, Amber Booth, CalDyn, Vibrex, or Consolidated Kinetics. Isolators shall be color coded or otherwise clearly identified so as to permit field verification of correct selection in accordance with the submittals, and shall have the undeflected height clearly marked on the isolator so as to permit measurement of deflection after installation. Isolators shall be selected to provide a minimum of 1-inch static deflection. Provide brackets for installation on piping and equipment.

2.07 MISCELLANEOUS METALS

A. Interior Installation: Preformed slotted channel system components used in supports and brackets shall be Unistrut Corporation P 1000 DS or approved equal, galvanized. Touch-up cut portions with zinc rich coating. Prepare surface and apply coating in accordance with coating manufacturer's printed instructions.

B. Exterior Installation: Preformed slotted channel system components used in supports and brackets shall be Type 316 stainless steel, Unistrut Corporation or approved equal.

PART 3 - EXECUTION

3.01 WORKMANSHIP

A. Comply with applicable codes of the County of Maui and with regulations of the State of Hawaii.

B. Defective work or materials shall be removed by the Contractor and corrected without extra compensation.

C. Before fabricating ductwork, field verify existing conditions by investigation and measurement at the project site.

3.02 INSTALLATION

A. Install ventilation work in accordance with the manufacturer's instructions and as indicated and as specified herein. Arrange for access to the site by written request submitted not less than seven (7) calendar days prior to the time at which access is requested. Install diffusers, registers, and grilles after installation of ceiling surfaces in which they are installed. Coordinate installation with other trades so as to eliminate or avoid conflicts and delays to the progress of the work.

B. Each unit shall be adjusted to deliver the air quantities indicated.

C. Air Balancing, Operation and Completion: Measure total air supplied and adjust fan speed and balancing dampers to deliver indicated quantity. Proportion air at existing inlets and outlets, positioning dampers therein to deliver air quantities indicated and face bars for uniform distribution and temperature in the space. Test all controls for proper operation. Provide clean new filters in each unit at the time of air balance. Touch up paint on units where and if damaged, using prime and finish paint to match material and color of factory finish. Submit written report of balancing work, which shall be in accordance with SECTION 15011 - GENERAL MECHANICAL PROVISIONS.

3.03 VIBRATION ISOLATION

A. Provide vibration isolation where indicated. Isolators shall be selected to limit transmitted vibration to not more than 1 percent of the vibration produced by any one rotating element at its operating speed. Temporarily block or rigidly support equipment during construction, after completion of the installation but prior to operation. Remove temporary supports and adjust isolator leveling bolts so as to provide design deflection of each isolator, effective isolation and no strain on pipe, duct or electrical connection to equipment.

3.04 NOISE CONTROL

A. It shall be the equipment manufacturer's responsibility to insure that the operating noise level of the unit is not objectionable. The equipment supplier shall evaluate the installation and application and shall submit any noise control measures as part of the substitution request.

B. Submit fan curves, discharge and casing sound data, NC data and sound power data, descriptive of each unit's noise level.

3.05 FANS

A. Install fans on vibration isolators

B. Do not operate units for any purpose until ductwork is clean, bearings lubricated, and units have been test run under observation.

C. Install flexible connections specified between fan inlet and discharge ductwork. Flexible connectors shall not be in tension while running.

D. Provide safety screen where fan inlet or outlet is exposed.

E. Provide backdraft dampers on discharge of exhaust fans and as indicated.

3.06 DUCTWORK

A. Install flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment. Flexible connectors shall not be tension while running.

B. Provide backdraft dampers on discharge of exhaust fans and as indicated.

C. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

D. Coordinate with other trades in installing air distribution ducts. Field verify and Review structural drawings to determine possible interferences and make all necessary revisions to avoid interferences. Cutting of any structural member will not be allowed.

E. Touch-up raw edges of galvanized steel or exposed ferrous metal equipment with zinc-rich primer and touch-up paint. Clean up all equipment before final inspection.

F. During construction, provide airtight temporary closures on open ductwork to prevent construction dust from entering ductwork system.

G. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

H. Provide balancing dampers on duct takeoff to diffusers, grilles and registers, regardless of whether dampers are specified as part of the diffuser, grille or register assembly.

3.07 PROTECTION

A. Provide planking, plastic sheeting, or other protective covering as required to prevent damage during construction to roof, roofing, or other building elements and equipment. Be prepared to immediately repair any damage that does occur during any operations, so as to avoid damage to building or contents or interruption of State’s operations.

3.08 INITIAL OPERATION AND COMPLETION

A. Test all controls for proper operation. Touch up paint on units where and if damaged, using primer and finish paint to match materials and color of factory finish.

3.09 INSPECTION

A. Acceptance of the work will not take place until after discrepancies noted by the Engineer have been corrected to the satisfaction of the Engineer.

3.10 PAINTING

A. General: Painting of interior and exterior metal surfaces shall be in accordance with SECTION 09901 - PAINTING.

3.11 TECHNICAL SUPPORT

A. The mechanical equipment supplier shall be staffed with factory trained representatives fully capable of providing instruction on routine and emergency maintenance service on all system components supplied for this project.

B. Suppliers shall provide on-site instruction, when requested by the Contractor or the Engineer, at no additional cost to the State.]

3.12 CLEANUP

A. All equipment and ducts shall be thoroughly cleaned in an approved manner, and maintained until the final inspection.

B. At completion of work, remove all debris and excess materials resulting from this work and leave location broom-clean acceptable to the Engineer.

END OF SECTION

SECTION 15830 – CEILING FANS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide ceiling fans as shown on the drawings, complete with control switches and accessories to operate as specified, without wobble and hum.

1.02 SUBMITTALS

A. General: The Contractor shall submit submittals in accordance with the SECTION 15011 - GENERAL MECHANICAL PROVISIONS.

B. Submit the following:

1. Shop drawings and/or manufacturer's product data showing construction and installation details.

2. Manufacturer's installation instructions.

3. Manufacturer's electrical control diagrams.

4. Manufacturer's operations and maintenance manual.

5. Manufacturer's standard color chart for body and blades.

6. Manufacturer's guaranty/warranty.

7. Maintenance Service Contract.

1.03 QUALITY ASSURANCE

A. Fans shall be provided with metal identification plates or adhesive labels permanently affixed in a conspicuous location identifying the manufacturer and model number.

B. Fans shall be U.L. listed. The U.L. label shall be firmly affixed to the fan.

C. Fans shall either be assembled and/or manufactured or distributed in the U.S.A. Imported fans and parts are acceptable provided they comply with the requirements of this specification, and are distributed through an American based distributing/manufacturing company who shall be responsible for the execution of the fan's guaranty/warranty agreement.

D. The manufacturer or the American based distributing/manufacturing company shall be an established company who has regularly engaged in the manufacture and/or distribution of ceiling fans for the past 10 years.

1.04 GUARANTY AND WARRANTY

A. The Contractor shall furnish the following:

1. A written guaranty against all defects in materials, workmanship and installation. The Contractor shall certify that any defects other than ordinary wear or improper use that may develop within 1 year from the date of project acceptance shall be corrected as no cost to the State.

2. Manufacturer's standard warranty on the fan motor.

3. Manufacturer's standard warranty on the flywheel.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Ceiling fans shall be constructed with the following requirements and accessories:

1. General:

a. Minimum 3-blade type with minimum sweep as scheduled on the drawings, and provides quiet operation.

b. All-metal construction, with painted steel fan blades. Fan and blade finish shall be white.

c. Provide secondary safety cable for each fan. The safety cable shall be fastened to the hanger bracket and the structure that supports the outlet box. Fasteners shall be metal screws, studs, or nuts and bolts. The safety cable and support fasteners shall be selected to support the entire weight of the fan.

d. Non-Rotating stationary hanger pipe (down rod) specifically designed and manufactured to support the fan. Hanger pipe shall be as provided by the fan manufacturer. Thin walled Electrical Metal Tubing (EMT) and aluminum tubing is not acceptable. Length of the hanger pipe (down rod) shall be as scheduled in the drawings. Hanger pipe (down rods) shall be provided to meet the mounting heights indicated on the drawings.

e. Fan control wiring shall be located within the hanger pipe (down rod), protected from rotating parts.

f. Extension lead wires shall be of sufficient length to accommodate the required length of extension hanger pipes (down rod). Rewiring of the fan unit or splicing of the wires to increase its length is not acceptable.

2. Motor:

a. The motor shall be manufactured in accordance with NEMA, U.L. or CSA Standards.

b. The motor's operation shall not interfere with radio or television reception.

c. Variable speed motors, impedance protected.

3. Bearings:

a. Bearings shall be corrosion resistant, permanently lubricated, sealed, no-oil type requiring no maintenance.

4. Control Switch:

a. "Off-Variable speed" control switch controlling the number of fans as indicated on the drawings. Control switch shall be as provided by the fan manufacturer.

b. Control switch shall be mounted in a metal box approved for electrical use and provided with a face plate.

c. The control switch shall have sufficient amperage to supply power to the number of fans connected to the switch as indicated on the drawings.

PART 3 - EXECUTION

3.01 INSPECTION

A. The Contractor and the Installer shall examine the areas and conditions under which the ceiling fans are to be installed.

B. Should any condition be found unsuitable, no work shall be done until the unsatisfactory conditions have been corrected and are acceptable to the Installer. Proceeding with work will imply acceptance of the conditions by the Installer.

3.02 INSTALLATION

A. Verify the ceiling deck slope and mounting conditions. Install mounting plates as required to provide a solid, level and plumb surface for mounting of the outlet box. Mounting plates and outlet box shall be securely mounted and capable of supporting a minimum of 40 lbs. Only U.L. listed outlet boxes labeled "For Fan Support" shall be used. Provide secondary safety cable for each fan housing.

B. Fan motor shall be properly grounded.

C. Assemble and install the fans in accordance with the manufacturer's instructions and recommendations, complete and ready for use.

D. Fans shall be installed at a height as noted on the plans, but in no case shall a fan be mounted with the bottom of its blades lower than 7-feet above the finished floor surface. In addition, fans shall be installed so that no fan blades are no closer than 24-inches away from adjacent walls and finishes.

E. Fan blades shall be uniformly balanced and tightly fastened to the blade holders.

F. Fans shall be balanced and shall not wobble or shake when running at all speeds.

3.03 INSTRUCTION TO PERSONNEL

A. Instruct the operations personnel in the aspects of safety, operation, and maintenance of the ceiling fans.

3.04 FIELD QUALITY CONTROL

A. Operational Test: Perform an operational test as required by the manufacturer in the presence of the Engineer. Each ceiling fan unit shall be operated to demonstrate no wobble operation. Any ceiling fan that wobbles more than 1/8-inch horizontal movement shall be repaired, rebalanced, and adjusted until satisfactory operation is obtained.

3.05 CLEANING

A. Prior to acceptance of the work, thoroughly clean each fan unit and the surrounding area. Patch and/or paint any surface marred or damaged as a result of the ceiling fan installation, as required.

3.06 2-YEAR MAINTENANCE SERVICE CONTRACT

A. In addition to the Guaranty on materials and workmanship noted under paragraph 1.05 of this Section, the Installer shall provide a Maintenance Service Contract, countersigned by the General Contractor.

B. The maintenance service shall provide for all labor, material, equipment and parts to service a ceiling fan complete, on a periodic bases, so as to assure its proper operation and function.

C. The Maintenance Service Contract shall extend for a period of 1 year, commencing on the Project Acceptance Date. All costs for periodic maintenance services shall be included.

END OF SECTION

SECTION 16000 - ELECTRICAL WORK

PART 1 - GENERAL

1. 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.

2. WORK INCLUDED: This section covers the work necessary for the complete power, lighting, and control systems at Site No. 1 – Kauluwai Well site, including but not limited to the following:

A. Complete underground service entrance raceways, including all handholes, pull boxes, and transformer pads required for electric utility service.

B. Complete electrical service and utility metering equipment.

C. Complete motor control center and telemetering cabinet, including motor control components and telemetering components and accessories.

D. Complete electrical conduit and wire system for connection to the well pump, valves, instruments, and controls.

E. Complete well pump control system.

F. Complete submersible well pump power system including installation of step-up pad-mount transformer, and providing load interrupter switch, and high voltage terminal box.

G. Coordination with utility company for power service.

H. Complete grounding system.

I. Complete interior lighting, general use receptacles and equipment connection systems.

J. Complete metering equipment according to Maui Electric Company requirements.

K. Final adjustment and testing of pump and controls.

L. All incidental work where not specifically shown or specified, but is necessary and required to complete the work to an acceptable and operational stage.

3. RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Materials Connected But Furnished and 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. Flow and Level Transmitters

4. Pressure Switches

4. QUALITY ASSURANCE: Comply with the latest applicable rules, regulations, requirements, and specifications of the following:

Local laws and ordinances
State and Federal laws
National Electrical Code
County of Maui 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.

5. 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 therefor, 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 and 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 and 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 ICS 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. Furnish submittal information on the following items:

a. Motor control equipment -- outline and schematic (elementary drawings, descriptive information, and component schedule).

b. MCC -- outline and one-line drawings, descriptive information, and component schedule.

c. Service Equipment

d. Panelboards

e. Disconnect Switches

f. Circuit breakers

g. Outdoor metering and electrical equipment enclosures

h. Special Pull Boxes and Junction Boxes

i. Lighting Fixtures

j. Load Interrupter Switch

k. High Voltage Terminal Box

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.

6. 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.

7. SITE INSPECTION: Prior to submitting a bid, visit the project, ascertain conditions affecting the proposed work, and make allowance as to the cost thereof.

8. 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, Maui Electric Company (MECO), and work of other trades to avoid conflicts, errors delays, and unnecessary interference 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.

9. 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.

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.

11. ELECTRICAL SERVICE:

A. Arrange with utility company 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 service to the project by Maui Electric Company.

B. Perform all work to meet the standards and requirements of Maui Electric Company where such work is under their jurisdiction.

C. Coordinate with Maui Electric Company to rectify any malfunction in the electrical service 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.

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 with these specifications.

2.03 ENCLOSURES: For outdoor weather exposed locations, enclosures shall be NEMA 4X Grade 316 Stainless Steel (SS) type. Exterior junction boxes shall be NEMA 4X Grade 316 SS, gasketed type, unless otherwise noted.

2.04 MOUNTING HARDWARE: All electrical equipment mounting hardware for outdoor installation shall be Type 316 Stainless Steel, unless otherwise noted.

2.05 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.

2.06 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, UL, and shall meet applicable ASTM test requirements for the intended use.

B. Conduit, Flexible: All flexible conduit shall be moisture proof flexible steel, polyvinyl chloride jacketed type, UL approved, with continuous copper ground path in the flexible steel tube, and shall be American Brass Sealtite Flexible Conduit, or as approved.

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, UL, and NEC.

2.07 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 ICEA S-95-658, the NEC, and UL. Conductor sizes shall not be less than those shown.

1. Conductors smaller than No. 8 for lighting and convenience outlets shall be solid. All other conductors No. 12 and larger shall be stranded. Conductors No. 8 AWG or larger shall have insulation of a heat and moisture resistant grade THW. Smaller conductors shall have thermoplastic insulation type THW or THWN, and shall be factory color coded with separate color for each phase and neutral used consistently throughout the system.

2. All conductors and cables for underground or aerial 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 ICEA S-95-658.

B. Cables, 5 kV: Shielded, 133% insulation level, UL Listed as Type MV-105.

1. Conductor: Annealed uncoated copper compact stranded per ASTM B-496. Size of conductor as indicated on drawings.

2. Strand Screen: Extruded semiconducting EPR strand screen. Shall meet or exceed the electrical and physical requirements of ICEA S-93-639/NEMA WC74 & S-97-682, AEIC CS8 and UL 1072.

3. Insulation: Shall meet or exceed the electrical and physical requirements of ICEA S-93-639/NEMA WC74 & S-97-682, AEIC CS8 and UL 1072.

4. Insulation Screen: Extruded semiconducting EPR insulation screen applied directly over the insulation. Shall meet or exceed electrical and physical requirements of ICEA S-93-639/NEMA WC74 & S-97-682, AEIC CS8 and UL 1072.

5. Shield: 5 mil bare copper tape helically applied.

6. Jacket: Shall meet or exceed electrical and physical requirements of ICEA S-93-639/NEMA WC74 & S-97-682, and UL 1072 for polyvinyl chloride jackets.

   UL Listed as Type MV-105 and sunlight resistant, in accordance with UL 1072.

7. Manufacturer: The Okonite Company's Okoguard Shielded Okoseal 5kV Type MV-105 cable, or approved equivalent.

C. 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.

2.08 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.

2.09 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 with conduit hubs.

2.10 DEVICE PLATES: Provide one piece device plates of satin finish stainless steel, unless otherwise specified. Screws shall be of metal with countersunk heads and color to match the finish of the plate.

2.11 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, cast metal cover plate, and cap over each receptacle opening. The cap shall be provided with a spring-hinged flap with rubber gaskets and stainless steel springs.

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.

2.12 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.

2.13 LIGHTING FIXTURES:

A. Fixtures: Description and manufacturer of each fixture as indicated in Fixture Schedule on drawings.

B. LED Drivers: Drivers shall consist of a high frequency inverter, and power control and regulation circuitry. Drivers shall be Class 2 certified and meet safety standard UL 1310.

2.14 PANELBOARDS: Panelboards shall be circuit breaker type as indicated, copper bussed with bolted molded plastic case circuit breaker complement, and shall meet the standards established by UL, NEMA PB 1, and the NEC. Assembly shall be flush mounted in motor control center, or surface mounted type, as indicated.

2.15 TRANSFORMERS: NEMA ST20, general-purpose, dry-type, self-cooled, ventilated. Transformer shall be mounted in MCC as indicated, with six 2-1/2 percent full capacity taps (4 below and 2 above the primary winding rating). Transformer shall have 220 degrees C insulation system with a temperature rise not exceeding 80 degrees C under full rated load in a maximum ambient temperature of 40 degrees C. Transformer shall be capable of carrying 115% of the nameplate KVA without exceeding insulation rating.

2.16 SURGE PROTECTIVE DEVICE (SPD):

A. Branch Feeder Circuit SPD:

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° to 200° 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).

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° to 85°C

f. Operating Humidity: 1% to 95%

g. Maximum peak transient power line voltage @ 120V - 2.4 megawatts

h. Capacitance: 1 to 1.5 - microfared per line

i. Rated power dissipation: 1 watt per line

j. Latest UL 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: 160,000
4) Transient energy (joules): 3150
5) Fuses: 5 Amp, 600V (Buss KTK-5)
6) Manufacturer: MCG 160M-480D or approved equal

b. System: 277/480V, 3 phase, 4 wire (wye)

1) Max. continuous line voltage (RMS): 300
2) Nominal clamping voltage (peak): 423
3) Max. peak current (8 x 20) sum: 90,000
4) Transient energy (joules): 3150
5) Fuses: 5 Amp, 600V (Buss KTK-5)
6) Manufacturer: MVC Model MV400 or approved equal

c. 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

d. System: 120/240V, 1 phase, 3 wire

1) Max. continuous line voltage (RMS): 130
2) Nominal clamping voltage (peak): 198
3) Max. peak current (8 x 20) sum: 60,000
4) Transient energy (joules): 930
5) Fuses: 5 Amp, 250V (AGC or equal)
6) Manufacturer: MVC Model MV100 or approved equal

e. System: 120V, 1 phase, 2 wire

1) Max. continuous line voltage (RMS): 130
2) Nominal clamping voltage (peak): 170
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

2.17 MOTOR CONTROL CENTER:

The motor control center and telemetering cabinets shall be Allen-Bradley CENTERLINE 2100 MCCs or approved equal.

THE ELECTRICAL CONTROL CENTER SHALL BE FACTORY ASSEMBLED, WIRED, AND TESTED BY THE MAKER OF THE MAJOR COMPONENT PARTS. All component parts listed in this portion of the specifications shall be

General Electric, Cutler Hammer, Square D, Siemens, Allen-Bradley, or approved equal.

The motor control center and telemetering cabinet shall be constructed in accordance with the latest NEMA PB-2 and UL 845 standards, with necessary steel plates, angle iron supports and bolts, and shall be of the cubicle type as shown on the drawings. Motor control center shall be 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 Owner). The wire number, terminal block number and terminal block arrangement within the MCC shall be indicated on the shop drawings.

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. General Electric CR151 series or equal.

Wire markers shall be slip-thru type, white bands with black numbers, compression type of heat shrink, identification numbers to match shop drawings.

Nameplates shall be installed as shown on the drawings.

The Contractor shall be responsible for securing all dimensions and hole spacing for mounting the required displays and appurtenances on the telemetering cabinet.

The MCC shall be arranged in one continuous assembly and shall include, but not be limited to, the following:

A. Structure:

1. The MCC shall be of dead front construction and shall consist of one or more vertical sections bolted together to form a rigid, free-standing assembly.

2. Vertical sections shall be rigid, free-standing structures.

   a. Vertical sections shall have internal mounting angles running continuously within the shipping block.

   b. Vertical sections shall be 90 in. high, 20 in. deep and 20 in. Wide, except where larger dimensions are required.

   c. 71 in. high, reduced height sections shall be provided, if specified on the contract drawings.

   d. Each standard section shall be capable of being subdivided into 12 usable, unit spaces.

   e. Two unit spaces shall constitute one space factor and shall be 13 in. in height.

   f. One unit space shall constitute one-half space factor and

shall be 6.5 in. in height.

3. Enclosure:

a. The MCC enclosure shall be NEMA Type 1 with gasket around perimeter of doors.

b. Each section shall be equipped with two full-metal side sheets to isolate each vertical section and to help reduce the likelihood of fault propagation between sections.

c. All unpainted parts shall be plated for corrosion resistance.

B. SCADA Cabinet: For housing telemetering and supervisory control equipment, RTU, PLC, touch panel, and for flush mounting displays and instruments as shown on plans.

C. Motor Control Center Panels: Number of panels as shown on plans.

1. For housing motor starter, molded case circuit breaker, control circuit relays, wiring, and appurtenances.

2. For flush mounting the digital multi-function power monitor.

3. For mounting circuit breakers and selector switches and panelboard, as shown on drawings.

4. For mounting main power breaker.

5. For mounting panelboard and step-down dry-type transformer.

D. The following is a list of the major component parts of the electrical control center. All component parts shall be Square D, General Electric Co., Cutler Hammer, Siemens, Allen-Bradley.

1. Bus Bars:

a. Horizontal Power Bus:

1) The horizontal bus shall be rated as shown on the drawings.
2) The horizontal bus material shall be copper with tin plating.
3) The horizontal bus shall be supported, braced and isolated from the vertical bus with a high strength, non-conductive, non-tracking, glass polyester material.
4) For standard sections the horizontal bus shall be continuous within each shipping block and shall be braced within each section.
5) Horizontal bus splices shall have at least two bolts on each side.

b. Vertical Bus:

1) The vertical power bus shall have an effective rating of 600 A. If a center horizontal bus construction is utilized, then the rating shall be 300 A above and below the horizontal bus for an effective rating of 600 A. If a top or bottom mounted horizontal bus is utilized, then the full bus must be rated for 600 A.
2) The vertical bus material shall be copper with tin plating.
3) The vertical bus shall attach to the horizontal bus with at least two bolts.
4) The vertical bus shall be continuously braced by a high strength, non-conductive, non- tracking, glass-filled polyester material and isolated from the unit spaces by a non- conductive, polycarbonate molded cover.
5) The vertical bus shall be isolated from the horizontal power bus except where necessary to connect the vertical power bus to the horizontal power bus.

c. Ground Bus:

1) Provide a ground bus system consisting of a horizontal ground bus connected to vertical ground buses mounted in each section.
2) Provide a tin-plated copper 0.25 x 1 in. horizontal ground bus mounted in the bottom of the MCC unless otherwise specified in the drawings.
3) Provide a pressure-type mechanical lug mounted on the ground bus in the incoming line section.
4) Provide a unit ground stab on all unit inserts. The ground stab shall establish unit insert grounding to the vertical ground bus before the plug-in power stabs engage the power bus. The grounding shall be maintained until after the plug-in power stabs are disengaged.

2. Motor Starters: The pump motor starter shall be Allen-Bradley SMC Flex Smart Motor Controller or approved equal and shall include the following features:

a. Integrated bypass contactor that is closed once the motor is up to full speed.

b. Electronic overload protection with adjustable trip class.

c. Four programmable auxiliary contacts.

d. Selectable control capabilities: soft start, kickstart, current limit start, dual ramp, full voltage, linear speed, preset slow

speed, soft stop.

e. LCD display.

f. Keypad programming for configuration.

g. Built-in, selectable protective functions for: overload, jam, stall, excessive starts per hour, underload, over/under voltage, voltage unbalance.

h. Metering capabilities for: current, voltage, kW, kWH, power factor, motor thermal capacity utilized, elapsed time.

i. Ground fault protection (1 A to 5 A).

3. Hand-Off-Auto: Hand-off-auto selector switch shall be 3 position type, Square D Class 9001, single pole, double throw control switch or approved equal. Switches shall be marked HAND-OFF-AUTO.

4. 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 switchboard or motor control center.

5. Control Circuit Sequence Timer:

a. Shall be as manufactured by the Siemens Energy AND 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.

6. Emergency Stop Switch: 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 switch shall be labeled EMERGENCY STOP.

7. Relays: The relays in the pump motor control circuit shall be 120 volts, size 0, four-pole minimum.

8. Indicating Lights: The indicator lights mounted on the front of the motor starter panels shall be 22 mm panel mounted, with LED pilot lights and push-to-test circuit. The lights shall indicate the following functions:

a. RED LIGHT: PUMP RUNNING; MAINLINE FLOW; PUMP CONTROL VALVE FULLY OPEN

b. GREEN LIGHT: PUMP STOPPED; PUMP CONTROL VALVE FULLY CLOSED

c. AMBER LIGHT: NO MAINLINE FLOW; VARIOUS ALARMS

d. BLUE LIGHT: RESERVOIR CALLING FOR WATER

9. Control Switches: Control switches shall be oil-tight type for switchboard panel mounting with knob handles and 6 amperes, 300 volts, cam operated contacts. Contact and cam assembly enclosed in a plastic enclosure. Position of switch identified by engravings on a metal legend plate.

10. Running Time Meter: Running time meters shall be conventional 3-1/2" square case meters designed for flush mounting. The meter shall display elapsed running tine of each motor in hours by 6-digit dials. The meters shall be operable on 120-volt, 60 Hertz power.

11. 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.

12. Wireways: Wireways shall be fabricated from NEC code gage steel, square cross-section, galvanized, prime painted and enamel finished.

a. Horizontal Wireways:

1) Horizontal wireways shall be located at the top and bottom of the MCC.
2) Horizontal wireways shall be continuous across the length of the MCC, except where access needs to be denied due to electrical isolation requirements.
3) The horizontal wireways shall be isolated from the power bus.

b. Vertical Wireways: Provide a full height vertical wireway in each standard vertical section.

1) The vertical wireway shall be isolated from the vertical and horizontal buses.
2) The vertical wireway shall be covered with a hinged and secured door.
3) Wireway tie bars shall be provided.
4) Isolation between the wireway and units shall be provided.

13. Control Relays: The control relays in the pump motor control circuit shall be IEC 2 HP contactors with coil surge suppression unit, mounted on 35 mm DIN rail with end stoppers.

14. Time Delay Relays: Time delay relays shall be industrial type rated, time delay after de-energization or time delay after energization type with synchronous motor driven timing mechanism. Open type, and with contacts rated for 120 volts, 40 amperes make, 15 amperes break. Time delay shall be dial adjustable.

15. 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 accept a burden of up to 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 C12.201 (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; 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) Meter shall provide Harmonics %THD (% of total Harmonic Distortion). Harmonic magnitude recording to the 40th 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.

b. The meter shall include a three-line, bright red, .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.

c. 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.

d. 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.

e. 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) These virtual upgrade packs must be able to be updated without physically removing the installed meter.

f. 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 57,600 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.

g. 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 an update rate of every 6 cycles for Watts, VAR, and VA. All other parameters shall be every 60 cycles.

h. 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 a burden of less than 11VA. An optional power supply of 18-60 Volts DC shall be available.

i. 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 the Ethernet Option Card.

j. 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 limits.

k. 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 Option card 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, an 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. In addition, 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) Allow the meter to speak with both Modbus TCP and DNP over Ethernet simultaneously.
   d) Process data at not more than 0.6 kbs to 1.5 kbs.
   e) Allow auto transmit/receive detection for straight or null RJ45 cables.
   f) 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 0-1mA outputs.
   b) Assignable to any measured parameter.
   c) 0.1% of 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 Link 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.

l. The meter shall have a standard 4-year warranty.
m. 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.

o. The power meter shall be Electro Industries/GaugeTech model Shark 200 meter or approved equal.

16. Transistor Sensitive Relay: Resistance sensitive device, plug-in DPDT, Cutler Hammer or equal.

17. Backspin Sequence Timer:

a. Shall be four circuits, as manufactured by the Siemens Energy and 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.

18. Phase Reversal/Loss Relay: The phase reversal/loss relay shall be rated 3-phase, 480 volts, with adjustable range of 380-500 VAC and drop out time of 0.05 seconds. An adjustable trip delay shall prevent nuisance trips and a restart delay timer shall prevent short cycling. Relay drops out under the following conditions; loss of any phase, low voltage on any or all phases and phase reversed from A-B-C sequence.

a. The relay shall continuously monitor 3-phase power lines for abnormal conditions. Solid state sensing circuit and reset timer can be used with either Wye or Delta systems without requiring a neutral. Red "Trip Light" and green "Normal Light" to show condition of sensing circuit and the output contacts shall be provided.

Nominal voltage (phase to phase):	480V
Adjust range (VAC):	380-500V
Max. voltage (VAC):	520V
Input frequency:	60Hz
Repeat accuracy:	+/- 0.5% of set point
Dead band:	2% max
Reset:	Selectable automatic or manual
Trip delay:	Adjustable 1 to 10 sec. +/- 5%
Restart delay:	Adjustable 0.3 to 5 min. +/- 5%

Output contacts: DPDT

b. The phase reversal/loss relay shall be Timemark Model No. 2652, 3-phase, 480 volts or approved equal.

19. 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)
2) 500-600 VAC, 3 phase (Available 777-575-P2))

b. Frequency: 50 or 60 Hz

c. Motor Full Load amp Range:

1) 2 - 90 Amps, 3ø (Direct)
2) 80 - 800 Amps, 3ø (External CT's)

d. Programmable Operating Points

1) LV - Low Voltage Threshold: 170V – 524V
2) HV - High Voltage Threshold: 172 – 528V
3) VUB - Voltage Unbalance Threshold: 2 - 25% or 999 (Disabled)
4) MULT - # of Loops or CT Ratio (XXX:5): 1 - 10 Loops or 100-800 Ratio
5) OC - Over Current Threshold: (20 - 100A) / MULT or 80 – 140% of CT Primary.
6) UC - Under Current Threshold: (0, 10 - 98A) / MULT or 40 – 140% of CT Primary.
7) CUB - Current Unbalance Threshold: 2 - 50% or 999 (Disabled)
8) TC - Over Current Trip Class: 02 – 60, J02 – J60, L50 – L60 or off
9) RD1 - Rapid Cycle Timer: 0 – 999 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, A (Automatic)
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 – 999 Seconds (Standard)
16) GF - Ground Fault Current Threshold: (3 - 20A) / MULT or 12 -40% of CT Primary or OFF

e. Physical Specifications

1) Low Voltage: 4 seconds
2) Output Contact Rating (Pilot Duty) SPDT: 480 VA @ 240 VAC, B300
3) Transient Protection (Internal): 2500 V for 10 mSeconds

f. Accuracy

1) Voltage: +/- 1%
2) Current: +/- 3% (<100 amps direct)
3) Timing: 0.5% +/- 1 Second
4) Ground Fault: +/- 15% (<100A)

g. Repeatability

1) Voltage: +/- 0.5% of normal voltage
2) Current: +/- 1% (<100 amps direct)

h. Temperature Range: -20 - 70 degrees Celsius (Ambient)

i. Dimensions: 3.05" H x 5.05" D x 3.85" W

j. Power Consumption: 10 Watts (Max.)

k. Weight: 1.2 lbs.

20. 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-P2 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: Pendin

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: De-pluggable terminal block

21. Lighting Time Switch: Automatic electric motor driven time switch shall have 2-circuit, simultaneous "ON" and separate "OFF" operations and shall be panel mounted in the motor control center in NEMA 1 enclosure.

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 35 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.

22. Disconnects:

a. Main Circuit Breaker Disconnect

1) Lugs to accommodate the incoming power conductors as indicated on the contract drawings shall be provided by the MCC manufacturer
2) Size the circuit breaker frame and trip rating as shown on the drawings
3) The interrupting capacity rating shall meet or exceed the available fault current as shown on the contract drawings

a) Interrupting capacity based on a slash rating is not acceptable

4) Provide a circuit breaker with thermal magnetic trip unit for 250 A and smaller frames; provide electronic trip unit for 400 A and larger frames
5) Provide a removable protective barrier to reduce the possibility of incidental contact with the line terminals
6) Provide one normally open and one normally closed circuit breaker auxiliary contact that follows the position of the circuit breaker main contacts for indication of 'On' or 'Off/Tripped'
7) For circuit breakers rated 1000 A and above, on Wye connected systems with a solidly grounded neutral, provide integrated ground fault protection with adjustable pick-up and adjustable time delay

b. Feeder Disconnects

1) Disconnecting means for feeders shall be circuit breakers with thermal-magnetic trip units for 250 A and smaller frames; provide an electronic trip unit for 400 A and larger frames
2) Interrupting capacity rating shall meet or exceed the available fault current as shown on the contract drawings

a) Interrupting capacity based on a slash rating is not acceptable

3) Minimum frame size shall be 125 A
4) Provide one normally open and one normally closed circuit breaker auxiliary contact which follows the position of the circuit breaker main contacts for indication of 'On' or 'Off/Tripped'

23. Capacitors and Capacitor Circuit Breakers: The KVAR rating of the capacitors 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°C to +46°C. They shall be subject to all NEMA standard dielectric tests. They shall be filled with nonflammable high dielectric liquid and be individually fused with current-limiting fuses. Askarel and insulating liquids containing poly-chlorinated biphenyls (PCB's) shall not be provided.

a. 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.

b. Capacitors and capacitor circuit breakers shall be mounted in motor control center.

24. 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.

E. Motor Control Center Approval: Prior to installation, the Contractor shall submit to the Owner for their approval, five copies of the dimensional drawings and connection diagram of the motor control center, including the telemetering section. 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.

F. Ordering of Motor Control Center: The motor control center shall be ordered and written confirmation submitted to the Owner within twenty (20) calendar days after all shop drawings and catalog data relating to the motor control center have been approved by the Engineer.

G. 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 Owner 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.

2.17 LOAD INTERRUPTER SWITCH: The switch shall consist of a solid dielectric insulated manually operated resettable vacuum fault interrupter electronically controlled.

A. General:

1. Quality Assurance:

a. Manufacturer Qualifications: The chosen manufacturer shall have at least 10 years of experience in manufacturing solid dielectric insulated medium voltage switchgear. The manufacturer shall be completely and solely responsible for the performance of the fault interrupter as rated.

b. The manufacturer shall furnish certification of ratings of the

fault interrupter switch upon request.

c. The switch shall comply with requirements of the latest revision of applicable industry standards, including: IEEE C37.74, IEEE C37.60, ANSI/IEEE 386, IEC60529, IEEE 592

d. The switch shall be tested to IEC 60529 for submersibilty. The switch shall be rated IP 68 for 20 days with a 20-foot head of water.

e. The switch manufacturer shall be ISO 9001:2008 and ISO 14001:2004 certified.

f. The switch shall be RUS approved.

2. Delivery, Storage, and Handling:

a. The fault interrupter switch shall be shipped preassembled at the factory. No field assembly shall be required.

b. The contractor, if applicable, shall handle, transfer and move the switches in accordance with manufacturer's recommendations.

B. Products

1. Switch Configuration:

a. The fault interrupter switch shall be a two way device.

b. The fault interrupter switch shall be designed for front access to cables and operators.

2. Switch Construction

a. The fault interrupter switch shall be a dead-front design. The operating mechanism housing shall be stainless steel with a viewing window for verification of vacuum interrupter contact position. The housing shall be painted ANSI 70 light gray using corrosion-resistant epoxy paint.

b. Operating handles shall be padlock-able and adaptable to keylock schemes. The operating shaft shall be stainless steel providing maximum corrosion resistance. A double "O" ring shaft seal shall be used for a leak resistant, long life seal.

c. The solid dielectric module must be coated with a semi-conductive layer of epoxy, providing a completely dead front device. The semi-conductive layer must be tested to IEEE 592 to ensure it can carry fault current to ground so

as to ensure operator safety.

d. The fault interrupter switch shall be designed for long term operation in the harshest environments. The interrupter design must be tested to IEC60529 and achieve a protection rating of IP68, subjected to a 20' head of water pressure for 20 days.

e. The fault interrupter switch shall interrupt all load and fault currents within the vacuum bottle.

f. The fault interrupter switch mechanism shall consist of three individual vacuum bottle assemblies mechanically linked to a single spring-assisted operating mechanism. Manual opening and closing of the fault interrupter switch shall be via an operating handle.

3. Design Ratings

SELECTION OF RATINGS	IEEE/IEC			
Maximum Design Voltage, kV	15.5	27	29.3	38
Impulse Level (BIL) Voltage, kV	110	125	125	150
Continuous Current, Amperes	800	800	800	800
Load break Current, Amperes	800	800	800	800
One Minute Withstand (dry), AC kV	35	50	50	70
Production Test Rating	34	40	40	50
15 Minute Withstand, DC kV	53	78	78	103
Fault Interrupter rating, kA asymmetrical	20*	20	20	20
Fault Interrupter rating, kA symmetrical	12.5*	12.5	12.5	12.5
Mechanical Endurance, Operations	2000	2000	2000	2000

Note: 15kV rated Trident-S switches have an optional 16kA symmetrical (25.6kA asymmetrical) fault interrupt rating.

4. IEEE C37.60 Fault Interrupting Duty

Percent of Maximum Interrupt Rating	Approx. Interrupting: Current, Amps	No. of Fault: Interruptions
15-20%	2000	44
45-55%	6000	56
90-100%	12500	16
Total Number of Fault Interruptions: 116		

5. Cable Entrances: Cable entrances shall be tested to IEEE 386 and be, as indicated on the switch drawing: 15.5kV BIL 200A Bushing Well per IEEE Figure 3

6. Vacuum Interrupter Control: An electronic control shall be provided to monitor load and fault current on all three phases of the interrupter. The current transformers encapsulated within the solid dielectric modules provide control power and current sensing. No external power source shall be required for overcurrent protection. Operational temperature range of the control shall be -40degrees C to +65degrees C. Maximum time for power up and ready to trip when closing on a circuit shall be ten percent of the trip time or 1/2 cycle, whichever is greater. Trip selection may be made with the interrupter energized. The range of Phase Overcurrent minimum trip settings shall be 15-300A (500:1 CT)

   Type 2: The control shall include 30 Time Current Characteristic (TCC) curves, which shall be field selectable using dips switches. The control shall be equipped with multiple TCC curve modifications options, including Instantaneous Trip, Inrush, Restraint, and Phase Time Delay. In addition, the control shall include a Phase Imbalance (Ground Fault) setting. All settings shall be inputted via selector knobs located on the faceplate of the control. The control shall include a last cause of trip indicator. Trip modules shall not require a computer or other external device for inputting trip settings or other operational parameters.

7. Pad Mounted Enclosure: The enclosure shall be fabricated of 12 gauge galvanized stainless steel and manufactured to ANSI C37.72 and C57.12.29 standards. The enclosure shall be tamper resistant incorporating hinged access doors with pentahead locking bolts and provision for padlocking. The enclosure shall be provided with lift provisions and painted with a Munsell 7.0GY3.29/1.5 green finish.

8. Factory Production Tests: Each interrupter shall undergo the

following production testing. Test reports must be available upon request.

a. A mechanical operation check

b. AC hi-pot tested one minute phase-to-phase, phase-to-ground and across the open contacts

c. Circuit resistance shall be checked.

d. Each solid dielectric module shall undergo an X-ray inspection and a partial discharge test to ensure void-free construction.

e. Leak test to insure the integrity of all seals and gaskets.

f. Primary current injection test to test CTs, trip mechanism, and electronic control.

9. Standard Components: The following shall be included as standard:

a. Welded stainless steel mechanism housing painted light gray with stainless steel and brass fasteners.

b. Lifting provisions

c. 1/2"- 13 nuts to provide sufficient grounding provisions for interrupter and all cable entrances.

d. Stainless steel three line diagram and corrosion-resistant nameplates.

e. Switch operating handle with padlock provision.

f. Removable parking stands

g. Mounting brackets

h. Operating handle

10. Options: The following options shall be supplied:

a. Mounting frame to bolt switch to the floor (specify galvanized or stainless-steel construction. Specify height of lowest bushing)

b. 4/0 brass ground lugs

c. Provisions to mount a key interlock after installation

d. Keylock installed at the factory, to lock in open position

e. Two (2) Form C contacts for remote monitoring of the position of the vacuum bottle contacts.

11. Labeling

a. Hazard Alerting Signs: The exterior of the pad mount enclosure shall be provided with “Warning-Keep Out-Hazardous Voltage Inside-Can Shock, Burn, or Cause Death” signs. Each unit of switchgear shall be provided with a “Danger-Hazardous Voltage-Failure to Follow These Instruction will Likely Cause Shock, Burn, or Death” sign. The text shall further indicate that operating personnel must know and obey the employer’s work rules, know the hazards involved, and use proper protective equipment and tools to work on this equipment. Each unit of switchgear shall be provided with a “Danger-Keep Away-Hazardous Voltage-Will Shock, Burn, or Cause Death” sign.

b. Nameplates, Rating Labels, and Connection Diagrams: Each unit of switchgear shall be provided with a nameplate indicating the manufacturer’s name, catalog number, model number, date of manufacture, and serial number. Each unit of switchgear shall be provided with a rating label indicating the following: voltage rating; main bus continuous rating; short-circuit rating; fault interrupter ratings including interrupting and duty-cycle fault-closing; and fault interrupter switch ratings including duty-cycle fault-closing and short-time.

2.18 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.

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 AND 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 AND 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 AND 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. Rigid steel, galvanized.

2. Rigid PVC Schedule 40 heavy wall conduit.

3. Rigid steel to points at least five feet outside building walls and all 90° bends.

4. Rigid steel under or embedded in equipment mounting pads.

C. Interior, Concealed:

1. Rigid steel, galvanized.

D. Interior, Exposed:

1. Rigid steel, galvanized.

3.09 INSTALLATION: Conduit system installations shall meet or exceed the requirements of the NEC. Raceways shall be concealed or exposed as

indicated. Group raceways in same area together. Raceways shall be supported at intervals required by the NEC. 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.

A. 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.

B. 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. Use approved heating methods for forming smaller bends. 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.

C. 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.

D. Do not backfill underground conduit until it has been inspected and approved by the Engineer or his representative.

E. Final connection to motors, 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.

3.10 CONDUCTORS: Conductors 600 Volts and 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.

A. 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.

3.11 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.

3.12 JUNCTION BOXES: Construct junction boxes, where specified or required, of code-gauge galvanized sheet metal of not less than the minimum size required by the NEC. Junction boxes for exterior use shall be stainless steel, as indicated. Furnish boxes with screw-fastened covers. All boxes shall be readily accessible and shall not be installed in finished areas unless approved by the Engineer. Junction boxes not more than 150 feet apart in long runs.

3.13 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.

3.14 RECEPTACLES AND WALL SWITCHES: Equipment shall be located at the following height above the floor, unless otherwise indicated:

A. Outdoor convenience receptacles, as indicated on plans.

B. Indoor convenience receptacles, 12 inches above floor.

C. Wall switches, 48 inches above floor.

D. Special receptacles, as indicated on plans.

3.15 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.

3.16 LIGHTING FIXTURES: Fixtures securely and safely supported by means of fixture studs in the outlet boxes or other approved means. Ceiling fixtures arranged to hang vertically unless noted otherwise. Provide accessories such as straps, mounting plates, nipples, or brackets for proper installation.

3.17 MOTOR CONTROL CENTER: Install equipment in strict accordance with approved drawings and manufacturer's recommendations. Secure motor control centers 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.

A. 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.

3.18 STEP-UP PADMOUNT TRANSFORMER AND LOAD INTERRUPTER SWITCH: Step-up pad-mount transformer and load interrupter switch shall be mounted on concrete pads. Units shall be carefully installed so as not to scratch finishes. After installation, finished surfaces shall be inspected and scratches touched up with a finish furnished by the manufacturer especially for this purpose.

A. Concrete Pads: Concrete pads shall be constructed as indicated. Tops of concrete pads shall be level and shall project 6 inches above finished paving or grade and sloped to drain. Conduits for primary, secondary, and grounding conductors shall be set in place prior to pouring of concrete pads.

3.19 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.

A. 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.

1. 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.

B. 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.

C. 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.

D. Overload Protective Devices: The Contractor shall compile, by visual inspection of equipment installed for each motor, the following data in neatly tabulated form:

1. Equipment drive.

2. Nameplate amperes.

3. Service factor.

4. Overload catalog number.

5. 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.

3.20 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. 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.

3.21 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.

3.22 MEASUREMENT AND PAYMENT: The electrical work shall be measured and paid for at the contract lump sum price bid.

A. General: No separate payments will be made for the work covered by the separate section of the 16000 series of these specifications. 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.

B. Compensation: Payment of the furnishing and installing of equipment (exclusive of nonrecurring utility installation costs) will be made at the lump sum price bid of which the item is a part and shall be full compensation for all work in accordance therewith, complete and finished in accordance with the drawings and specifications.

C. Utility Installation Costs: Payment for the nonrecurring utility installation costs will be made by the Owner.

END OF SECTION

SECTION 16200 - THREE-PHASE DISTRIBUTION TRANSFORMERS

PART 1 – GENERAL

1.01 GENERAL

A. SECTION INCLUDES

1. Liquid-filled pad-mounted transformer.

B. REFERENCES

1. ANSI C37.47 - Specifications for Distribution Fuse Disconnecting Switches, Fuse Supports, and Current-Limiting Fuses.

2. IEEE C57.12.00 - Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.

3. IEEE C57.12.01 - Standard General Requirements for Dry-Type Distribution and Power Transformers.

4. IEEE C57.12.34 - Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers, 2,500 kVA and Smaller: High Voltage, 34,500 GrdY/19,920 Volts and Below; Low Voltage, 480 Volts and Below.

5. ANSI C57.12.28 - Switchgear and Transformers, Pad-Mounted Equipment - Enclosure Integrity.

6. IEEE C57.12.90 - Standard Test Code for Liquid-Immersed Distribution Power, and Regulating Transformers and Guide for Short-Circuit Testing of Distribution and Power Transformers.

7. IEEE C57.12.91 - Test Code for Dry-Type Distribution and Power Transformers.

8. IEEE C57.13 - Requirements for Instrument Transformers.

9. ANSI/IEEE 386 - Separable Insulated Connector Systems for Power Distribution Systems above 600 V.

10. ASTM D877 - Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes.

11. NEMA AB1 - Molded Case Circuit Breakers.

12. CAN/CSA-C88-M90 - Electrical Power Systems and Equipment.

C. SUBMITTALS

1. Submit shop drawings indicating outline dimensions, connection and support points, weight, specified ratings and materials.

2. Submit product data indicating standard model design tests and options.

3. Submit manufacturer's installation instructions.

D. OPERATION AND MAINTENANCE DATA

1. Include procedures for sampling and maintaining fluid, cleaning and maintaining unit, and replacing components.

E. QUALITY ASSURANCE

1. Manufacturer: Company specializing in distribution transformers with three years documented experience.

1.02 PRODUCTS

A. MANUFACTURERS

1. Cooper Power Systems, ABB, or Engineer approved equal.

2. Southwest Electric shall be strictly prohibited.

B. LIQUID-FILLED PAD-MOUNTED TRANSFORMERS

1. The transformer(s) shall be compartment type, self-cooled, for mounting on a pad and shall comply with the latest applicable standards.

2. The average temperature rise of the windings, measured by the resistance method, shall be 65° C when the transformer is operated at rated kVA output in a 40° C ambient. The transformer shall be capable of being operated at rated load in a 30° C average, 40° C maximum ambient, as defined by IEEE C57.12.00 without loss of service life expectancy.

3. Coolant and insulating fluid shall be inhibited mineral oil.

4. The high and low voltage compartments shall be located side by side, separated by a steel barrier. When facing the transformer, the low voltage compartments shall be on the right. Terminal compartments shall be full height, air-filled, with individual doors. The high voltage door fastenings shall not be accessible until the low voltage door has been opened.

5. The tank, tank base, cabinet, cabinet sides & sill, and cooling fins shall be constructed of Grade 304 Stainless Steel.

6. The following accessories shall be provided as standard on all transformers:

   i. Nameplate in low voltage compartment, 1 inch upper filter press and filling plug, 1 inch drain plug.

   ii. Drain plug provided on 75-500 kVA. Drain valve provided on units rated 750 kVA and above.

   iii. Tap changer, for de-energized operation only, which is externally operable and padlockable. The front of both compartments shall be removable to allow the transformer to be rolled or skidded into position over conduit stubs. ANSI tank grounding provisions shall be furnished in both compartments.

7. The transformers shall be rated as noted below:

   i. Step-Up Transformer

      a The step-up transformer shall be rated 500 kVA self-cooled (OA). Primary voltage 480 delta. Secondary voltage 2300 wye, 4-wire, 60 Hz with two 2-1/2% full capacity above normal and two 2-1/2% below normal taps. **A reverse-fed step-down transformer will not be accepted.** Impedance shall be manufacturer's standard impedance. Basic impulse level of the primary winding shall be as specified in ANSI C57.12.00 for comparable kV class.

      b In a delta configuration, the transformers shall be constructed to permit the secondary (high voltage) side the ability to provide the full load voltage required by the motor, 2300V or 4160V as specified on the plans, at an intermediate tap setting.

      c Molded case circuit breaker in the low voltage compartment shall be rated 1600 amperes.

8. The transformer shall be of sealed-tank construction of sufficient strength to withstand a pressure of 7 psi without permanent distortion. The cover shall be welded and the fastenings tamper-resistant. The transformer shall remain effectively sealed for a top oil temperature range of -5° C to 105° C. When required, cooling panels will be provided on the back and sides of the tank. Lifting eyes and jacking pads will be provided.

9. Coils shall be wound with copper conductors.

10. The core shall be manufactured using high grade, grain-oriented silicon steel laminations carefully annealed after fabrication to restore high magnetic permeability. Magnetic flux is to be kept well below the saturation point.

11. The high voltage terminations and equipment shall be dead front.

12. Dead front bushings shall be either universal wells or one-piece integrated for use with separable connectors. Bushings shall be externally clamped and front removable.

13. The low voltage bushings shall be molded epoxy, and provided with blade-type spade terminals with NEMA standard hole spacing arranged for vertical take-off. The low voltage neutral shall be an insulated bushing, grounded to the tank by a removable ground strap.

14. Provide a load break, gang operated, liquid immersed switch that is externally operable from the high voltage compartment through the use of a distribution hot-stick.

15. Switch to be 2-position "OFF-ON" type for use on a radial feed-system.

16. Provide the following options for fusible protection:

    i. For 500 kVA padmounted transformer: Provide internal liquid immersed cartridge fuses sized at approximately three times the full-load primary current.

17. Surge Protection - Provide three 5 kV distribution class lightning arresters for surge protection.

    i. Arresters are to be under oil MOV.

18. Additional Accessories

    i. 1 inch drain valve with sampling device for both transformers.

    ii. Dial type thermometer.

    iii. Automatic pressure relief device (self-resealing with indicator).

    iv. Molded case circuit breaker in the low voltage compartment rated as indicated on drawings.

    v. Bushing well inserts.

    vi. Pentahead bolts for compartment doors.

19. Testing - Tests shall be conducted in accordance with the provisions of IEEE C57.12.90 and shall include, as a minimum, the following tests:

    i. Ratio

    ii. Polarity

    iii. Phase Rotation

    iv. No-Load Loss

    v. Excitation Current

    vi. Impedance Voltage

    vii. Load Loss

    viii. Applied Potential

    ix. Induced Potential

    x. QA Impulse Test

1.03 EXECUTION

A. EXAMINATION

1. Verify that pads are ready to receive work.

2. Verify field measurements are as instructed by manufacturer.

3. Beginning of installation means installer accepts conditions.

B. INSTALLATION

1. Install in accordance with manufacturer's instructions.

2. Install safety labels to NEMA 260.

C. FIELD QUALITY CONTROL

1. Test dielectric liquid to ASTM D877, using 25,000 volts minimum breakdown voltage, after installation and before energization from system.

2. Test transformer to IEEE C57.12.90.

3. Test transformer to IEEE C57.12.91.

D. ADJUSTING

1. Adjust primary taps so that secondary voltage is within 2% of rated voltage.

END OF SECTION