STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
HONOLULU, HAWAII

SPECIAL PROVISIONS PROPOSAL, CONTRACT, BOND AND PLANS

FOR

MATERIALS TESTING LAB FACILITY RENOVATION

PROJECT NO. HWY-L01-22

DISTRICT OF HONOLULU

ISLAND OF OAHU

FY 2024

NOTICE TO BIDDERS
Hawaii Revised Statutes (HRS),
Chapter 103D

The receiving of bids for **MATERIAL TESTING LAB FACILITY RENOVATION, DISTRICT OF HONOLULU, ISLAND OF OAHU, PROJECT NO. HWY-L01-22**, will begin as of the HIePRO Release Date. Bidders shall register and submit complete bids through HIePRO only. Refer to the following HIePRO link for important information on Vendor Registration: https://hiepro.ehawaii.gov/welcome.html.

The solicitation plans, specifications, proposal, and additional documents designated or incorporated by reference shall be available in HIePRO.

HIePRO OFFER DUE DATE AND TIME is **June 20, 2024, at 2:00 p.m.,** Hawaii Standard Time (HST). **Bidders shall submit and upload the complete proposal to HIePRO prior to the offer due date and time. Proposals received after said due date and time shall not be considered. Any additional support documents explicitly designated as confidential and/or proprietary shall be uploaded as a separate file to HIePRO. Bidders shall not include confidential and/or proprietary documents as part of their proposal. The record of each bidder and their respective proposal shall be open to public inspection. FAILURE TO UPLOAD THE PROPOSAL TO HIePRO SHALL BE GROUNDS FOR REJECTION.**

The Base Bid scope of work consists of demolition work to include portions of parking lot, exterior doors and frames, acoustical ceiling tile, roofing, etc. on the Lab side of the building. Renovation work includes repave and restripe portion of parking lot, replace exterior doors, roofing, fume hoods, acoustical tile ceiling, drinking fountains, eye wash, etc. on the Lab side of the building. The Bid Additive Alternate consists of replacing air conditioning system. The estimated cost of construction is between $2,000,000 and $2,500,000.

To be eligible for award, bidders shall possess a valid State of Hawaii General Engineering "A" license **at the time of bidding.**

A virtual pre-bid conference is scheduled for **June 5, 2024 at 11 a.m.,** HST on Microsoft Teams. The link to attend is Teams Meeting. All prospective bidders and/or their respective representatives are encouraged to attend, however, attendance is not mandatory. All information presented at the pre-bid conference shall be provided for clarification and information only. Any amendments to the solicitation shall be made by formal addendum and posted in HIePRO.

All Request for Information (RFI) questions and Substitution Requests shall be submitted in HIePRO **no later than June 7, 2024, 2:00 p.m., HST.** RFI questions received after the stated deadline shall not be addressed. Substitution Requests received after the stated deadline shall not be considered. Verbal RFI(s) shall not receive a response. All responses to RFI questions shall be provided for clarification and information only and issued by formal addendum. Any amendments to the solicitation shall be made by formal addendum and posted in HIePRO.

If there is a conflict between the solicitation and information stated in the pre-bid conference, the meeting minutes, and/or the responses to RFI questions, the solicitation shall govern and control, unless as amended by formal addendum.

Apprenticeship Preference. A five percent bid adjustment for bidders that are party to apprenticeship agreements pursuant to HRS § 103-55.6 is applicable to this project.

Employment of State Residents on Construction Procurement Contracts. Compliance with HRS § 103B-3 is a requirement for this project whereby a minimum of 80 percent of the bidder's work force on this project shall consist of Hawaii residents.

Campaign contributions by State and County Contractors. Contractors are hereby

notified of the applicability of HRS § 11-355 which states that campaign contributions are prohibited from specified State or county government contractors during the term of the contract if the contractors are paid with funds appropriated by a legislative body. For more information, contact the Campaign Spending Commission at (808) 586-0285.

Protests. Any protest of this solicitation shall be submitted in writing to the Director of Transportation, in accordance with HRS § 103D-701 and Hawaii Administrative Rules § 3-126.

The Equal Employment Opportunity Regulations of the Secretary of Labor implementing Executive Order 11246, as amended, shall be complied with on this project.

The U.S. Department of Transportation Regulation entitled "Nondiscrimination in Federally Assisted Programs of the U.S. Department of Transportation", Title 49, Code of Federal Regulations (CFR), Part 21, is applicable to this project. Bidders are hereby notified that the Department of Transportation shall affirmatively ensure that the contract entered into pursuant to this advertisement shall be awarded to the lowest responsible bidder without discrimination on the grounds of race, color, national origin, or sex (as directed by 23 CFR Part 200).

Driving While Impaired (DWI) Education. The Hawaii Department of Transportation (HDOT) encourages all organizations contracted with HDOT to have an employee education program preventing DWI. DWI is defined as operating a motor vehicle while impaired by alcohol or other legal or illegal substances. HDOT promotes this type of program to accomplish our mission to provide a safe environment for motorists, bicyclists, and pedestrians utilizing our State highways, and expects its contractors to do so as well.

For additional information, contact Ms. Mung Fa Chung, Project Manager, by phone at (808) 832-3405 extension105, or by email at mungfa.chung@hawaii.gov.

The State reserves the right to reject any or all proposals and to waive any defects in said proposals in the best interest of the public.

ROBIN K. SHISHIDO
Deputy Director of Transportation for Highways

HIePRO RELEASE DATE: May 30, 2024

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INSTRUCTIONS FOR CONTRACTOR'S LICENSING

"A" general engineering contractors and "B" general building contractors are reminded that due to the Hawaii Supreme Court's January 28, 2002 decision in Okada Trucking Co., Ltd. v. Board of Water Supply, et al., 97 Haw. 450 (2002), they are prohibited from undertaking any work, solely or as part of a larger project, which would require the general contractor to act as a specialty contractor in any area where the general contractor has no license. Although the "A" and "B" contractor may still bid on and act as the "prime" contractor on an "A" or "B" project *(See, HRS § 444-7 for the definitions of an "A" and "B" project.)*, respectively, the "A" and "B" contractor may only perform work in the areas in which they have the appropriate contractor's license *(An "A" or "B" contractor obtains "C" specialty contractor's licenses either on its own, or automatically under HAR § 16-77-32.)*. The remaining work must be performed by appropriately licensed entities. It is the sole responsibility of the contractor to review the requirements of this project and determine the appropriate licenses that are required to complete the project.

Amend **Section 101 - TERMS, ABBREVIATIONS, AND DEFINITIONS** to read as follows:

"DIVISION 100 - GENERAL PROVISIONS

SECTION 101 - TERMS, ABBREVIATIONS, AND DEFINITIONS

101.01 Meaning of Terms. The specifications are generally written in the imperative mood. In sentences using the imperative mood, the subject, "the Contractor shall", is implied. In the material specifications, the subject may also be the supplier, fabricator, or manufacturer supplying material, products, or equipment for use on the project. The word "will" generally pertains to decisions or actions of the State.

When a publication is specified, it refers to the most recent date of issue, including interim publications, before the bid opening date for the project, unless a specific date or year of issue is provided.

101.02 Abbreviations. Meanings of abbreviations used in the specifications, on the plans, or in other contract documents are as follows:

AAN	American Association of Nurserymen
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ADA	Americans with Disabilities Act
ADAAG	Americans with Disabilities Act Accessibility Guidelines
AGC	Associated General Contractors of America
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
APA	American Plywood Association

ARA	American Railway Association
AREA	American Railway Engineering Association
ASA	American Standards Association
ASCE	American Society of Civil Engineers
ASLA	American Society of Landscape Architects
ASTM	American Society for Testing and Materials
AWG	American Wire Gauge
AWPA	American Wood Preserver's Association
AWS	American Welding Society
AWWA	American Water Works Association
BMP	Best Management Practice
CCO	Contract Change Order
CFR	Code of Federal Regulations
CRSI	Concrete Reinforcing Steel Institute
DCAB	Disability and Communication Access Board, Department of Health, State of Hawaii
DOTAX	Department of Taxation, State of Hawaii
EPA	U.S. Environmental Protection Agency
FHWA	Federal Highway Administration, U.S. Department of Transportation
FSS	Federal Specifications and Standards, General Services Administration, U.S. Department of Defense
HAR	Hawaii Administrative Rules
HDOT	Department of Transportation, State of Hawaii

HIOSH	Occupational Safety and Health, Department of Labor and Industrial Relations, State of Hawaii
HMA	Hot Mix Asphalt
HRS	Hawaii Revised Statutes
ICEA	Insulated Cable Engineers Association (formerly IPCEA)
IMSA	International Municipal Signal Association
IRS	Internal Revenue Service
ITE	Institute of Transportation Engineers
MUTCD	Manual on Uniform Traffic Control Devices for Streets and Highways, FHWA, U.S. Department of Transportation
NCHRP	National Cooperative Highway Research Program
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Forest Products Association
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration/Act, U.S. Department of Labor
SAE	Society of Automotive Engineers
SI	International Systems of Units
UFAS	Uniform Federal Accessibility Standards
UL	Underwriter's Laboratory
USGS	U.S. Geological Survey
VECP	Value Engineering Cost Proposal

101.03 Definitions. Whenever the following words, terms, or pronouns are used in the contract documents, unless otherwise prescribed therein and without regards to the use or omission of uppercase letters, the intent and meaning shall be interpreted as follows:

Addendum (plural - Addenda) - A written or graphic document, including drawings and specifications, issued by the Director during the bidding period. This document modifies or interprets the bidding documents by additions, deletions, clarifications or corrections.

Addition (to the contract sum) **-** Amount added to the contract sum by change order.

Advertisement - A public announcement inviting bids for work to be performed or materials to be furnished.

Amendment - A written document issued to amend the existing contract between the State and Contractor and properly executed by the Contractor and Director.

Award - Written notification to the bidder that the bidder has been awarded a contract.

Bad Weather Day (or Unworkable Day) - A day when weather or other conditions prevent a minimum of four hours of work with the Contractor's normal work force on critical path activities at the site.

Bag - 94 pounds of cement.

Barrel - 376 pounds of cement.

Base Course - The layer or layers of specified material or selected material of a designed thickness placed on a subbase or subgrade to support a surface course.

Basement Material - The material in excavation or embankments underlying the lowest layer of subbase, base, pavement, surfacing or other specified layer.

Bid - See Proposal.

Bidder - An individual, partnership, corporation, joint venture or other legal entity submitting, directly or through a duly authorized representative or agent, a proposal for the work or construction contemplated.

Bidding Documents (or Solicitation Documents) - The published solicitation notice, bid requirements, bid forms and the proposed contract documents including all addenda and clarifications issued prior to receipt of the bid.

Bid Security - The security furnished by the bidder from which the State may recover its damages in the event the bidder breaches its promise to enter into a contract with the State, or fails to execute the required bonds covering the work contemplated, if its proposal is accepted.

Blue Book - EquipmentWatch Cost Recovery (formerly known as EquipmentWatch Rental Rate Blue Book), available from EquipmentWatch, a division of Penton, Inc.

Calendar Day - See Day.

Change Order (or Contract Change Order) - A written order signed by the Engineer issued with or without the consent of the Contractor directing changes in the work, contract time or contract price. The purposes of a change order include, but are not limited to (1) establishing a price or time adjustment for changes in the work; (2) establishing full payment for direct, indirect, and consequential costs, including costs of delay; (3) establishing price adjustment or time adjustment for work covered and affected by one or more field orders; or (4) settling Contractor's claims for direct, indirect, and consequential costs, or for additional contract time, in whole or in part.

Completion - See Substantial Completion and Final Completion.

Completion Date - The date specified by the contract for the completion of all work on the project or of a designated portion of the project.

Comptroller - the Comptroller of the State of Hawaii, Department of Accounting and General Services.

Contract - The written agreement between the Contractor and the State, by which the Contractor shall provide all labor, equipment, and materials and perform the specified work within the contract time stipulated, and by which the State of Hawaii is obligated to compensate the Contractor at the prices set forth in the contract documents.

Contract Certification Date - The Date on which the Deputy Comptroller for the State of Hawaii (or authorized representative) signs the Contract Certification.

Contract Completion Date - The calendar day on which all work on the project, required by the contract, must be completed. See CONTRACT TIME.

Contract Documents - The contract, solicitation, addenda, notice to bidders, Contractor's bid proposal (including wage schedule, list of subcontractors and other documentations accompanying the bid), notice to proceed, bonds, general provisions, special provisions, specifications, drawings, all modifications, all written amendments, change orders, field orders, orders for minor changes in the work, the Engineer's written interpretations and clarifications issued on or after the effective date of the contract.

Contract Item (Pay Item) - A specific unit of work for which there is a price in the contract.

Contract Modification (Modification) - A change order that is mutually agreed to and signed by the parties to the contract.

Contract Price - The amount designated on the face of the contract for the performance of work.

Contract Time (or Contract Duration) - The number of calendar or working days provided for completion of the contract, inclusive of authorized time extensions. Contract time shall commence on the Start Work Date and end on the Substantial Completion Date. If in lieu of providing a number of calendar or working days, the contract requires completion by a certain date, the work shall be completed by that date.

Contracting Officer - See Engineer.

Contractor - Any individual, partnership, firm, corporation, joint venture, or other legal entity undertaking the execution of the work under the terms of the contract with the State.

Critical Path - Longest logical sequence of activities that must be completed on schedule for the entire project to be completed on schedule.

Day - Any day shown on the calendar, beginning at midnight and proceeding up to, but not including, midnight the following day. If no designation of calendar or working day is made, "day" shall mean calendar day.

Department - The Department of Transportation of the State of Hawaii (abbreviated HDOT).

Director - The Director of the HDOT acting directly or through duly authorized representatives.

Plans (or Drawings) - The contract drawings in graphic or pictorial form including the notes, tables and other notations thereon indicating the design, location, character, dimensions, and details of the work.

Engineer - The Highway Administrator, Highways Division, HDOT, or the authorized person delegated to act on the Administrator's behalf.

Equipment - All machinery, tools, and apparatus needed to complete the contract.

Field Order - A written order issued by the Engineer or the Engineer's authorized representative to the Contractor requiring a change or changes to the contract work. A field order may (1) establish a price adjustment or time adjustment; or (2) may declare that no adjustment will be made to contract price or contract time; or (3) may request the Contractor to submit a proposal for an adjustment to the contract price or contract time.

Final Acceptance - The Status of the project when the Engineer finds that the Contractor has satisfactorily completed all contract work in compliance with the contract including all plant establishment requirements, and all the materials have been accepted by the State.

Final Completion - The date set by the Director that all work required by the contract has been completed in full compliance with the contract documents.

Final Inspection - Inspection where all contract items (with the exception of Planting Period and Plant Establishment Period) are accepted by the Engineer. Substantial Completion will be issued by the Engineer based on the satisfactory results of the Final Inspection.

Float - The amount of time between when an activity can start and when an activity must start, i.e., the time available to complete non-critical activities required for the performance of the work without affecting the critical path.

Guarantee - Legally enforceable assurance of the duration of satisfactory performance of quality of a product or work.

Hawaii Administrative Rules - Rules adopted by the State in accordance with Chapter 91 of the Hawaii Revised Statutes, as amended.

Highway (Street, Road, or Roadway) - A public way within a right-of-way designed, intended, and set aside for use by vehicles, bicyclists, or pedestrians.

Highways Division - The Highways Division of the Hawaii Department of Transportation constituted under the laws of Hawaii for the administration of highway work.

Holidays - The days of each year which are set apart and established as State holidays pursuant to Chapter 8 of the Hawaii Revised Statutes, as amended.

Inspector - The Engineer's authorized representative assigned to make detailed inspections of contract performance, prescribed work, and materials supplied.

Laboratory - The testing laboratory of the Highways Division or other testing laboratories that may be designated by the Engineer.

Laws - All Federal, State, and local laws, executive orders and regulations having the force of law.

Leveling Course - An aggregate mixture course of variable thickness used to restore horizontal and vertical uniformity to existing pavements or shoulders.

Liquidated Damages - The amount prescribed in Subsection 108.08 - Liquidated Damages for Failure to Complete the Work or Portions of the Work on Time, to be paid to the State or to be deducted from any payments payable to or, which may become payable to the Contractor.

Lump Sum (LS) - When used as a payment method means complete payment for the item of work described in the contract documents.

Material - Any natural or manmade substance or item specified in the contract to be incorporated in the work.

Notice to Bidders - The advertisement for proposals for all work or materials on which bids are required. Such advertisement will indicate the location of the work to be done or the character of the material to be furnished and the time and place for the opening of proposals.

Notice to Proceed - Written notice from the Engineer to the Contractor identifying the date on which the Contractor is to begin procuring materials and required permits and adjusting work forces, equipment, schedules, etc. prior to beginning physical work.

Pavement - The uppermost layer of material placed on the traveled way or shoulders or both. Pavement and surfacing may be interchangeable.

Pavement Structure - The combination of subbase, base, pavement, surfacing or other specified layer of a roadway constructed on a subgrade to support the traffic load.

Payment Bond - The security executed by the Contractor and surety or sureties furnished to the Department to guarantee payment by the Contractor to laborers, material suppliers and subcontractors in accordance with the terms of the contract.

Physical Work - Physical construction activities on the project site or at appurtenant facilities including staging areas. It includes; (i) building or installing any structures or facilities including, but not limited to sign erection; BMP installation; field office site grading and building; (ii) removal, adjustment, or demolition of physical obstructions on site; (iii) any ground breaking activities; and (iv) any utility work. It does not include pre-construction environmental testing (such as water quality baseline measurements) that may be required as part of contract.

Pre-Final Inspection - Inspection scheduled when Contractor notifies Engineer that all physical work on the project, with the exception of planting period and plant establishment period, has been completed. Notice from Contractor of substantial completion will suspend contract time until Contractor receives punchlist from Engineer.

Profile Grade - The elevation or gradient of a vertical plane intersecting the top surface of the proposed pavement.

Project Acceptance Date - The calendar day on which the Engineer accepts the project as completed. See Final Completion.

Proposal (Bid) - The executed document submitted by a Bidder in response to a solicitation request, to perform the work required by the proposed contract documents, for the price quoted and within the time allotted.

Public Traffic - Vehicular or pedestrian movement on a public way.

Punchlist - A list compiled by the Engineer specifying work yet to be completed or corrected by the Contractor in order to substantially complete the contract.

Questionnaire - The specified forms on which the bidder shall furnish required information as to its ability to perform and finance the work.

Request for Change Proposal - A written notice from the Engineer to the Contractor requesting that the Contractor provide a price and/or time proposal for contemplated changes preparatory to the issuance of a field order or change order.

Right-of-Way - Land, property, or property interests acquired by a government agency for, or devoted to transportation purposes.

Roadbed - The graded portion of a highway within top and side slopes, prepared as a foundation for the pavement structure and shoulders.

Roadside - The area between the outside edges of the shoulders and the right-of-way boundaries. Unpaved median areas between inside shoulders of divided highways and infield areas of interchanges are included.

Section and Subsection - Section or subsection shall be understood to refer to these specifications unless otherwise specified.

Shop Drawings - All drawings, diagrams**,** illustrations, schedules and other data or information which are specifically prepared or assembled by or for the Contractor and submitted by the Contractor to illustrate some portion of the work.

Shoulder - The portion of the roadway next to the traveled way for: accommodation of stopped vehicles, placement of underground facilities, emergency use, and lateral support of base and surface courses.

Sidewalk - That portion of the roadway primarily constructed for use by pedestrians.

Solicitation - An invitation to bid or request for proposals or any other document issued by the Department to solicit bids or offers to perform a contract. The solicitation may indicate the time and place to receive the bids or offers and the location, nature and character of the work, construction or materials to be provided.

Specifications - Compilation of provisions and requirements to perform prescribed work.

(A) Standard Specifications. Specifications by the State intended for general application and repetitive use.

(B) Special Provisions. Revisions and additions to the standard specifications applicable to an individual project.

Standard Plans - Drawings provided by the State for specific items of work approved for repetitive use.

State - The State of Hawaii, its Departments and agencies, acting through its authorized representative(s).

State Waters – All waters, fresh, brackish, or salt, around and within the State, including, but not limited to, coastal waters, streams, rivers, drainage ditches, ponds, reservoirs, canals, ground waters, and lakes; provided that drainage

ditches, ponds, and reservoirs required as a part of a water pollution control system are excluded.

Start Work Date - Date on which Contractor begins physical work on the contract. This date shall also be the beginning of Contract Time.

Structures - Bridges, culverts, catch basins, drop inlets, retaining walls, cribbing, manholes, endwalls, buildings, sewers, service pipes, underdrains, foundation drains, and other such features that may be encountered in the work.

Subbase - A layer of specified material of specified thickness between the subgrade and a base.

Subcontract - Any written agreement between the Contractor and its subcontractors which contains the conditions under which the subcontractor is to perform a portion of the work for the Contractor.

Subcontractor - An individual, partnership, firm, corporation, joint venture or other legal entity, as licensed or required to be licensed under Chapter 444, Hawaii Revised Statutes, as amended, which enters into an agreement with the Contractor to perform a portion of the work**.**

Subgrade - The top surface of completed earthwork on which subbase, base, surfacing, pavement, or a course of other material is to be placed.

Substantial Completion - The Status of the project when the Contractor has completed the work, except for the planting period and plant establishment period, and each of the following requirements are met:

(1) All traffic lanes (including shoulders, ramps, sidewalks and bike paths) are in their final configuration as designed and the final wearing surface has been installed;

(2) All operational and safety devices have been installed in accordance with the contract documents including guardrails, end treatments, traffic barriers, required signs and pavement markings, drainage, parapet, and bridge and pavement structures;

(3) All required illumination and lighting for normal and safe use and operation is installed and functional in accordance with the contract documents;

(4) All utilities and services are connected and working;

(5) The need for temporary traffic controls or lane closures at any time has ceased, except for lane closures required for routine maintenance;

(6) The building, structure, improvement or facility can be used for its intended purpose.

Substantial Completion Date - The date the Substantial Completion is granted by the Engineer in Writing and Contract Time stops.

Superintendent - The employee of the Contractor who is responsible for all the work and is a Contractor's agent for communications to and from the State.

Surety - The qualified individual, firm or corporation other than the Contractor, which executes a bond with and for the Contractor to insure its acceptable performance of the contract.

Surfacing - The uppermost layer of material placed on the traveled way or shoulders. This term is used interchangeably with pavement.

Traveled Way - The portion of the roadway for the movement of vehicles, exclusive of shoulders.

Unsuitable Material - Materials that contain organic matter, muck, humus, peat, sticks, debris, chemicals, toxic matter, or other deleterious materials not suitable for use in earthwork.

Utility - A line, facility, or system for producing, transmitting, or distributing communications, power, electricity, heat, gas, oil, water, steam, waste, or storm water.

Utility Owner - The entity, whether private or owned by a State, Federal, or County governmental body, that has the power and responsibility to grant approval for, or undertake construction work involving a particular utility.

Water Pollutant - Dredged spoil, solid refuse, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical waste, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, soil, sediment, cellar dirt and industrial, municipal, and agricultural waste.

Water Pollution - (1) Such contamination or other alteration of the physical, chemical, or biological properties of any state waters, including change in temperature, taste, color, turbidity, or odor of the waters, or **(2)** Such discharge of any liquid, gaseous, solid, radioactive, or other substances into any state waters, as will or is likely to create a nuisance or render such waters unreasonably harmful, detrimental, or injurious to public health, safety, or

welfare, including harm, detriment, or injury to public water supplies, fish and aquatic life and wildlife, recreational purposes and agricultural and industrial research and scientific uses of such waters or as will or is likely to violate any water quality standards, effluent standards, treatment and pretreatment standards, or standards of performance for new sources adopted by the Department of Health.

Work - The furnishing of all labor, material, equipment, and other incidentals necessary or convenient for the successful execution of all the duties and obligations imposed by the contract.

Working Day - A calendar day in which a Contractor is capable of working four or more hours with its normal work force, exclusive of:

(1) Saturdays, Sundays, and recognized legal State holidays and such other days specified by the contract documents as non-working days,

(2) Day in which the Engineer suspends work for four or more hours through no fault of the Contractor."

END OF SECTION 101

Make this section a part of the Standard Specifications:

"**SECTION 102 - BIDDING REQUIREMENTS AND CONDITIONS**

102.01 Prequalification of Bidders. Prospective bidders shall be capable of performing the work for which they are bidding.

In accordance with HRS Chapter 103D-310, the Department may require any prospective bidder to submit answers to questions contained in the 'Standard Qualification Questionnaire For Prospective Bidders On Public Works Contracts' furnished by the Department, properly executed and notarized, setting forth a complete statement of the experience of such prospective bidder and its organization in performing similar work and a statement of the equipment proposed to be used, together with adequate proof of the availability of such equipment. Whenever it appears to the Department, from answers to the questionnaire or otherwise, that the prospective bidder is not fully qualified and able to perform the intended work, the Department will, after affording the prospective bidder an opportunity to be heard and if still of the opinion that the bidder is not fully qualified to perform the work, refuse to receive or consider any bid offered by the prospective bidder. All information contained in the answers to the questionnaire shall be kept confidential. Questionnaire so submitted shall be returned to the bidders after serving their purpose.

No person, firm or corporation may bid where (1) the person, firm, or corporation, or (2) a corporation owned substantially by the person, firm, or corporation, or (3) a substantial stockholder or an officer of the corporation, or (4) a partner or substantial investor in the firm is in arrears in payments owed to the State or its political subdivisions or is in default as a surety or failure to do faithfully and diligently previous contracts with the State.

102.02 Contents of Proposal Forms. The Department will furnish prospective bidders with proposal forms posted in HIePRO stating:

(1) The location,

(2) Description of the proposed work,

(3) The approximate quantities,

(4) Items of work to be done or materials to be furnished,

(5) A schedule of items, and

(6) The time in which the work shall be completed.

Papers bound with or attached to the proposal form are part of the proposal. The bidder shall not detach or alter the papers bound with or attached to the proposal when the bidder submits its proposal through HIePRO.

Also, the bidder shall consider other documents including the plans and specifications a part of the proposal form whether attached or not.

102.03 (Unassigned)

102.04 Estimated Quantities. The quantities shown in the contract are approximate and are for the comparison of bids only. The actual quantity of work may not correspond with the quantities shown in the contract. The Department will make payment to the Contractor for unit price items in accordance with the contract for only the following:

(1) Actual quantities of work done and accepted, not the estimated quantities; or

(2) Actual quantities of materials furnished, not the estimated quantities.

The Department may increase, decrease, or omit each scheduled quantities of work to be done and materials to be furnished. When the Department increases or decreases the estimated quantity of a contract item by more than 15% the Department will make payment for such items in accordance with Subsection 104.06 - Methods of Price Adjustment.

102.05 Examination of Contract and Site of Work. The bidder shall examine carefully the site of the proposed work and contract before submitting a proposal.

By the act of submitting a bid for the proposed contract, the bidder warrants that:

(1) The bidder and its Subcontractors have reviewed the contract documents and found them free from ambiguities and sufficient for the purpose intended;

(2) The bidder and its workers, employees and subcontractors have the skills and experience in the type of work required by the contract documents bid upon;

(3) Neither the bidder nor its employees, agents, suppliers or subcontractors have relied upon verbal representations from the Department, its employees or agents, including architects, engineers or consultants, in assembling the bid figure; and

(4) The basis for the bid figure is solely on the construction contract documents.

Also, the bidder warrants that the bidder has examined the site of the work. From its investigations, the bidder acknowledges satisfaction on:

(1) The nature and location of the work;

(2) The character, quality, and quantity of materials;

(3) The difficulties to be encountered; and

(4) The kind and amount of equipment and other facilities needed.

Subsurface information or hydrographic survey data furnished are for the bidders' convenience only. The data and information furnished are the product of the Department's interpretation gathered in investigations made at the specific locations. These conditions may not be typical of conditions at other locations within the project area or that such conditions remain unchanged. Also, conditions found at the time of the subsurface explorations may not be the same conditions when work starts. The bidder shall be solely responsible for assumptions, deductions, or conclusions the bidder may derive from the subsurface information or data furnished.

If the Engineer determines that the natural conditions differ from that originally anticipated or contemplated by the Contractor in the items of excavation, the State may treat the difference in natural conditions, as falling within the meaning of Subsection 104.02 – Changes.

102.06 Preparation of Proposal. The submittal of its proposal shall be on forms furnished by the Department. The bidder shall specify in words or figures:

(1) A unit price for each pay item with a quantity given;

(2) The products of the respective unit prices and quantities;

(3) The lump sum amount; and

(4) The total amount of the proposal obtained by adding the amounts of the several items.

The words and figures shall be in ink or typed. If a discrepancy occurs between the prices written in words and those written in figures, the prices written in words shall govern.

When an item in the proposal contains an option to be made, the bidder shall choose in accordance with the contract for that particular item. Determination of an option will not permit the Contractor to choose again.

The bidder shall sign the proposal properly in ink. A duly authorized representatives of the bidder or by an agent of the bidder legally qualified and acceptable to the Department shall sign, including one or more partners of the bidder and one or more representatives of each entity comprising a joint venture.

When an agent, other than the officer(s) of a corporation authorized to sign contracts for the corporation or a partner of a partnership, signs the proposals, a 'Power of Attorney' shall be on file with the Department or submitted with the proposal. Otherwise, the Department will reject the proposal as irregular and unauthorized.

The bidder shall submit acceptable evidence of the authority of the partner, member(s) or officer(s) to sign for the partnership, joint venture, or corporation respectively with the proposal. Otherwise, the Department will reject the proposal as irregular and unauthorized.

102.07 Irregular Proposals. The Department may consider proposals irregular and may reject the proposals for the following reasons:

(1) The proposal is a form not furnished by the Department, altered, or detached;

(2) The proposal contains unauthorized additions, conditions, or alternates. Also, the proposal contains irregularities that may tend to make the proposal incomplete, indefinite, or ambiguous to its meaning;

(3) The bidder adds provisions reserving the right to accept or reject an award. Also, the bidder adds provisions into a contract before an award;

(4) The proposal does not contain a unit price for each pay item listed except authorized optional pay items; and

(5) Prices for some items are out of proportion to the prices for other items.

(6) If in the opinion of the Director, the bidder and its listed subcontractors do not have the Contactor's licenses or combination of Contractor's licenses necessary to complete the work.

Where the prospective bidder is bidding on multiple projects simultaneously and the proposal limits the maximum gross amount of awards that the bidder can accept at one bid letting, the proposal is not irregular if the limit on the gross amount of awards is clear, and the Department selects the awards that can be given.

102.08 Proposal Guaranty. The Department will not consider a proposal of $25,000 or more unless accompanied by:

(1) A deposit of legal tender; or

(2) A valid surety bid bond, underwritten by a company licensed to issue bonds in the State of Hawaii, in the form and composed, substantially, with the same language as provided herewith and signed by both parties; or

(3) A certificate of deposit, share certificate, cashier's check, treasurer's check, teller's check, or official check drawn by, or a certified check accepted by and payable on demand to the State by a bank, savings institution, or credit union insured by the Federal Deposit Insurance Corporation (FDIC) or the National Credit Union Administration (NCUA).

(a) The bidder may use these instruments only to a maximum of $100,000.

(b) If the required security or bond amount totals over $100,000 more than one instrument not exceeding $100,000 each and issued by different financial institutions shall be acceptable.

(c) The instrument shall be made payable at sight to the Department.

(d) Proposal Guaranty listed in (1) and (3) shall be in its original form, and shall be received at the Contracts Office, Department of Transportation, 869 Punchbowl Street, Honolulu, Hawaii 96813 before the bid deadline.

In accordance with HRS Chapter 103D-323, the above shall be in a sum not less than 5% of the amount bid.

102.09 Delivery of Proposal. The bidder shall submit the proposal in HIePRO. Bids received after said due date and time shall not be considered. Original bid documents do not have to be submitted. Award will be made based on proposals submitted in HIePRO.

102.10 Withdrawal or Revision of Proposals. A bidder may withdraw or revise a proposal after the bidder submits the proposal in HIePRO. Withdrawal or

revision of proposal must be completed before the time set for the receiving of bids.

102.11 Public Opening of Proposals. Not applicable.

102.12 Disqualification of Bidders. The Department may disqualify a bidder and reject its proposal for the following reasons:

(1) Submittal of more than one proposal whether under the same or different name.

(2) Evidence of collusion among bidders. The Department will not recognize participants in collusion as bidders for any future work of the Department until such participants are reinstated as qualified bidders.

(3) Lack of proposal guaranty.

(4) Submittal of an unsigned or improperly signed proposal.

(5) Submittal of a proposal without a listing of subcontractors or containing only a partial or incomplete listing of subcontractors.

(6) Submittal of an irregular proposal in accordance with Subsection 102.07 - Irregular Proposals.

(7) Evidence of assistance from a person who has been an employee of the agency within the preceding two years and who participated while in State office or employment in the matter with which the contract is directly concerned, pursuant to HRS Chapter 84-15.

(8) Suspended or debarred in accordance with HRS Chapter 104-25.
(9) Failure to complete the prequalification questionnaire, if applicable.

(10) Failure to attend the mandatory pre-bid meeting, if applicable.

102.13 Material Guaranty. The successful bidder may be required to furnish a statement of the composition, origin, manufacture of materials, and samples.

102.14 Substitution of Materials and Equipment Before Bid Opening. See Subsection 106.13 for Substitution Of Materials and Equipment After Bid Opening.

(A) General. When brand names of materials or equipment are specified in the contract documents, they are to indicate a quality, style, appearance, or performance and not to limit competition. The bidder shall base its bid on one of the specified brand names unless alternate brands are qualified as equal or better in an addendum. Qualification of such proposed alternate brands shall be submitted via email to the Contact person listed in HIePRO for the solicitation and also post a question in HIePRO under the question/answer tab referencing the email with the request. The request must be posted in HIePRO no later than 14 calendar days before the bid opening date, not including the bid opening date

An addendum will be issued to inform all prospective bidders of any accepted substitution in accordance with Subsection 102.17 – Addenda .

(B) Statement of Variances. The statement of variances must list all features of the proposed substitution that differ from the contract documents and must further certify that the substitution has no other variant features. The brochure and information submitted shall be clearly marked showing make, model, size, options, and any other features requested by the Engineer and must include sufficient evidence to evaluate each feature listed as a variance. A request will be denied if submitted without sufficient evidence. If after installing the substituted product, an unlisted variance is discovered, the Contractor shall immediately replace the product with a specified product at no increase in contract price and contract time.

(C) Substitution Denial. Any substitution request not complying with the above requirements will be denied.

102.15 Preferences.

(A) Preference for Hawaii Products. In accordance with ACT 174, SLH 2022, effective June 27, 2022, Hawaii Products Preference shall not apply to solicitations for public works construction. Therefore, the Hawaii Products Preference shall not apply to this project.

(B) Preferences for Apprenticeship Programs. In accordance with ACT 17, SLH 2009 – Apprenticeship Program, a 5% bid adjustment for bidders that are parties to apprenticeship agreements pursuant to Hawaii Revised Statutes (HRS) Section 103-55.6 may be applied to the bidder's price for evaluation purposes. These procedures apply to public works projects with estimated cost of $250,000 or more and entered into under the provisions of HRS Chapter 103.

The following provisions apply to this Apprenticeship Program.

(1) Definitions

(a) "Apprenticeable trade", HRS Section 103-55.6 (c), shall have the same meaning as 'apprenticeable occupation' pursuant to Hawaii Administrative Rules (HAR) Section 30-1-5.

(b) "Department" means the department of labor and industrial relations.

(c) "Director" means the director of labor and industrial relations.

(d) "Employ" means the employment of a person in an employer-employee relations.

(e) "Governmental body" means as defined in HRS Section 103D-104.

(f) "Party to an apprenticeship agreement" means party to a registered apprenticeship program with the department of labor and industrial relations.

(g) "Preference" means the 5% by which the qualified bidder's offer amount would be decreased for evaluation purposes.

(h) "Public work" shall be as defined in HRS Section 104-2 and HAR Section 12-22-1.

(i) "Registered apprenticeship program" means a construction trade program approved by the department pursuant to HAR Section 12-30-1 and Section 12-30-4.

(j) "Sponsor" means an operator of an apprenticeship program and in whose name the program is approved and registered with the department of labor and industrial relations pursuant to HAR Section 12-30-1.

(k) Offeror – Entity/bidder submitting a proposal to undertake a project.

(l) Procurement Officer – Director of Transportation or his authorized representative.

(2) Qualification Procedures

(a) Any bidder seeking the preference must be a party to an apprenticeship agreement registered with the department at the time the offer is made for each apprenticeable trade the bidder will employ to construct the public works projects for which the offer is being made.

1. The apprenticeship agreement shall be registered and conform to the requirements of HRS Chapter 372.

2. Subcontractors do not have to be a party to an apprenticeship agreement for the bidder to obtain the preference.

3. The bidder is not required to have apprentices in its employ at the time of submittal of an offer to qualify for the preference.

(b) The department shall:

1. Develop and maintain a list of construction trades in registered apprenticeship programs which conform to HRS Chapter 372; and

2. Electronically post the list, including any amendments, on the department website (http://labor.hawaii.gov).

(c) Bidder is responsible to comply with all submission requirements for registration of its apprenticeship program before requesting a preference.

(d) Bidder shall provide a certification by the sponsor of the respective registered apprenticeship programs covering the relevant trade(s) for the public works project.

(e) *Certification Form 1* issued by the department shall include:

1. Contractor information;

2. Solicitation reference;

3. Trade(s);

4. Date and name of apprenticeship program;

5. Signature of authorized training coordinator or training trust fund administrator certifying that the contractor is a participant in the program, and that the program is registered with the department;

6. Contract information for sponsor's authorized representative signing the form;

7. Number of apprentices enrolled in the program, number who successfully completed the apprenticeship program in the past 12 months, including whether the contractor is signatory to a collective bargaining agreement for that trade, or if not, provide for attachment of a copy of the agreement between the contractor and the program.

(3) Solicitation Procedures.

(a) If the NTB indicates that this project is covered by this preference, and the offer is less than $250,000 this preference will still be applicable in determining the lowest bidder.

(b) A claim for this preference must include the following:

1. Allow bidder seeking to claim the preference to state the trades the bidder will employ to perform the work;

2. For each trade to be employed to perform the work, the bidder shall submit a completed signed original *Certification Form 1* verifying participation in an apprenticeship program registered with the department;

3. The *Certification Form 1* shall be authorized by an apprenticeship sponsor of the department's list of registered apprenticeship programs. The authorization shall be an original signature by an authorized official of the apprenticeship sponsor; and

4. The completed *Certification Form 1* for each trade must be submitted by the bidder with the offer. Previous certifications shall not apply unless allowed by the solicitation.

(c) Upon receiving *Certification Form 1*, the procurement officer will verify with the department that the apprenticeship program is on the list of apprenticeship programs registered with the department. If the programs are not confirmed by the department, the bidder will not qualify for the preference.

(4) Evaluation and Contract Award

(a) If the bidder certifies participation in an apprenticeship program for each trade which will be employed by the bidder for the project, the procurement officer shall apply the preference and decrease the bidder's total bid amount by five per cent (5%) for evaluation purposes.

(b) Should the bidder qualify for other statutory preferences (for example, Hawaii products), all applicable preferences shall be applied to the bidder's price.

(c) The contract amount shall be the original offer amount, exclusive of any preference; the preference is only for evaluation purposes.

(d) Any claims challenging a bidder's representation that the bidder is a participant in an apprenticeship program(s) as claimed, shall be submitted to the procurement officer. The procurement officer will refer the challenge to the department of labor and industrial relations who shall investigate any such claims and shall make a determination.

(5) Contract Administration

(a) For the duration of a contract awarded utilizing the apprenticeship preference, the contractor shall certify each month that work is being conducted on the project, that it continues to be a participant in the relevant apprenticeship program for each trade it employs.

(b) Monthly certification shall be made on *Monthly Certification Form 2* prepared and made available by the department, be a signed original by the respective apprenticeship program sponsors authorized official, and submitted by the contractor with its monthly payment requests.

(c) Should the contractor fail or refuse to submit its monthly certification forms, or at any time during the construction of the project, cease to be a part to a registered apprenticeship agreement for each apprenticeable trades the contractor employs, or will employ, the contractor will be subject to the following sanctions:

1. Withholding of the requested payment until the required form(s) are submitted;

2. Temporary or permanent cessation of work on the project , without recourse to breach of contract claims by the contractor; provided the agency shall be entitled to restitution for nonperformance or liquidated damages claims; or

3. Proceed to debar or suspend pursuant to HRS Section 103D-702.

(d) If events such as “acts of God,” acts of a public enemy, acts of the State or any other governmental body in its sovereign or contractual capacity, fires, floods, epidemics, freight embargoes, unusually severe weather, or strikes or other labor disputes prevent the contractor from submitting the certification forms, the contractor shall not be penalized as provided herein, provided the contractor completely and expeditiously complies with the certification process when the event is over.

This subsection shall not apply when its application will disqualify the State from receiving federal funds or aid.

(C) Preference for Recycled Products. Recycled Products shall not apply to this project.

(D) Evaluation Procedures and Contract Award. For bid evaluation, the Engineer will evaluate the bids by applying the applicable preferences selected by the bidders according to the contract. The Engineer will base the calculations for adjustments upon the original bid prices offered. If more than one preference applies, the evaluated bid price shall be the sum of the original bid price plus applicable preference adjustments.

If a bidder has designated use of a Hawaii Product and fails to provide the product, the contract will become void, and no payments will be made.

The Engineer will award the contract to the responsible bidder submitting the responsive bid with the lowest evaluated bid price. The contract amount of the contract awarded shall be the original bid price offered exclusive of any preference.

102.16 Certification for Safety and Health Program for Bids in excess of $100,000. In accordance with HRS Chapter 396-18, the bidder or offeror, by signing and submitting this proposal, certifies that a written safety and health plan for this project will be available and implemented by the notice to proceed date for this project. Details of the requirements of this plan may be obtained from the State Department of Labor and Industrial Relations, Occupational Safety and Health Division (HIOSH).

102.17 Addenda. Addenda issued shall become part of the contract documents. Addenda to the bid documents will be provided to all prospective bidders via HIePRO. Each addendum shall be an addition to the contract documents. The terms and requirements of the bid documents (i.e., drawings, specifications and other bid and contract documents) cannot be changed prior to the bid opening except by a duly issued addendum."

END OF SECTION 102

Make this section a part of the Standard Specifications:

"SECTION 103 - AWARD AND EXECUTION OF CONTRACT

103.01 Consideration of Proposals. The Department will compare the proposals in terms of the summation of the products of the approximate quantities and the unit bid prices after the submittal date and time established in HIePRO. If a discrepancy occurs between the unit bid price and the bid price, the unit bid price shall govern.

The Department reserves the right to reject proposals, waive technicalities or advertise for new proposals, if the rejection, waiver, or new advertisement favors the Department.

103.02 Award of Contract. The award of contract, if it be awarded, will be made within 60 calendar days after the opening of bids, to the lowest responsible and responsive bidder whose bid meets all the requirements and criteria set forth in the invitation for bids. (Through HIePRO). The successful bidder will be notified by letter mailed to the address shown in its proposal, that its proposal has been accepted, and that it has been awarded the contract.

(1) Requirement for Award. To be eligible for award, the apparent low bidder will be contacted to submit copies of the documents listed below to demonstrate compliance with HRS Section 103D-310(c). The documents shall be submitted to the Department within 14 days after bid opening unless otherwise specified in the invitation for bids or an extension is granted in writing by the Department. If a valid certificate/clearance is not submitted on a timely basis for award of a contract, a bidder otherwise responsive and responsible may not receive the award. See also Subsection 108.03 – Preconstruction Data Submittal.

The Department may request the bidders to allow the Department to consider the bids for the issuance of an award beyond the 60 calendar day period. Agreement to such an extension must be made by a bidder in writing. Only bidders who have agreed to such an extension will be eligible for the award.

(A) Tax Clearance. Pursuant to HRS Sections 103D-310(c), 103-53 and 103D-328, the successful bidder shall be required to submit a certified copy of its tax clearance issued by the Hawaii State Department of Taxation (DOTAX) and the Internal Revenue Service (IRS) to demonstrate its compliance with HRS Chapter 237. A tax clearance is valid for six (6) months from the most recent approval stamp date on the tax clearance and must be valid on the bid's first legal advertisement date or any date thereafter up to the bid opening date.

FORM A6, TAX CLEARANCE CERTIFICATE, is available at the following website:

https://tax.hawaii.gov/

To receive DOTAX Forms by fax or mail, phone (808) 587-7572 or 1-800-222-7572.

The application for the Tax Clearance Certificate is the responsibility of the bidder and must be submitted directly to the DOTAX or IRS. The approved certificate may then be submitted to the Department.

(B) DLIR Certificate of Compliance. Pursuant to HRS Section 103D-310(c), the successful bidder shall be required to submit a copy (faxed copies are acceptable) of its approved certificate of compliance issued by the Hawaii State Department of Labor and Industrial Relations (DLIR) to demonstrate its compliance with unemployment insurance (HRS Chapter 383), workers' compensation (HRS Chapter 386), temporary disability insurance (HRS Chapter 392), and prepaid health care (HRS Chapter 393). The certificate is valid for six (6) months from the most recent approval stamp date on the certificate and must be valid on the bid's first legal advertisement date or any date thereafter up to the bid opening date. For certificates which receive a "pending" approval stamp, a DLIR approval stamp is required prior to the issuance of the Notice to Proceed.

FORM LIR#27, APPLICATION FOR CERTIFICATE OF COMPLIANCE WITH SECTION 3-122-112, HAR, is available at the following website:

http://labor.hawaii.gov/

More information is available by calling the DLIR Unemployment Insurance Division at (808) 586-8926.

Inquiries regarding the status of a LIR#27 Form may be made by calling the DLIR Disability Compensation Division at (808) 586-9200.

The application for the Certificate of Compliance is the responsibility of the bidder and must be submitted directly to the DLIR. The approved certificate may then be submitted to the Department.

(C) DCCA Certificate of Good Standing. Pursuant to HRS Section 103D-310(c), the successful bidder shall be required to submit a copy (faxed copies are acceptable) of its approved Certificate of Good Standing issued by the Hawaii State Department of Commerce and Consumer Affairs (DCCA), Business Registration Division (BREG) to demonstrate that it is either:

(1) Incorporated or organized under the laws of the State; or

(2) Registered to do business in the State as a separate branch or division that is capable of fully performing under the contract.

The Certificate of Good Standing is valid for six (6) months from the approval date on the certificate and must be valid on the bid's first legal advertisement date or any date thereafter up to the bid opening date. A Hawaii business that is a sole proprietorship, however, is not required to register with the BREG, and therefore not required to submit a Certificate of Good Standing. Bidders are advised that there are costs associated with registering and obtaining a Certificate of Good Standing from the DCCA.

To purchase a CERTIFICATE OF GOOD STANDING, go to On-Line Services at the following website:

http://cca.hawaii.gov/

The application for the Certificate of Good Standing is the responsibility of the bidder and must be submitted directly to the DCCA. The approved certificate may then be submitted to the Department.

(D) Hawaii Compliance Express (HCE). In lieu of the certificates referenced above, the bidder may make available proof of compliance through the Hawaii Compliance Express or any other designated certification process. Bidders may apply and register at the "Hawaii Compliance Express" website:

https://vendors.ehawaii.gov/hce/

103.03 Cancellation of Award. The Department reserves the right to cancel the award of contracts before the execution of said contract by the parties. There will be no liability to the awardee and to other bidders.

103.04 Return of Proposal Guaranty. The Department will return the proposal guaranties, except those of the three lowest bidders, after the Department checks the proposals. The Department will return the proposal guaranties of the remaining two lowest bidders, not awarded the contract, within five working days following the execution of the contract. The Department will return the successful bidder's proposal guaranty after the successful bidder furnishes a bond and executes the contract.

103.05 Requirement of Contract Bond. At the time of execution of the contract, the successful bidder shall file a good and sufficient performance bond and a payment bond on the forms furnished by the Department conditioned for the full and faithful performance of the contract in accordance with the terms and intent thereof and for the prompt payment to all others for all labor and material furnished by them to the bidder and used in the prosecution of the work provided for in the contract. The bonds shall be of an amount equal to 100 percent of the amount of the contract price and include 5 percent of the contract amount estimated to be required for extra work. The bidder shall limit the acceptable performance and payment bonds to the following:

(a) Legal tender;

(b) Surety bond underwritten by a company licensed to issue bonds in the State of Hawaii; or

(c) A certificate of deposit; share certificate; cashier's check; treasurer's check, teller's check drawn by or a certified check accepted by and payable on demand to the State by a bank savings institution or credit union insured by the Federal Deposit Insurance Corporation (FDIC) or the National Credit Union Administration (NCUA).

1. The bidder may use these instruments only to a maximum of $100,000.

2. If the required security or bond amount totals over $100,000 more than one instrument not exceeding $100,000 each and issued by different financial institutions shall be acceptable.

Such bonds shall also by the terms inure to the benefit of any and all persons entitled to file claims for labor done or material furnished in the work so as to give them a right of action as contemplated by HRS Section 103D-324.

103.06 Execution of the Contract. The contract bond and HRS Chapter 104 - Compliance Certificate, similar to a copy of the same annexed hereto, shall be executed by the successful bidder and returned within ten days after the award of the contract or within such further time as the Director may allow after the bidder has received the contract for execution.

The contract shall not bind the Department unless said parties execute the contract and the Director of Finance endorses the bidder's certificate in accordance with HRS Section 103-39.

103.07 Failure to Execute Contract. Failure to execute the contract and file acceptable bonds shall be cause for the cancellation of the award in accordance with Subsection 103.06 - Execution of the Contract. Also, the Contractor forfeits the proposal guaranty which becomes the property of the Department. This is not a penalty, but liquidated damages sustained by the State. The Department may then make award to the next lowest responsible and responsive bidder or the Department may readvertise and construct the work under contract."

END OF SECTION 103

SECTION 104 – SCOPE OF WORK

Make the following amendment to said Section:

(I) Amend **Section 104.11(B) Contractor's Duty to Locate and Protect Utility** by adding the following after line 291:

"**(4)** The Contractor shall contact the Hawaii One Call Center at 811 prior to any execution in a public right of way or on private property."

(II) Amend **Section 104.06 Methods of Price Adjustment** as follows:

"104.06 Methods of Price Adjustment. Any adjustment in the contract price pursuant to a change or claim shall be made in one or more of the following ways:

(1) By written agreement on a fixed price adjustment before commencement of the pertinent performance.

(2) By unit prices or other price adjustments specified in the contract or subsequently agreed upon before commencement of the pertinent performance.

(3) The Engineer may base the adjustment for a lump sum item on a calculated proportionate unit price. The Engineer will calculate the proportionate unit price by dividing the original contract lump sum price by the actual or original estimated quantity established by the contract documents.

(4) In any other lawful manner as the parties may mutually agree upon before commencement of the pertinent performance.

(5) At the sole option of the Engineer, work may be paid for on a force account basis in accordance with Subsection 109.06 - Force Account Provisions and Compensation.

(6) By the cost variations attributable to the events or situations with adjustment of profit and fee, all as specified in the contract or subsequently agreed upon before commencement of the pertinent performance.

(7) In the absence of agreement by the parties:

(A) For change orders with value not exceeding $50,000 by documented actual costs of the work, allowing for overhead and profit as set forth in Section 109.05 - Allowances for Overhead and Profit. A change order shall be issued within fifteen days of

submission by the contractor of proper documentation of completed force account work, whether periodic (conforming to the applicable billing cycle) or final. The Engineer shall return any documentation that is defective, to the contractor within fifteen days after receipt, with a statement identifying the defect; or

(B) For change orders with value exceeding $50,000 by a unilateral determination by the Engineer of the costs attributable to the events or situations with adjustment of profit and fee, all as computed by the Engineer in accordance with applicable sections of HAR Chapters 3-123 and 3-126, and Section 109.05 - Allowances for Overhead and Profit. When a unilateral determination has been made, a unilateral change order shall be issued within ten days. Upon receipt of the unilateral change order, if the contractor does not agree with any of the terms or conditions, or the adjustment or nonadjustment of the contract time or contract price, the contractor shall file a notice of intent to claim within thirty days after the receipt of the written unilateral change order. Failure to file a protest within the time specified shall constitute agreement on the part of the contractor with the terms, conditions, amounts, and adjustment or nonadjustment of the contract time or the contract price set forth in the unilateral change order.

A contractor shall be required to submit cost or pricing data if any adjustment in contract price is subject to the provisions of HAR Chapter 3-122, Subchapter 15. A fully executed change order or other document permitting billing for the adjustment in price under any method listed in Subsections 104.06(1) through 104.06(7) shall be issued within ten days after agreement on the method of adjustment."

END OF SECTION 104

SECTION 105 – CONTROL OF WORK

Make the following amendments to said Section:

(I) Amend **105.01 – Authority** to read as follows:

"**105.01 Authority.**

(A) Authority of the Engineer. The Engineer is the representative of the Director and has all the authority of the Director with respect to the contract. The Engineer will make decisions on all questions that may arise regarding the contract, such as, but not limited to:

(1) Interpretation of the contract documents.

(2) Acceptability of the materials furnished and work performed.

(3) Manner of performance and rate of progress of the work.

(4) Acceptable fulfillment of the contract on the part of the Contractor.

(5) Compensation under the contract.

The Engineer's decisions on questions, claims, and disputes will be final and conclusive subject to Subsection 107.15 – Disputes and Claims.

The Engineer may delegate specific authority to act for the Engineer to a specific person or persons. Such delegation of authority shall be established in writing and shall become effective upon delivery to the Contractor.

(B) Authority of the Inspectors. Inspectors, as a representative of the Engineer or other agencies, will inspect the work done and materials furnished. Such inspection may extend to the preparation, fabrication or manufacture of the materials to be used. The Inspector does not have authority vested in the Engineer unless specifically delegated in writing. The Inspector may not alter or waive the provisions of the contract, issue instructions contrary to the contract, or act as agent or representative of the Contractor.

Failure of an Inspector at any time to reject non-conforming work shall not be considered a waiver of the State's right to require work in strict conformity with the contract documents as a condition of final acceptance.

(C) Authority of the Consultant and Construction Management. The State may engage consultants and construction managements to perform duties in connection with the work. Unless otherwise specified in writing to the Contractor, such retained consultants and construction managements shall have no greater authority than an Inspector."

(II) Amend **Subsection 105.02 - Submittals** by revising the first paragraph from lines 52 to 61 to read as follows:

"**105.02 Submittals.** The contract contains the description of various items that the Contractor must submit to the Engineer for review and acceptance. The Contractor shall review all submittals for correctness, conformance with the requirements of the contract documents and completeness before submitting them to the Engineer. The submittal shall indicate the contract items and specifications subsections for which the submittal is provided. The submittal shall be legible and clearly indicate what portion of the submittal is being submitted for review. The Contractor shall provide six copies of the required submissions at the earliest possible date."

(III) Amend **Subsection 105.08 (A) - Furnishing Drawings and Special Provisions** to read as follows:

"**(A) Furnishing Drawings and Special Provisions.** The State will furnish the Contractor an electronic set of the special provisions and plans." The Contractor shall have and maintain at least one set of plans and specifications on the work site, at all times.

(IV) Amend **Subsection 105.14(D) – No Designated Storage Area** from lines 421 to 432 to read as follows:

"**(D) No Designated Storage Area.** If no storage area is designated within the contract documents, materials and equipment may be stored anywhere within the State highway right-of-way, provided such storage and access to and from such site, within the sole discretion of the Engineer, does not create a public or traffic hazard or an impediment to the movement of traffic."

(V) Amend **105.16(A) – Subcontract Requirements** by adding the following paragraph after line 483:

The 'Specialty Items' of work for this project are as follows:

Section No.	Description
312	Contract Item No. 312.0100 under Section 312 – Hot Mix Glassphalt Base Course
401	Contract Item No. 401.0100 under Section 401 – Hot Mix Asphalt Pavement
606	All Contract Items under Section 606 - Guardrail
622	All Contract Items under Section 622 – Roadway and Sign Lighting System
623	All Contract Items under Section 623 - Traffic Signal System
629	All Contract Items under Section 629 - Pavement Markings
630	All Contract Items under Section 630 - Traffic Control Guide Signs
631	All Contract Items under Section 631 - Traffic Control Regulatory, Warning, and Miscellaneous Signs
632	All Contract Items under Section 632 - Markers
645	Contract Item No. 645.0100 under Section 645 – Work Zone Traffic Control”

(VI) Amend **Subsection 105.16(B) – Substituting Subcontractors** from line 487 to line 494 to read:

(B) Substituting Subcontractors. Under HRS Chapter 103D-302, the Contractor is required to list the names of persons or firms to be engaged by the Contractor as a subcontractor or joint contractor in the performance of the contract. No subcontractor may be added or deleted, unless authorized by the Engineer. Substitutions will be allowed only if the subcontractor:

END OF SECTION 105

SECTION 106 – MATERIAL RESTRICTIONS AND REQUIREMENTS

Make the following amendment to said Section:

(I) Amend **106.05(B) – Deviation** by revising the third sentence from line 106 to 108 to read as follows:

"Any deviations will be subject to Subsection 102.14 – Substitution of Materials and Equipment Before Bid Opening.

(II) Amend **106.11 Steel and Iron Construction Material** from line 238 to line 277 to read as follows

"**106.11 Steel and Iron Construction Material.** (Not Applicable)"

END OF SECTION 106

SECTION 107 - LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

Make the following amendments to said Section:

(I) Amend **Section 107.01 Insurance Requirements** from lines to 81 to read as follows:

"(A) Obligation of Contractor. Contractor shall not commence any work until it obtains, at its own expense, all required insurance described herein. Such insurance shall be provided by an insurance company authorized by the laws of the State to issue such insurance in the State of Hawaii. Coverage by a "Non-Admitted" carrier is permissible provided the carrier has a Best's Rating of "A-VII" or better. The Contractor shall maintain and ensure all insurance policies are current for the full period of the contract until final acceptance of the work by the State.

The Certificate of Insurance shall contain: a clause that it is agreed that any insurance maintained by the State of Hawaii will apply in excess of, and not contribute with, insurance provided by this policy; and shall be accompanied by endorsement form CG2010 or equivalent naming the State as an additional insured to the policy which status shall be maintained for the full period of the contract until final acceptance of the work by State.

The Contractor shall obtain all required insurance as part of the contract price. Where there is a requirement for the State of Hawaii and its officers and employees to be named as additional insureds under any Contractor's insurance policy, before the State of Hawaii issues the Notice to Proceed, the Contractor shall obtain and submit to the Engineer a Certificate of Insurance and a written policy endorsement that confirms the State of Hawaii and its officers and employees are additional insureds for the specific State project number and project title under such insurance policies. The written policy endorsement must be issued by the insurance company insuring the Contractor for the specified policy type or by an agent of such insurance company who is vested with the authority to issue a written policy endorsement. The insurer's agent shall also submit written confirmation of such authority to bind the insurer. Any delays in the issuance of the Notice to Proceed attributed to the failure to obtain the proof of the State of Hawaii and its officers and employees' additional insured status shall be charged to the Contractor.

A mere Certificate of Insurance issued by a broker who represents the Contractor (but not the Contractor's insurer), or by any other party who is not authorized to contractually name the State as an additional insured under the Contractor's insurance policy, is not sufficient to meet the Contractor's insurance obligations.

Certificates shall contain a provision that coverages being certified will not be cancelled or materially changed without giving the Engineer at least thirty (30) days prior written notice. Contractor will immediately provide written notice to the Director should any of the insurance policies evidenced on its Certificate of Insurance form be cancelled, reduced in scope or coverage, or not renewed upon expiration. Should any policy be canceled before final acceptance of the work by the State, and the Contractor fails to immediately procure replacement insurance as specified, the State, in addition to all other remedies it may have for such breach, reserves the right to procure such insurance and deduct the cost thereof from any money due or to become due to the Contractor.

Nothing contained in these insurance requirements is to be construed as limiting the extent of Contractor's responsibility for payment of damages resulting from its operations under this contract, including the Contractor's obligation to pay liquidated damages, nor shall it affect the Contractor's separate and independent duty to defend, indemnify and hold the State harmless pursuant to other provisions of this contract. In no instance will the State's exercise of an option to occupy and use completed portions of the work relieve the Contractor of its obligation to maintain the required insurance until the date of final acceptance of the work.

All insurance described herein shall be primary and cover the insured for all work to be performed under the contract, all work performed incidental thereto or directly or indirectly connected therewith, including but not limited to traffic detour work, barricades, warnings, diversions, lane closures, and other work performed outside the work area and all change order work.

The Contractor shall, from time to time, furnish the Engineer, when requested, satisfactory proof of coverage of each type of insurance required covering the work. Failure to comply with the Engineer's request may result in suspension of the work, and shall be sufficient grounds to withhold future payments due the Contractor and to terminate the contract for Contractor's default.

(B) Types of Insurance. Contractor shall purchase and maintain insurance described below which shall provide coverage against claims arising out of the Contractor's operations under the

contract, whether such operations be by the Contractor itself or by any subcontractor or by anyone directly or indirectly employed by any of them or by anyone for whose acts any of them may be liable.

(1) Workers' Compensation. The Contractor shall obtain worker's compensation insurance for all persons whom they employ in carrying out the work under this contract. This insurance shall be in strict conformity with the requirements of the most current and applicable State of Hawaii Worker's Compensation Insurance laws in effect on the date of the execution of this contract and as modified during the duration of the contract.

(2) Auto Liability. The Contractor shall obtain Auto Liability Insurance covering all owned, non-owned and hired autos with a Combined single Limit of not less than $1,000,000 per occurrence for bodily injury and property damage with the State of Hawaii named as additional insured. Refer to SPECIAL CONDITIONS for any additional requirements.

(3) General Liability. The Contractor shall obtain General Liability insurance with a limit of not less than $2,000,000 per occurrence and in the Aggregates for each of the following:

(a) Products - Completed/Operations Aggregate,

(b) Personal & Advertising Injury, and

(c) Bodily Injury & Property Damage

The General Liability insurance shall include the State as an Additional Insured. The required limit of insurance may be provided by a single policy or with a combination of primary and excess policies. Refer to SPECIAL CONDITIONS for any additional requirements.

(4) Builders Risk For All Work. The Contractor shall take out a policy of builder's risk insurance for the full replacement value of the project work; from a company licensed or otherwise authorized to do business in the State of Hawaii; naming the State as an additional insured under each policy; and covering all work, labor, and materials furnished by such Contractor and all its subcontractors against loss by fire, windstorm, tsunamis, earthquakes, lightning, explosion, other perils covered by the standard Extended Coverage Endorsement, vandalism, and malicious mischief. Refer to SPECIAL CONDITIONS for any additional requirements."

(II) Add **Section 107.18 Citizen and Residential Labor Force** after line 745 to read as follows:

"107.18 Citizen and Residential Labor Force.

(A) Citizen Labor. No person shall be employed as a laborer or mechanic unless such person is a citizen of the United States or eligible to become one; provided that persons without such qualifications may be employed with the approval of the Governor until persons who are citizens and are competent for such services are available for hire.

(B) Residential Labor Force. In accordance with Act 192; SLH 2011, no less than eighty (80) percent of the bidder's labor force working on the contract shall be provided by Hawaii residents. This act applies to all construction procurements under HRS Chapter 103D; however this act does not apply to procurements for professional services under Section 103D-304 and small purchases under Section 103D-305. This act is also applicable to any subcontract of $50.000.00 or more in connection with this contract.

Resident means a person who is physically present in the State of Hawaii at the time the person claims to have established the person's domicile in the State of Hawaii and shows the person's intent is to make Hawaii the person's primary residence.

(C) Percentage of workforce shall be determined by dividing the labor hours (including subcontractors) provided by residents working on the project divided by the total number of hours worked by all employees of the contractor in the performance of the contract. Hours worked by employees within shortage trades as determined by the Department of Labor and Industrial Relations shall not be included in the calculation of this percentage.

(D) Certification of compliance with the forgoing provisions shall be made by the contractor in the form of a written oath submitted to the Procurement Officer on a monthly basis for the duration of the contract.

(E) Sanctions for non compliance with these provisions are as follows:

(1) With respect to the General Contractor, withholding of payment on the contract until the Contractor or its Subcontractor complies with HRS Chapter 103B as amended by Act 192, SLH 2011.

(2) Proceedings for debarment or suspension of the Contractor or Subcontractor under Hawaii Revised Statutes § 103D-702.

This Section shall not apply when its application will disqualify the State from receiving federal funds or aid."

END OF SECTION 107

Amend **Section 108** – **PROSECUTION AND PROGRESS** to read as follows:

"SECTION 108 – PROSECUTION AND PROGRESS

108.01 Notice to Proceed (NTP). A Notice To Proceed will be issued to the Contractor not more 30 calendar days after the contract certification date. The Engineer may suspend the contract before issuing the Notice To Proceed, in which case the Contractor's remedies are exclusively those set forth in Subsection 108.10 – Suspension of Work.

The Contractor shall be allowed up to 14 calendar days after the Notice to Proceed to begin physical work. The Start Work Date will be established when this period ends or on the actual day that physical work begins, whichever is first. Charging of Contract Time will begin on the Start Work Date. The Contractor shall notify the Engineer, in writing, at least five working days before beginning physical work.

In the event that the Contractor fails to start physical work within the time specified, the Engineer may terminate the contract in accordance with Subsection 108.11 – Termination of Contract for Cause.

During the period between the Notice to Proceed and the Start Work Date the Contractor should adjust work forces, equipment, schedules, and procure materials and required permits, prior to beginning physical work.

Any physical work done prior to the Start Work Date will be considered unauthorized work. If the Engineer does not direct that the unauthorized work be removed, it shall be paid for after the Start Work Date and only if it is acceptable.

In the event that the Engineer establishes, in writing, a Start Work Date that is beyond 60 calendar days from the Notice to Proceed date, the Contractor may submit a claim in accordance with, Subsection 107.15 – Disputes and Claims for increased labor and material costs which are directly attributable to the delay beyond the first 60 calendar days after the Notice to Proceed date.

The Contractor shall notify the Engineer at least 24 hours before restarting physical work after a suspension of work pursuant to Subsection 108.10 – Suspension of Work.

Once physical work has begun, the Contractor shall work expeditiously and pursue the work diligently to completion with the contract time. If a portion of the work is to be done in stages, the Contractor shall leave the area safe and usable for the user agency and the public at the end of each stage.

108.02 Prosecution of Work. Unless otherwise permitted by the Engineer, in writing, the Contractor shall not commence with physical construction unless sufficient materials and equipment are available for either continuous construction or completion of a specified portion of the work.

108.03 Preconstruction Submittals. The awardee shall submit to the Engineer for information and review the pre-construction submittals within 21 calendar days from award. Until the items listed below are received and found acceptable by the Engineer, the Contractor shall not start physical work unless otherwise authorized to do so in writing and subject to such conditions set by the Engineer. Charging of Contract Time will not be delayed, and additional contract time will not be granted due to Contractor delay in submitting acceptable preconstruction submittals. No progress payment will be made to the Contractor until the Engineer acknowledges, in writing, receipt of the following preconstruction submittals acceptable to the Engineer:

(1) List of the Superintendent and other Supervisory Personnel, and their contact information.

(2) Name of person(s) authorized to sign for the Contractor.

(3) Work Schedule including hours of operation.

(4) Initial Progress Schedule (See Subsection 108.06 – Progress Schedule).

(5) Water Pollution and Siltation Control Submittals, including Site-Specific Best Management Practice Plan.

(6) Solid Waste Disposal form.

(7) Tax Rates.

(8) Insurance Rates.

(9) Certificate of Insurance, satisfactory to the Engineer, indicating that the Contractor has in place all insurance coverage required by the contract documents.

(10) Schedule of agreed prices.

(11) List of suppliers.

(12) Traffic Control Plan, if applicable.

108.04 Character and Proficiency of Workers. The Contractor shall at all times provide adequate supervision and sufficient labor and equipment for prosecuting the work to full completion in the manner and within the time required by the contract. The superintendent and all other representatives of the Contractor shall act in a civil and honest manner in all dealings with the Engineer, all other State officials and representatives, and the public, in connection with the work.

All workers shall possess the proper license, certification, job classification, skill, training, and experience necessary to properly perform the work assigned to them.

The Engineer may direct the removal of any worker(s) who does not carry out the assigned work in a proper and skillful manner or who is disrespectful, intemperate, violent, or disorderly. The worker shall be removed forthwith by the Contractor and will not work again without the written permission of the Engineer.

108.05 Contract Time.

(A) Calculation of Contract Time. When the contract time is on a working day basis, the total contract time allowed for the performance of the work will be the number of working days shown in the contract plus any additional working days authorized in writing as provided hereinafter. The count of elapsed working days to be charged against contract time, will begin from the Start Work Date and will continue consecutively to the date of Substantial Completion. When multiple shifts are used to perform the work, the State will not consider the hours worked over the normal eight working hours per day or night as an additional working day.

When the contract is on a calendar day basis, the total contract time allowed for the performance of the work will be the number of days shown in the contract plus any additional days authorized in writing as provided hereinafter. The count of elapsed days to be charged against contract time will begin from the Start Work Date and will continue consecutively to the date of Substantial Completion. The Engineer will exclude days elapsing between the orders of the Engineer to suspend work and resume work for suspensions not the fault of the Contractor.

(B) Modifications of Contract Time. Whenever the Contractor believes that an extension of contract time is justified, the Contractor shall serve written notice on the Engineer not more than five working days after the occurrence of the event that causes a delay or justifies a contract time extension. Contract time may be adjusted for the following reasons or events, but only if and to the extent the critical path has been affected:

(1) Changes in the Work, Additional Work, and Delays Caused by the State. If the Contractor believes that an extension of time is justified on account of any act or omission by the State, and is not adequately provided for in a field order or change order, it must request the additional time as provided above. At the request of the Engineer, the Contractor must show how the critical path will be affected and must also support the time extension request with schedules, as well as statements from its subcontractors, suppliers, or manufacturers, as necessary. Claims for compensation for any altered or additional work will be determined pursuant to Subsection 104.02 – Changes.

Additional time to perform the extra work will be added to the time allowed in the contract without regard to the date the change directive was issued, even if the contract completion date has passed. A change requiring time issued after contract time has expired will not constitute an excusal or waiver of pre-existing Contractor delay.

(2) Delay for Permits. For delays in the routine application and processing time required to obtain necessary permits, including permits to be obtained from State agencies, the Engineer may grant an extension provided that the permit takes longer than 30 days to acquire and the delay is not caused by the Contractor, and provided that as soon as the delay occurs, the Contractor notifies the Engineer in writing that the permits are not available. Permits required by the contract that take less than 30 days to acquire from the time which the appropriate documents are granted shall be acquired between Notice to Proceed and Start Work Date or accounted for in the contractor's progress schedule. Time extensions will be the exclusive relief granted on account of such delays.

(3) Delays Beyond Contractor's Control. For delays caused by acts of God, a public enemy, fire, inclement weather days or adverse conditions resulting therefrom, earthquakes, floods, epidemics, quarantine restrictions, labor disputes impacting the Contractor or the State, freight embargoes and other reasons beyond the Contractor's control, the Contractor may be granted an extension of time provided that:

(a) In the written notice of delay to the Engineer, the Contractor describes possible effects on the completion date of the contract. The description of delays shall:

1. State specifically the reason or reasons for the delay and fully explain in a detailed chronology how the delay affects the critical path.

2. Include copies of pertinent documentation to support the time extension request.

3. Cite the anticipated period of delay and the time extension requested.

4. State either that the above circumstances have been cleared and normal working conditions restored as of a certain day or that the above circumstances will continue to prevent completion of the project.

(b) The Contractor shall notify the Engineer in writing when the delay ends. Time extensions will be the exclusive relief granted and no additional compensation will be paid the Contractor for such delays.

(4) Delays in Delivery of Materials or Equipment. For delays in delivery of materials or equipment, which occur as a result of unforeseeable causes beyond the control and without fault of the Contractor, its subcontractor(s) or supplier(s), time extensions shall be the exclusive relief granted and no additional compensation will be paid the Contractor on account of such delay. The delay shall not exceed the difference between the originally scheduled delivery date and the actual delivery date. The Contractor may be granted an extension of time provided that it complies with the following procedures:

(a) The Contractor's written notice to the Engineer must describe the delays and state the effect such delays may have on the critical path.

(b) The Contractor, if requested, must submit to the Engineer within five days after a firm delivery date for the material and equipment is established, a written statement regarding the delay. The Contractor must justify the delay as follows:

1. State specifically all reasons for the delay. Explain in a detailed chronology the effect of the delay on the critical path.

2. Submit copies of purchase order(s), factory invoice(s), bill(s) of lading, shipping manifest(s), delivery tag(s), and any other documents to support the time extension request.

3. Cite the start and end date of the delay and the time extension requested.

(5) Delays for Suspension of Work. When the performance of the work is totally suspended for one or more days (calendar or working days, as appropriate) by order of the Engineer in accordance with Subsections 108.10(A)(1), 108.10(A)(2), or 108.10(A)(5) the number of days from the effective date of the Engineer's order to suspend operations to the effective date of the Engineer's order to resume operations shall not be counted as contract time and the contract completion date will be adjusted. During periods of partial suspensions of the work, the Contractor will be granted a time extension only if the partial suspension affects the critical path. If the Contractor believes that an extension of time is justified for a partial suspension of work, it must request the extension in writing at least five working days before the partial suspension will affect the critical operation(s) in progress. The Contractor must show how the critical path was increased based on the status of the work and must also support its claim if requested, with statements from its subcontractors. A suspension of work will not constitute a waiver of pre-existing Contractor delay.

(6) Contractor Caused Delays. No time extension will be granted under the following circumstances:

(a) Delays within the Contractor's control in performing the work caused by the Contractor, subcontractor, supplier, or any combination thereof.

(b) Delays within the Contractor's control in arrival of materials and equipment caused by the Contractor, subcontractor, supplier, or any combination thereof, in ordering, fabricating, and delivery.

(c) Delays requested for changes which do not affect the critical path.

(d) Delays caused by the failure of the Contractor to make submittals in a timely manner for review and acceptance by the Engineer, such as but not limited to shop drawings, descriptive sheets, material samples, and color samples except as covered in Subsection 108.05(B)(3) – Delays Beyond Contractor's Control and 108.05(B)(4) – Delays in Delivery of Materials or Equipment.

(e) Delays caused by the failure to submit sufficient information and data in a timely manner in the proper form in order to obtain necessary permits related to the work.

(f) Failure to follow the procedure within the time allowed by contract to request a time extension.

(g) Failure of the Contractor to provide evidence sufficient to support the time extension request.

(7) Reduction in Time. If the State deletes or modifies any portion of the work, an appropriate reduction of contract time may be made in accordance with Subsection 104.02 - Changes.

108.06 Progress Schedules.

(A) Forms of Schedule. All schedules shall be submitted using the specific computer program designated in the bid documents. If no such scheduling software program is designated, then all schedules shall be submitted using the latest version of Microsoft Project by Microsoft or approved equivalent software program.

Schedule submittals shall be as follows:

(1) For Contracts $2,000,000 or less or For Contract Time 100 Working Days or 140 Calendar Days or Less. For contracts of $2,000,000 or less or for contract time of 100 working days or 140 calendar days or less, the progress schedule will be a Time Scaled Logic Diagram (TSLD). The Contractor shall submit a TSLD submittal package meeting the following requirements and having these essential and distinctive elements:

(a) The major features of work, such as but not limited to BMP installation, grubbing, roadway excavation, structure excavation, structure construction, shown in the chronological order in which the Contractor proposes to work that feature or work and its location on the project. The schedule shall account for normal inclement weather, unusual soil or other

conditions that may influence the progress of the work, schedules, and coordination required by any utility, off or on site fabrications, and other pertinent factors that relate to progress;

(b) All features listed or not listed in the contract documents that the Contractor considers a controlling factor for the timely completion of the contract work.

(c) The time span and sequence of the activities or events for each feature, and its interrelationship and interdependencies in time and logic to other features in order to complete the project.

(d) The total anticipated time necessary to complete work required by the contract.

(e) A chronological listing of critical intermediate dates or time periods for features or milestones or phases that can affect timely completion of the project.

(f) Major activities related to the location on the project.

(g) Non-construction activities, such as submittal and acceptance periods for shop drawings and material, procurement, testing, fabrication, mobilization, and demobilization or order dates of long lead material.

(h) Set schedule logic for out of sequence activities to retain logic. In addition, open ends shall be non-critical.

(i) Show target bars for all activities.

(j) Vertical and horizontal sight lines both major and minor shall be used as well as a separator line between groups. The Engineer will determine frequency and style.

(k) The file name, print date, revision number, data and project title and number shall be included in the title block.

(l) Have columns with the appropriate data in them for activity ID, description, original duration, remaining duration, early start, early finish, total float, percent complete, resources. The resource column shall list who is responsible for the work to be done in the activity. These columns shall be to the left of the bar chart.

(2) For Contracts Which Have A Contract Amount More Than $2,000,000 Or Having A Contract Time Of More Than 100 Working Days Or 140 Calendar Days. For contracts which have a contract amount more than $2,000,000 or contract time of more than 100 working days or 140 calendar days, the Contractor shall submit a Timed-Scaled Logic Diagram (TSLD) meeting the following requirements and having these essential and distinctive elements:

(a) The information and requirements listed in Subsection 108.06(A)(1) – For Contracts $2,000,000 or Less or For Contract Time 100 Working Days or 140 Calendar Days or Less.

(b) Additional reports and graphics available from the software as requested by the Engineer.

(c) Sufficient detail to allow at least weekly monitoring of the Contractor and subcontractor's operations.

(d) The time scaled schematic shall be on a calendar or working days basis. What will be used shall be determined by how the contract keeps track of time. It will be the same. Plot the critical calendar dates anticipated.

(e) Breakdown of activity, such as forming, placing reinforcing steel, concrete pouring and curing, and stripping in concrete construction. Indicate location of work to be done in such detail that it would be easily determined where work would be occurring within approximately 200 feet.

(f) Latest start and finish dates for critical path activities.

(g) Identify responsible subcontractor, supplier, and others for their respective activity.

(h) No individual activity shall have duration of more than 20 calendar days unless requested and approved by the Engineer.

(i) All activities shall have work breakdown structure codes and activity codes. The activity codes shall have coding that incorporates information for phase, location, who is responsible for doing work and type of operation and activity description.

(j) Incorporate all physical access and availability restraints.

(B) Inspection and Testing. All schedules shall provide reasonable time and opportunity for the Engineer to inspect and test each work activity.

(C) Engineer's Acceptance of Progress Schedule. The submittal of, and the Engineer's receipt of any progress schedule, shall not be deemed an agreement to modify any terms or conditions of the contract. Any modifications to the contract terms and conditions that appear in or may be inferred from an acceptable schedule will not be valid or enforceable unless and until the Engineer exercises discretion to issue an appropriate change order. Nor shall any submittal or receipt imply the Engineer's approval of the schedule's breakdown, its individual elements, any critical path that may be shown, nor shall it obligate the State to make its personnel available outside normal working hours or the working hours established by the Contract in order to accommodate such schedule. The Contractor has the risk of all elements (whether or not shown) of the schedule and its execution. No claim for additional compensation, time, or both, shall be made by the Contractor or recognized by the Engineer for delays during any period for which an acceptable progress schedule or an updated progress schedule as required by Subsection 108.06(E) – Contractor's Continuing Schedule Submittal Requirements had not been submitted. Any acceptance or approval of the schedule shall be for general format only and shall not be deemed an agreement by the State that the construction means, methods, and resources shown on the schedule will result in work that conforms to the contract requirements or that the sequences or durations indicated are feasible.

(D) Initial Progress Schedule. The Contractor shall submit an initial progress schedule. The initial progress schedule shall consist of the following:

(1) Four sets of the TSLD schedule.

(2) All the software files and data to re-create the TSLD in a computerized software format as specified by the Engineer.

(3) A listing of equipment that is anticipated to be used on the project. Including the type, size, make, year of manufacture, and all information necessary to identify the equipment in the Rental Rate Blue Book for Construction Equipment.

(4) An anticipated manpower requirement graph plotting contract time and total manpower requirement. This may be superimposed over the payment graph.

(5) A Method Statement that is a detailed narrative describing the work to be done and the method by which the work shall be accomplished for each major activity. A major activity is an activity that:

(a) Has a duration longer than five days.

(b) Is a milestone activity.

(c) Is a contract item that exceeds $10,000 on the contract cost proposal.

(d) Is a critical path activity.

(e) Is an activity designated as such by the Engineer.

Each Method Statement shall include the following items needed to fulfill the schedule:

(a) Quantity, type, make, and model of equipment.

(b) The manpower to do the work, specifying worker classification.

(c) The production rate per eight hour day, or the working hours established by the contract documents needed to meet the time indicated on the schedule. If the production rate is not for eight hours, the number of working hours shall be indicated.

(6) Two sets of color time-scaled project evaluation and review technique charts ("PERT") using the activity box template of Logic – Early Start or such other template designated by the Engineer.

If the contract documents establish a sequence or order for the work, the initial progress schedule shall conform to such sequence or order.

(E) Contractor's Continuing Schedule Submittal Requirements. After the acceptance of the initial TSLD and when construction starts, the Contractor shall submit four plotted progress schedules, two PERT charts, and reports on all construction activities every two weeks (bi-weekly). This scheduled bi-weekly submittal shall also include an updated version of the project schedule in a computerized software format as specified by the Engineer. The submittal shall have all the information needed to re-create that time period's TSLD plot and reports. The bi-weekly submittal shall include, but not limited to, an update of activities based on actual durations,

all new activities and any changes in duration or start or finish dates of any activity.

The Contractor shall submit with every update, in report form acceptable to the Engineer, a list of changes to the progress schedule since the previous schedule submittal. The Engineer may change the frequency of the submittal requirements but may not require a submittal of the schedule to be more than once a week. The Engineer may decrease the frequency of the submittal of the bi-weekly schedule.

The Contractor shall submit updates of the anticipated work completion graph, equipment listing, manpower requirement graph or method statement when requested by the Engineer. The Contractor shall submit such updates within 4 calendar days from the date of the request by the Engineer.

The Engineer may withhold progress payment until the Contractor is in compliance with all schedule update requirements

(F) Float. All float appearing on a schedule is a shared commodity. Float does not belong to or exist for the exclusive use or benefit of either the State or the Contractor. The State or the Contractor has the opportunity to use available float until it is depleted. Float has no monetary value.

(G) Scheduled Meetings. The Contractor shall meet on a bi-weekly basis with the Engineer to review the progress schedule. The Contractor shall have someone attending the meeting that can answer all questions on the TSLD and other schedule related submittals.

(H) Accelerated Schedule; Early Completion. If the Contractor submits an accelerated schedule (shorter than the contract time), the Engineer's review and acceptance of an accelerated schedule does not constitute an agreement or obligation by the State to modify the contract time or completion date. The Contractor is solely responsible for and shall accept all risks and any delays, other than those that can be directly and solely attributable to the State, that may occur during the work, until the contract completion date. The contract time or completion date is established for the benefit of the State and cannot be changed without an appropriate change order or Substantial Completion granted by the State. The State may accept the work before the completion date is established, but is not obligated to do so.

If the TSLD indicates an early completion of the project, the Contractor shall, upon submittal of the schedule, cooperate with the Engineer in explaining how it will be achieved. In addition, the Contractor shall submit the above explanation in writing which shall include the State's part, if any, in achieving the early completion date. Early completion of the project shall not rely on changes to the Contract Documents unless approved by the Engineer.

(l) Contractor Responsibilities. The Contractor shall promptly respond to any inquiries from the Engineer regarding any schedule submission. The Contractor shall adjust the schedule to address directives from the Engineer and shall resubmit the TSLD package to the Engineer until the Engineer finds it acceptable.

The Contractor shall perform the work in accordance with the submitted TSLD. The Engineer may require the Contractor to provide additional work forces and equipment to bring the progress of the work into conformance with the TSLD at no increase in contract price or contract time whenever the Engineer determines that the progress of the work does not insure completion within the specified contract time.

108.07 Weekly Meeting. In addition to the bi-weekly schedule meetings, the Contractor shall be available to meet once a week with the Engineer at the time and place as determined by the Engineer to discuss the work and its progress including but not limited to, the progress of the project, potential problems, coordination of work, submittals, erosion control reports, etc. The Contractor's personnel attending shall have the authority to make decisions and answer questions.

The Contractor shall bring to weekly meetings a detailed work schedule showing the next three weeks' work. Number of copies of the detailed work schedule to be submitted will be determined by the Engineer. The three-week schedule is in addition to the TSLD and shall in no way be considered as a substitute for the TSLD or vice versa. The three-week schedule shall show:

(a) All construction events, traffic control and BMP related activities in such detail that the Engineer will be able to determine at what location and type of work will be done for any day for the next three weeks. This is for the State to use to plan its manpower requirements for that time period.

(b) The duration of all events and delays.

(c) The critical path clearly marked in red or marked in a manner that makes it clearly distinguishable from other paths and is acceptable to the Engineer.

(d) Critical submittals and requests for information (RFI's).

(e) The project title, project number, date created, period the schedule covers, Contractor's name and creator of the schedule on each page.

Two days prior to each weekly meeting, the Contractor shall submit a list of outstanding submittals, RFIs and issues that require discussion.

108.08 Liquidated Damages for Failure to Complete the Work or Portions of the Work on Time. The actual amount of damages resulting from the Contractor's failure to complete the contract in a timely manner is difficult to accurately determine. Therefore, the amount of such damages shall be liquidated damages as set forth herein and in the special provisions. The State may, at its discretion, deduct the amount from monies due or that may become due under the contract.

When the Contractor fails to reach substantial completion of the work for which liquidated damages are specified, within the time or times fixed in the contract or any extension thereof, in addition to all other remedies for breach that may be available to the State, the Contractor shall pay liquidated damages to the State, in the amount of $ _____ per working day.

(A) Liquidated Damages Upon Termination. If the State terminates on account of Contractor's default, liquidated damages may be charged against the defaulting Contractor and its surety until final completion of work.

(B) Liquidated Damages for Failure to Complete the Punchlist. The Contractor shall complete the work on any punchlist created after the pre-final inspection, within the contract time or any extension thereof.

When the Contractor fails to complete the work on such punchlist within the contract time or any extension thereof, the Contractor shall pay liquidated damages to the State of 20 percent of the amount of liquidated damages established for failure to substantially complete the work within contract time. Liquidated damages shall not be assessed for the period between:

(1) Notice from the Contractor that the project is substantially complete and the time the punchlist is delivered to the Contractor.

(2) The date of the completion of punchlist as determined by the Engineer and the date of the successful final inspection, and

(3) The date of the Final Inspection that results in Substantial Completion and the receipt by the Contractor of the written notice of Substantial Completion.

(C) Actual Damages Recoverable If Liquidated Damages Deemed Unenforceable. In the event a court of competent jurisdiction holds that any liquidated damages assessed pursuant to this contract are unenforceable, the State will be entitled to recover its actual damages for Contractor's failure to complete the work, or any designated portion of the work within the time set by the contract.

108.09 Rental Fees for Unauthorized Lane Closure or Occupancy. In addition to all other remedies available to the State for Contractor's breach of the terms of the contract, the Engineer will assess the rental fees in the amount of $500 for every one-to fifteen-minute increment for each roadway lane closed to public use or occupied beyond the time periods authorized in the contract or by the Engineer. The maximum amount assessed per day shall be $5,000. The State may, at its discretion, deduct the amount from monies due or that may become due under the contract. The rental fee may be waived in whole or part if the Engineer determines that the unauthorized period of lane closure or occupancy was due to factors beyond the control of the Contractor. Equipment breakdown is not a cause to waive liquidated damages.

108.10 Suspension of Work.

(A) Suspension of Work. The Engineer may, by written order, suspend the performance of the work, either in whole or in part, for such periods as the Engineer may deem necessary, for any cause, including but not limited to:

(1) Weather or soil conditions considered unsuitable for prosecution of the work.

(2) Whenever a redesign that may affect the work is deemed necessary by the Engineer.

(3) Unacceptable noise or dust arising from the construction even if it does not violate any law or regulation.

(4) Failure on the part of the Contractor to:

(a) Correct conditions unsafe for the general public or for the workers.

(b) Carry out orders given by the Engineer.

(c) Perform the work in strict compliance with the provisions of the contract.

(d) Provide adequate supervision on the jobsite.

(5) The convenience of the State.

(B) Partial and Total Suspension. Suspension of work on some but not all items of work shall be considered a "partial suspension". Suspension of work on all items shall be considered "total suspension". The period of suspension shall be computed from the date set out in the written order for work to cease until the date of the order for work to resume.

(C) Reimbursement to Contractor. In the event that the Contractor is ordered by the Engineer in writing as provided herein to suspend all work under the contract for the reasons specified in Subsections 108.10(A)(2), 108.10(A)(3), or 108.10(A)(5) of the "Suspension of Work" paragraph, the Contractor may be reimbursed for actual direct costs incurred on work at the jobsite, as authorized in writing by the Engineer, including costs expended for the protection of the work. An allowance of 5 percent for indirect categories of delay costs will be paid on any reimbursed direct costs, including extended branch and home-office overhead and delay impact costs. No allowance will be made for anticipated profits. Payment for equipment which is ordered to standby during such suspension of work shall be made as described in Subsection 109.06(H) - Idle and Standby Equipment.

(D) Cost Adjustment. If the performance of all or part of the work is suspended for reasons beyond the control of the Contractor except an adjustment shall be made for any increase in cost of performance of this contract (excluding profit) necessarily caused by such suspension, and the contract modified in writing accordingly.

However, no adjustment to the contract price shall be made for any suspension, delay, or interruption:

(1) For weather related conditions.

(2) To the extent that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor.

(3) Or, for which an adjustment is provided for or excluded under any other provision of this Contract.

(E) Claims for Adjustment. Any adjustment in contract price made shall be determined in accordance with Subsections 104.02 – Changes and 104.06 – Methods of Price Adjustment.

Any claims for such compensation shall be filed in writing with the Engineer within 30 days after the date of the order to resume work or the claim will not be considered. The claim shall conform to the requirements of Subsection 107.15(D) – Making of a Claim. The Engineer will take the claim under consideration, may make such investigations as are deemed necessary and will be the sole judge as to the equitability of the claim. The Engineer's decision will be final.

(F) No Adjustment. No provision of this clause shall entitle the Contractor to any adjustments for delays due to failure of its surety, the cancellation or expiration of any insurance coverage required by the contract documents, for suspensions made at the request of the Contractor, for any delay required under the contract, for suspensions, either partial or whole, made by the Engineer under Subsection 108.10(A)(4) of the "Suspension of work" paragraph.

108.11 Termination of Contract for Cause.

(A) Default. If the Contractor refuses or fails to perform the work, or any separable part thereof, with such diligence as will assure its completion within the time specified in this contract, or any extension thereof, or commits any other material breach of this contract, and further fails within seven days after receipt of written notice from the Engineer to commence and continue correction of the refusal or failure with diligence and promptness, the Engineer may, by written notice to the Contractor, declare the Contractor in breach and terminate the Contractor's right to proceed with the work or the part of the work as to which there has been delay or other breach of contract. In such event, the State may take over the work, perform the same to completion, by contract or otherwise, and may take possession of, and utilize in completing the work, the materials, appliances, and plants as may be on the site of the work and necessary therefore. Whether or not the Contractor's right to proceed with the work is terminated, the Contractor and the Contractor's sureties shall be liable for any damage to the State resulting from the Contractor's refusal or failure to complete the work within the specified time.

(B) Additional Rights and Remedies. The rights and remedies of the State provided in this contract are in addition to any other rights and remedies provided by law.

(C) Costs and Charges. All costs and charges incurred by the State, together with the cost of completing the work under contract, will be

deducted from any monies due or which would or might have become due to the Contractor had it been allowed to complete the work under the contract. If such expense exceeds the sum which would have been payable under the contract, then the Contractor and the surety shall be liable and shall pay the State the amount of the excess.

In case of termination, the Engineer will limit any payment to the Contractor to the part of the contract satisfactorily completed at the time of termination. Payment will not be made until the work has satisfactorily been completed and all required documents, including the tax clearance required by Subsection 109.11 – Final Payment are submitted by the Contractor. Termination shall not relieve the Contractor or Surety from liability for liquidated damages.

(D) Erroneous Termination for Cause. If, after notice of termination of the Contractor's right to proceed under this section, it is determined for any reason that good cause did not exist to allow the State to terminate as provided herein, the rights and obligations of the parties shall be the same as, and the relief afforded the Contractor shall be limited to, the provisions contained in Subsection 108.12 – Termination for Convenience.

108.12 Termination For Convenience.

(A) Terminations. The Director may, when the interests of the State so require, terminate this contract in whole or in part, for the convenience of the State. The Director will give written notice of the termination to the Contractor specifying the part of the contract terminated and when termination becomes effective.

(B) Contractor's Obligations. The Contractor shall incur no further obligations in connection with the terminated work and on the date set in the notice of termination the Contractor shall stop work to the extent specified. The Contractor shall also terminate outstanding orders and subcontracts as they relate to the terminated work. The Contractor shall settle the liabilities and claims arising out of the termination of subcontracts and orders connected with the terminated work subject to the State's approval. The Engineer may direct the Contractor to assign the Contractor's right, title, and interest under terminated orders or subcontracts to the State. The Contractor must still complete the work not terminated by the notice of termination and may incur obligations as necessary to do so.

(C) Right to Construction and Goods. The Engineer may require the Contractor to transfer title and to deliver to the State in the manner and to the extent directed by the Engineer, the following:

(1) Any completed work.

(2) Any partially completed construction, goods, materials, parts, tools, dies, jigs, fixtures, drawings, information, and contract rights (hereinafter called "construction material") that the Contractor has specifically produced or specially acquired for the performance of the terminated part of this contract.

(3) The Contractor shall protect and preserve all property in the possession of the Contractor in which the State has an interest. If the Engineer does not elect to retain any such property, the Contractor shall use its best efforts to sell such property and construction materials for the State's account in accordance with the standards of HRS Chapter 490:2-706.

(D) Compensation.

(1) The Contractor shall submit a termination claim specifying the amounts due because of the termination for convenience together with cost or pricing data, submitted to the extent required by HAR Subchapter 15, Chapter 3-122. If the Contractor fails to file a termination claim within one year from the effective date of termination, the Engineer may pay the Contractor, if at all, an amount set in accordance with Subsection 108.12(D)(3).

(2) The Engineer and the Contractor may agree to a settlement provided the Contractor has filed a termination claim supported by cost or pricing data submitted as required and that the settlement does not exceed the total contract price plus settlement costs reduced by payments previously made by the State, the proceeds of any sales of construction, supplies, and construction materials under Subsection 108.12(C)(3), and the proportionate contract price of the work not terminated.

(3) Absent complete agreement, the Engineer will pay the Contractor the following amounts less any payments previously made under the contract:

(a) The cost of all contract work performed prior to the effective date of the notice of termination work plus a 5 percent markup on the actual direct costs, including amounts paid to subcontractor, less amounts paid or to be paid for completed portions of such work; provided, however, that if it appears that the Contractor would have sustained a loss if the entire contract would have been completed, no markup shall be allowed or included and the amount of compensation shall

be reduced to reflect the anticipated rate of loss. No anticipated profit or consequential damage will be due or paid.

(b) Subcontractors shall be paid a markup of 10 percent on their direct job costs incurred to the date of termination. No anticipated profit or consequential damage will be due or paid to any subcontractor. These costs must not include payments made to the Contractor for subcontract work during the contract period.

(c) The total sum to be paid the Contractor shall not exceed the total contract price reduced by the amount of any sales of construction supplies, and construction materials.

(4) Cost claimed, agreed to, or established by the State shall be in accordance with HAR Chapter 3-123.

108.13 Pre-Final and Final Inspections.

(A) Inspection Requirements. Before the Engineer undertakes a final inspection of any work, a pre-final inspection must first be conducted. The Contractor shall notify the Engineer that the work has reached substantial completion and is ready for pre-final inspection.

(B) Pre-Final Inspection. Before notifying the Engineer that the work has reached substantial completion, the Contractor shall inspect the project and test all installed items with all of its subcontractors as appropriate. The Contractor shall also submit the following documents as applicable to the work:

(1) All written guarantees required by the contract.

(2) Two accepted final field-posted drawings as specified in Section 648 – Field-Posted Drawings;

(3) Complete weekly certified payroll records for the Contractor and Subcontractors.

(4) Certificate of Plumbing and Electrical Inspection.

(5) Certificate of building occupancy as required.

(6) Certificate of Soil and Wood Treatments.

(7) Certificate of Water System Chlorination.

(8) Certificate of Elevator Inspection, Boiler and Pressure Pipe Inspection.

(9) Maintenance Service Contract and two copies of a list of all equipment installed.

(10) Current Tax clearance. The contractor will be required to submit an additional tax clearance certificate when the final payment is made.

(11) And any other final items and submittals required by the contract documents.

(C) Procedure. When in compliance with the above requirements, the Contractor shall notify the Engineer in writing that the project has reached substantial completion and is ready for pre-final inspection.

The Engineer will then make a preliminary determination as to whether or not the project is substantially complete and ready for pre-final inspection. The Engineer may, in writing, postpone until after the pre-final inspection the Contractor's submittal of any of the items listed in Subsection 108.13(B) – Pre-Final Inspection, herein, if in the Engineer's discretion it is in the interest of the State to do so.

If, in the opinion of the Engineer, the project is not substantially complete, the Engineer will provide the Contractor a punchlist of specific deficiencies in writing which must be corrected or finished before the work will be ready for a pre-final inspection. The Engineer may add to or otherwise modify this punchlist from time to time. The Contractor shall take immediate action to correct the deficiencies and must repeat all steps described above including written notification that the work is ready for pre-final inspection.

After the Engineer is satisfied that the project appears substantially complete a final inspection shall be scheduled within ten working days after receipt of the Contractor's latest letter of notification that the project is ready for final inspection.

If, as a result of the pre-final inspection, the Engineer determines the work is not substantially complete, the Engineer will inform the Contractor in writing as to specific deficiencies which must be corrected before the work will be ready for another pre-final inspection. If the Engineer finds the work is substantially complete but finds deficiencies that must be corrected before the work is ready for final inspection, the Engineer will prepare in writing and deliver to the Contractor a punchlist describing such deficiencies.

At any time before final acceptance, the Engineer may revoke the determination of substantial completion if the Engineer finds that it was not warranted and will notify the Contractor in writing the reasons therefore together with a description of the deficiencies negating the declaration.

When the date of substantial completion has been determined by the State, liquidated damages for the failure to complete the punchlist, if due to the State will be assessed in pursuant to Subsection 108.08(B) - Liquidated Damages for Failure to Complete the Punchlist.

(D) Punchlist; Clean Up and Final Inspection. Upon receiving a punchlist after pre-final inspection, the Contractor shall promptly devote all required time, labor, equipment, materials and incidentals to correct and remedy all punchlist deficiencies. The Engineer may add to or otherwise modify this punchlist until substantial completion of the project.

Before final inspection of the work, the Contractor shall clean all ground occupied by the Contractor in connection with the work of all rubbish, excess materials temporary structures and equipment, shall remove all graffiti and defacement of the work and all parts of the work and the worksite must be left in a neat and presentable condition to the satisfaction of the Engineer.

Final inspection will occur within ten working days after the Contractor notifies the Engineer in writing that all punchlist deficiencies remaining after the pre-final inspection have been completed and the Engineer concurs. If the Engineer determines that deficiencies still remain at the final inspection, the work will not be accepted and the Engineer will notify the Contractor, in writing, of the deficiencies which shall be corrected and the steps above repeated.

If the Contractor fails to correct the deficiencies and complete the work by the established or agreed date, the State may correct the deficiencies by whatever method it deems appropriate and deduct the cost from any payments due the Contractor.

108.14 Substantial Completion and Final Acceptance.

(A) Substantial Completion. When the Engineer finds that the Contractor has satisfactorily completed all work for the project in compliance with the contract, with the exception of the planting period and the plant establishment period, the Engineer will notify the Contractor, in writing, of the project's substantial completion, effective as of the date of the final inspection. The substantial completion date shall determine end of contract time and relieve contractor of any additional accumulation of liquidated damages for failure to complete the punchlist.

(B) Final Acceptance. When the Engineer finds that the Contractor has satisfactorily completed all contract work in compliance with the contract including all plant establishment requirements, and all the materials have been accepted by the State, the Engineer will issue a Final Acceptance Letter. The Final Acceptance date shall determine the commencement of all guaranty periods subject to Subsection 108.16 – Contractor's Responsibility for Work; Risk of Loss or Damage.

108.15 Use of Structure or Improvement. The State has the right to use the structure, equipment, improvement, or any part thereof, at any time after it is considered by the Engineer as available. In the event that the structure, equipment or any part thereof is used by the State before final acceptance, the Contractor is not relieved of its responsibility to protect and preserve all the work until final acceptance.

108.16 Contractor's Responsibility for Work; Risk of Loss or Damage. Until the written notice of final acceptance has been received, the Contractor shall take every precaution against loss or damage to any part of the work by the action of the elements or from any other cause whatsoever, whether arising from the performance or from the non-performance of the work. The Contractor shall rebuild, repair, restore and make good all loss or damage to any portion of the work resulting from any cause before its receipt of the written notice of final acceptance and shall bear the risk and expense thereof.

The risk of loss or damage to the work from any hazard or occurrence that may or may not be covered by a builder's risk policy is that of the Contractor and Surety, unless such risk of loss is placed elsewhere by express language in the contract documents.

108.17 Guarantee of Work.

(1) Regardless of, and in addition to, any manufacturers' warranties, all work and equipment shall be guaranteed by the Contractor against defects in materials, equipment or workmanship for one year from the date of final acceptance or as otherwise specified in the contract documents.

(2) When the Engineer determines that repairs or replacements of any guaranteed work and equipment is necessary due to materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the contract, the Contractor shall, at no increase in contract price or contract time, and within five working days of receipt of written notice from the State, commence to all of the following:

(a) Correct all noted defects and make replacements, as directed by the Engineer, in the equipment and work.

(b) Repair or replace to new or pre-existing condition any damages resulting from such defective materials, equipment or installation thereof.

(3) The State will be entitled to the benefit of all manufacturers and installers warranties that extend beyond the terms of the Contractor's guaranty regardless of whether or not such extended warranty is required by the contract documents. The Contractor shall prepare and submit all documents required by the providers of such warranties to make them effective, and submit copies of such documents to the Engineer. If an available extended warranty cannot be transferred or assigned to the State as the ultimate user, the Contractor shall notify the Engineer who may direct that the warranted items be acquired in the name of the State as purchaser.

(4) If a defect is discovered during a guarantee period, all repairs and corrections to the defective items when corrected shall be guaranteed for a new duration equal to the original full guarantee period. The running of the guarantee period shall be suspended for all other work affected by any defect. The guarantee period for all other work affected by any such defect shall restart for its remaining duration upon confirmation by the Engineer that the deficiencies have been repaired or remedied.

(5) Nothing in this section is intended to limit or affect the State's rights and remedies arising from the discovery of latent defects in the work after the expiration of any guarantee period.

108.18 No Waiver of Legal Rights. The following will not operate or be considered as a waiver of any portion of the contract, or any power herein reserved, or any right to damages provided herein or by law:

(1) Any payment for, or acceptance of, the whole or any part of the work.

(2) Any extension of time.

(3) Any possession taken by the Engineer.

A waiver of any notice requirement or of any noncompliance with the contract will not be held to be a waiver of any other notice requirement or any other noncompliance with the contract.

108.19 Final Settlement of Contract.

(A) Closing Requirements. The contract will be considered settled after the project acceptance date and when the following items have been satisfactorily submitted, where applicable:

(1) All written guarantees required by the contract.

(2) Complete and certified weekly payrolls for the Contractor and its subcontractor's.

(3) Certificate of plumbing and electrical inspection.

(4) Certificate of building occupancy.

(5) Certificate for soil treatment and wood treatment.

(6) Certificate of water system chlorination.

(7) Certificate of elevator inspection, boiler and pressure pipe installation.

(8) Tax clearance.

(9) All other documents required by the Contract or by law.

(B) Failure to Meet Closing Requirements. The Contractor shall meet the applicable closing requirements within 60 days from the date of Project Acceptance or the agreed to Punchlist complete date. Should the Contractor fail to comply with these requirements, the Engineer may terminate the contract for cause."

END OF SECTION 108

SECTION 109 - MEASUREMENT AND PAYMENT

Make the following amendment to said Section:

(I) Amend **Subsection 109.05 Allowances for Overhead and Profit** by revising lines 101 to 110 to read as follows:

"**(1)** 20 percent of the direct cost for any work performed by the Contractor's own labor force.

(2) 20 percent of the direct cost for any work performed by each subcontractor's own labor force.

(3) For the Contractor or any subcontractor for work performed by their respective subcontractor or tier subcontractor, 10 percent of the amount due to the performing subcontractor or tier subcontractor."

(II) Amend **109.08(A) Monthly Payment** by adding the following after line 411:

"**(1) Retainage.** If the Engineer finds that the Contractor is progressing satisfactorily in completing the project work and:

a. Less than 50% of the whole contract cost is complete, the Engineer shall retain 5% of the value of the work done until the Engineer makes final payment;

b. More than 50% of the whole contract cost is complete, the Engineer may make the remaining progress payments in full.

c. After satisfactory completion of work other than landscaping items, the Engineer may adjust the amount of retainage to 15% of the landscaping items or 2½% of the total contract amount whichever is less. Do not use this subsection if the contract is only landscaping."

(III) Amend **Subsection 109.08(B) Payment for Material On Hand** by revising lines 421 to 423 to read as follows:

"**(2)** The materials shall be stored and handled in accordance with Subsection 105.14 – Storage and Handling of Materials and Equipment."

(IV) Amend **Subsection 109.11 Final Payment** by revising lines 568 to 576 to read as follows:

"**(3)** A current "Certificate of Vendor Compliance" issued by the Hawaii Compliance Express (HCE). The Certificate of Vendor Compliance is used to certify the Contractor's compliance with

(a) Section 103D-328, HRS (for all contracts $25,000 or more) which requires a current tax clearance certificate issued by the Hawaii State Department of Taxation and the Internal Revenue Service;

(b) Chapters 383, 386, 392, and 393, HRS; and

(c) Subsection 103D-310(c), HRS. The State reserves the right to verify that compliance is current prior to the issuance of final payment. Contractors are advised that non-compliance status will result in final payment being withheld until compliance is attained.

Sums necessary to meet the claims of any governmental agencies may be withheld from the sums due the Contractor until said claims have been fully and completely discharged or otherwise satisfied."

END OF SECTION 109

SECTION 201 – CLEARING AND GRUBBING

Make the following amendments to said Section:

(I) Amend **201.04 – Measurement** by revising lines 167 to 168 to read as follows:

"**201.04 Measurement.** The Engineer will measure clearing and grubbing per acre or square yard in accordance with the contract documents."

(II) Amend **201.05 – Payment** by revising lines 170 to 179 to read as follows:

"**201.05 Payment.** The Engineer will pay for the accepted clearing and grubbing per acre or square yard. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for the following pay item when included in the proposal schedule:

Pay Item	**Pay Unit**
Clearing and Grubbing	Square Feet

END OF SECTION 201

SECTION 202 – REMOVAL OF STRUCTURES AND OBSTRUCTIONS

Make the following amendments to said Section:

(I) Amend **202.04 – Measurement** by revising lines 119 to 120 to read as follows:

"**202.04 Measurement.** If the proposal provides a contract item for the removal of structure and obstructions, the Engineer will measure the removal of structures and obstructions by the square yard, each, or linear foot.

The Engineer will not measure the removal of structures and obstructions when contracted on a lump sum basis."

(II) Amend **202.05 – Payment** by revising lines 122 to 131 to read as follows:

"**202.05 Payment.** If the proposal does not show a contract item for the removal of structures and obstructions, the Engineer will not pay for the removal of structures and obstructions separately. The Contractor shall consider them incidental to the various contract items.

The Engineer will pay for specific items stipulated for removal and disposal at the contract price bid per unit specified in the proposal. The price shall be full compensation for removal and disposal of that items, excavation, backfill, salvage of materials removed. Salvaging of materials removed includes their custody, preservation, storage on the right-of-way. Also, the price shall be full compensation for equipment, tools, labor materials and incidentals necessary to complete the work.

The Engineer will pay for the following pay item when included in the proposal schedule:

Pay Item	**Pay Unit**
Removal of _____	Each
Removal of _____	Lump Sum

END OF SECTION 202

Amend **Section 209 - TEMPORARY WATER POLLUTION, DUST, AND EROSION CONTROL** to read as follows:

"SECTION 209 - TEMPORARY WATER POLLUTION, DUST, AND EROSION CONTROL

209.01 Description. This section describes the following:

(A) Including detailed plans, diagrams, and written Site-Specific Best Management Practices (BMP); constructing, maintaining, and repairing temporary water pollution, dust, and erosion control measures at the project site, including local material sources, work areas and haul roads; removing and disposing hazardous wastes; control of fugitive dust (defined as uncontrolled emission of solid airborne particulate matter from any source other than combustion); and complying with applicable State and Federal permit conditions.

(B) Work associated with construction stormwater, dewatering, and hydrotesting activities and complying with conditions of the National Pollutant Discharge Elimination System (NPDES) permit(s) authorizing discharges associated with construction stormwater, dewatering, and hydrotesting activities.

(C) Potential pollutant identification and mitigation measures are listed in Appendix A for use in the development of the Contractor's Site-Specific BMP.

Requirements of this section also apply to construction support activities including concrete or asphalt batch plants, rock crushing plants, equipment staging yards/areas, material storage areas, excavated material disposal areas, and borrow areas located outside the State Right-of-Way. For areas serving multiple construction projects, or operating beyond the completion of the construction project in which it supports, the Contractor shall be responsible for securing the necessary permits, clearances, and documents, and following the conditions of the permits and clearances, at no cost to the State.

209.02 Materials. Comply with applicable materials described in Chapters 2 and 3 of the current HDOT "Construction Best Management Practices Field Manual". In addition, the materials shall comply with the following:

(A) Grass. Grass shall be a quick growing species such as rye grass, Italian rye grass, or cereal grasses. Grass shall be suitable to the area and provide a temporary cover that will not compete later with permanent cover.

Alternative grasses are allowable if acceptable to the Engineer.

(B) Fertilizer and Soil Conditioners. Fertilizer and soil conditioners shall be a standard commercial grade acceptable to the Engineer. Fertilizer shall conform to Subsection 619.02(H)(1) - Commercial Fertilizer.

(C) Hydro-mulching. Hydro-mulching used as a temporary vegetative stabilization measure shall consist of materials in Subsections 209.02(A) - Grass, and 209.02(B) – Fertilizer and Soil Conditioners. Mulches shall be recycled materials including bagasse, hay, straw, wood cellulose bark, wood chips, or other material acceptable to the Engineer. Mulches shall be clean and free of noxious weeds and deleterious materials. Potable water shall meet the requirements of Subsection 712.01 - Water. Submit alternate sources of irrigation water for the Engineer's acceptance if deviating from 712.01 - Water. Installation and other requirements shall be in accordance with portions of Section 641- Hydro-Mulch Seeding including 641.02(D) - Soil and Mulch Tackifier, 641.03(A) – Seeding, and 641.03(B) - Planting Period. Install non-vegetative controls including mulch or rolled erosion control products while the vegetation is being established. Water and fertilize grass. Apply fertilizer as recommended by the manufacturer. Replace grass the Engineer considers unsuitable or sick. Remove and dispose of trash and debris. Remove invasive species. Mow as needed to prevent site or signage obstructions, fire hazard, or nuisance to the public. Do not remove down stream sediment control measures until the vegetation is uniformly established, including no large bare areas, and provides 70 percent of the density of pre-disturbance vegetation. Temporary vegetative stabilization shall not be used longer than one year.

(D) Silt Fences. Comply with ASTM D6462, Standard Practice for Silt Fence Installation.

Alternative materials or methods to control, prevent, remove and dispose pollution are allowable if acceptable to the Engineer.

209.03 Construction.

(A) Preconstruction Requirements.

(1) Water Pollution, Dust, and Erosion Control Meeting. Schedule a water pollution, dust, and erosion control meeting with the Engineer after Site-Specific BMP is accepted in writing by the Engineer. Meeting shall be scheduled a minimum of 7 calendar days prior to the Start Work Date. Discuss sequence of work, plans and proposals for water pollution, dust, and erosion control.

(2) Water Pollution, Dust, and Erosion Control Submittals. Submit a Site-Specific BMP Plan within 21 calendar days of date of award. Submission of complete and acceptable Site-Specific BMP Plan is the sole responsibility of the Contractor and additional contract time will not be issued for delays due to incompleteness. Include the following:

(a) Written description of activities to minimize water pollution and soil erosion into State waters, drainage or sewer systems. BMP shall include the following:

1. An identification of potential pollutants and their sources.

2. A list of all materials and heavy equipment to be used during construction.

3. Descriptions of the methods and devices used to minimize the discharge of pollutants into State waters, drainage or sewer systems.

4. Details of the procedures used for the maintenance and subsequent removal of any erosion or siltation control devices.

5. Methods of removing and disposing hazardous wastes encountered or generated during construction.

6. Methods of removing and disposing concrete and asphalt pavement cutting slurry, concrete curing water, and hydrodemolition water.

7. Spill Control and Prevention and Emergency Spill Response Plan.

8. Fugitive dust control, including dust from grinding, sweeping, or brooming off operations or combination thereof.

9. Methods of storing and handling of oils, paints and other products used for the project.

10. Material storage and handling areas, and other staging areas.

11. Concrete truck washouts.

12. Concrete waste control.

13. Fueling and maintenance of vehicles and other equipment.

14. Tracking of sediment offsite from project entries and exits.

15. Litter management.

16. Toilet facilities.

17. Other factors that may cause water pollution, dust and erosion control.

(b) Provide plans indicating location of water pollution, dust and erosion control devices; provide plans and details of BMPs to be installed or utilized; show areas of soil disturbance in cut and fill, indicate areas used for construction staging and storage including items (1) through (17) above, storage of aggregate (indicate type of aggregate), asphalt cold mix, soil or solid waste, equipment and vehicle parking, and show areas where vegetative practices are to be implemented. Indicate intended drainage pattern on plans. Include flow arrows. Include separate drawing for each phase of construction that alters drainage patterns. Indicate approximate date when device will be installed and removed.

(c) Construction schedule.

(d) Name(s) of specific individual(s) designated responsible for water pollution, dust, and erosion controls on the project site. Include home, cellular, and business telephone numbers, fax numbers, and e-mail addresses.

(e) Description of fill material to be used.

(f) For projects with an NPDES Permit for Construction Activities, submit information to address all sections in the Storm Water Pollution Prevention Plan (SWPPP).

(g) For projects with an NPDES Permit, information required for compliance with the conditions of the Notice of General Permit Coverage (NGPC)/NPDES Permit.

(h) Site-Specific BMP Review Checklist. The checklist may be downloaded from HDOT's Stormwater Management website at http://stormwaterhawaii.com.

Date and sign Site-Specific BMP Plan. Keep accepted copy on site or at an accessible location so that it can be made available at the time of an on-site inspection or upon request by the Engineer, HDOT Third-Party Inspector, and/or DOH/EPA Representative. Amendments to the Site-Specific BMP Plan shall be included with original Site-Specific BMP Plan. Modify SWPPP if necessary to conform to revisions. Include date of installation and removal of Site-Specific BMP measures. Obtain written acceptance by the Engineer before implementing revised Site-Specific BMPs in the field.

Follow the guidelines in the current HDOT "Construction Best Management Practices Field Manual", in developing, installing, and maintaining Site-Specific BMPs for all projects. For any conflicting requirements between the Manual and applicable bid documents, the applicable bid documents will govern. Should a requirement not be clearly described within the applicable bid documents, notify the Engineer immediately for interpretation. For the purposes of clarification "applicable bid documents" include the construction plans, standard specifications, special provisions, Permits, and the SWPPP when applicable.

Follow Honolulu's City and County "Rules for Soil Erosion Standards and Guidelines" for all projects on Oahu. Use respective Soil Erosion Guidelines for Maui, Kauai and Hawaii projects.

(B) Construction Requirements. Do not begin work until submittals detailed in Subsection 209.03(A)(2) - Water Pollution, Dust, and Erosion Control Submittals are completed and accepted in writing by the Engineer.

Install, maintain, monitor, repair and replace site-specific BMP measures, such as for water pollution, dust and erosion control; installation, monitoring, and operation of hydrotesting activities; removal and disposal of hazardous waste indicated on plans, concrete cutting slurry, concrete curing water; or hydrodemolition water. Site-Specific BMP measures shall be in place, functional and accepted by HDOT personnel prior to initiating any ground disturbing activities.

If necessary, furnish and install rain gage in a secure location prior to field work including installation of site-specific BMP. Provide rain gage with a tolerance of at least 0.05 inches of rainfall. Install rain gage on project site in an area that will not deter rainfall from entering the gate opening. Do not install in a location where rain water may splash into rain gage. The rain gage installation shall be stable and plumbed. Maintain rain gage and replace rain gage that is stolen, does not function properly or accurately, is worn out, or needs to be relocated. Do not begin field work until rain gage is installed and Site-Specific BMPs are in place. Rain gage data logs shall be readily available. Submit rain gage data logs weekly to the Engineer.

Address all comments received from the Engineer.

Modify and resubmit plans and construction schedules to correct conditions that develop during construction which were unforeseen during the design and pre-construction stages.

Coordinate temporary control provisions with permanent control features throughout the construction and post-construction period.

Limit maximum surface area of earth material exposed at any time to 300,000 square feet. Do not expose or disturb surface area of earth material (including clearing and grubbing) until BMP measures are installed and accepted in writing by the Engineer. Protect temporarily or permanently disturbed soil surface from rainfall impact, runoff and wind before end of the work day.

Immediately initiate stabilizing exposed soil areas upon completion of earth disturbing activities for areas permanently or temporarily ceased on any portion of the site. Earth-disturbing activities have permanently ceased when clearing and excavation within any area of the construction site that will not include permanent structures has been completed. Earth-disturbing activities have temporarily ceased when clearing, grading, and excavation within any area of the site that will not include permanent structures will not resume for a period of 14 or more calendar days, but such activities will resume in the future. The term “immediately” is used in this section to define the deadline for initiating stabilization measures. “Immediately” means as soon as practicable, but no later than the end of the next work day, following the day when the earth-disturbing activities have temporarily or permanently ceased.

For projects with an NPDES Permit for Construction activities:

(1) For construction areas discharging into waters not impaired for nutrients or sediments, complete initial stabilization within 14 calendar days after the temporary or permanent cessation of earth-disturbing activities.

(2) For construction areas discharging into nutrient or sediment impaired waters, complete initial stabilization within 7 calendar days after the temporary or permanent cessation of earth-disturbing activities.

For projects without an NPDES Permit for Construction activities, complete initial stabilization within 14 calendar days after the temporary or permanent cessation of earth-disturbing activities.

Any of the following types of activities constitutes initiation of stabilization:

(1) Prepping the soil for vegetative or non-vegetative stabilization;

(2) Applying mulch or other non-vegetative product to the exposed area;

(3) Seeding or planting the exposed area;

(4) Starting any of the activities in items (1) – (3) above on a portion of the area to be stabilized, but not on the entire area; and

(5) Finalizing arrangements to have stabilization product fully installed in compliance with the deadline for completing initial stabilization activities.

Any of the following types of activities constitutes completion of initial stabilization activities:

(1) For vegetative stabilization, all activities necessary to initially seed or plant the area to be stabilized; and/or

(2) For non-vegetative stabilization, the installation or application of all such non-vegetative measures.

If the Contractor is unable to meet the deadlines above due to circumstances beyond the Contractor's control, and the Contractor is using vegetative cover for temporary or permanent stabilization, the Contractor may comply with the following stabilization deadlines instead as agreed to by the Engineer:

(1) Immediately initiate, and complete within the timeframe shown above, the installation of temporary non-vegetative stabilization measures to prevent erosion;

(2) Complete all soil conditioning, seeding, watering or irrigation installation, mulching, and other required activities related to the planting and initial establishment of vegetation as soon as conditions or circumstances allow it on the site; and

(3) Notify and provide documentation to the Engineer the circumstances that prevent the Contractor from meeting the deadlines above for stabilization and the schedule the Contractor will follow for initiating and completing initial stabilization and as agreed to by the Engineer.

Follow the applicable requirements of the specifications and special provisions including Section 619 Planting and Section 641 Hydro-Mulch Seeding.

Immediately after seeding or planting the area to be vegetatively stabilized, to the extent necessary to prevent erosion on the seeded or planted area, select, design, and install non-vegetative erosion controls that provide cover (e.g., mulch, rolled erosion control products) to the area while vegetation is becoming established.

Protect exposed or disturbed surface area with mulches, grass seeds or hydromulch. Spray mulches at a rate of 2,000 pounds per acre. Add tackifier to mix at a rate of 85 pounds per acre. Apply grass seeds at a rate of 125 pounds per acre. For hydromulch, use the ingredients and rates required for mulches and grass seeds. Submit recommendations from a licensed Landscape Architect when deviating from the application rates above.

Apply fertilizer to mulches, grass seed or hydromulch per manufacturer's recommendations. Submit recommendations from a licensed Landscape Architect when deviating from the manufacturer's recommendations.

Install velocity dissipation measures when exposing erodible surfaces greater than 15 feet in height.

BMP measures shall be in place and operational at the end of work day or as required by Section 209.03(B) Construction Requirements**.**

Install and maintain either or both stabilized construction entrances and wheel washes to minimize tracking of dirt and mud onto roadways. Restrict traffic to stabilized construction areas only. Clean dirt, mud, or other material tracked onto the road, sidewalk, or other paved area by the end of the same day in which the track-out occurs. Modify stabilized construction entrances to prevent mud from being tracked onto road. Stabilize entire access roads if necessary.

Chemicals may be used as soil stabilizers for either or both erosion and dust control if acceptable to the Engineer.

Provide temporary slope drains of rigid or flexible conduits to carry runoff from cuts and embankments. Provide portable flume at the entrance. Shorten or extend temporary slope drains to ensure proper function.

Protect ditches, channels, and other drainageways leading away from cuts and fills at all times by either:

(1) Hydro-mulching the lower region of embankments in the immediate area.

(2) Installing check dams and siltation control devices.

(3) Other methods acceptable to the Engineer.

Provide for controlled discharge of waters impounded, directed, or controlled by project activities or erosion control measures.

Cover exposed surface of materials completely with tarpaulin or similar device when transporting aggregate, soil, excavated material or material that may be source of fugitive dust.

Cleanup and remove any pollutant that can be attributed to the Contractor.

Install or modify Site-Specific BMP measures due to change in the Contractor's means and methods, or for omitted condition that should have been allowed for in the accepted Site-Specific BMP or a Site-Specific BMP that replaces an accepted Site-Specific BMP that is not satisfactorily performing. Modifications to Site-Specific BMP measures shall be accepted in writing by the Engineer prior to implementation.

Properly maintain all Site-Specific BMP measures.

For projects with an NPDES Permit for Construction Activities:

(1) For construction areas discharging into nutrient or sediment impaired waters, inspect, prepare a written report, and make repairs to BMP measures at the following intervals:

(a) Weekly.

(b) Within 24 hours of any rainfall of 0.25 inch or greater which occurs in a 24-hour period.

(c) When existing erosion control measures are damaged or not operating properly as required by Site-Specific BMP.

(2) For construction areas discharging to waters not impaired for nutrients or sediments, inspect, prepare a written report, and make repairs to BMP measures at the following intervals:

(a) Weekly.

(b) When existing erosion control measures are damaged or not operating properly as required by Site-Specific BMP.

For projects without an NPDES Permit for Construction activities, inspect, prepare a written report, and make repairs to BMP measures at the following intervals:

(a) Weekly.

(b) When existing erosion control measures are damaged or not operating properly as required by Site-Specific BMP.

Temporarily remove, replace or relocate any Site-Specific BMP that must be removed, replaced or relocated due to potential or actual flooding, or potential danger or damage to project or public.

Maintain records of inspections of Site-Specific BMP work. Keep continuous records for duration of the project. Submit copy of Inspection Report to the Engineer within 24 hours after each inspection.

The Contractor's designated representative specified in Subsection 209.03(A)(2)(d) shall address any Site-Specific BMP deficiencies brought up by the Engineer immediately, including weekends and holidays, and complete work to fix the deficiencies by the close of the next work day if the problem does not require significant repair or replacement, or if the problem can be corrected through routine maintenance. Address any Site-Specific BMP deficiencies brought up by the State's Third-Party Inspector in the

timeframe above or as specified in the Consent Decree or MS4 NPDES Permit, whichever is more stringent. The Consent Decree timeframe requirement applies statewide. The MS4 NPDES Permit only applies to Oahu. In this section, "immediately" means the Contractor shall take all reasonable measures to minimize or prevent discharge of pollutants until a permanent solution is installed and made operational. If a problem is identified at a time in the day in which it is too late to initiate repair, initiation of repair shall begin on the following work day. When installation of a new pollution prevention control or a significant repair is needed, complete installation or repair no later than 7 calendar days from the time of notification/Contractor discovery. Notify the Engineer and document why it is infeasible to complete the installation or repair within 7 calendar days and complete the work as soon as practicable and as agreed to by the Engineer. Address Site-Specific BMP deficiencies discovered by the Contractor within the timeframe above. The Contractor's failure to satisfactorily address these Site-Specific BMP deficiencies, the Engineer reserves the right to employ outside assistance or use the Engineer's own labor forces to provide necessary corrective measures. The Engineer will charge the Contractor such incurred costs plus any associated project engineering costs. The Engineer will make appropriate deductions from the Contractor's monthly progress estimate. Failure to apply Site-Specific BMP measures may result in one or more of the following: assessment of liquidated damages, suspension, or cancellation of Contract with the Contractor being fully responsible for all additional costs incurred by the State.

(C) Discharges of Storm Water Associated with Construction Activities. If work includes disturbance of one acre or more, an NPDES Permit authorizing Discharges of Storm Water Associated with Construction Activity (CWB-NOI Form C) or Individual Permit authorizing storm water discharges associated with construction activity is required from the Department of Health Clean Water Branch (DOH-CWB).

Do not begin construction activities until all required conditions of the permit are met and submittals detailed in Subsection 209.03(A)(2) – Water Pollution, Dust, and Erosion Control Submittals are completed and accepted in writing by the Engineer.

(D) Discharges Associated with Hydrotesting Activities. If hydrotesting activities require effluent discharge into State waters or drainage systems, an NPDES Hydrotesting Waters Permit (CWB-NOI Form F) or Individual Permit authorizing discharges associated with hydrotesting from DOH-CWB is required from the DOH-CWB.

Do not begin hydrotesting activities until the DOH-CWB has issued an Individual NPDES Permit or Notice of General Permit Coverage

(NGPC). Conduct Hydrotesting operations in accordance with the conditions of the permit or NGPC.

(E) Discharges Associated with Dewatering Activities. If dewatering activities require effluent discharge into State waters or drainage systems, an NPDES Dewatering Permit (CWB-NOI Form G) or Individual Permit authorizing discharges associated with dewatering from DOH-CWB is required from the DOH-CWB.

Do not begin dewatering activities until the DOH-CWB has issued an Individual NPDES Permit or Notice of General Permit Coverage (NGPC). Conduct dewatering operations in accordance with the conditions of the permit or NGPC.

(F) Solid Waste. Submit the Solid Waste Disclosure Form for Construction Sites to the Engineer within 21 calendar days of date of award. Provide a copy of all the disposal receipts from the facility permitted by the Department of Health to receive solid waste to the Engineer monthly. This should also include documentation from any intermediary facility where solid waste is handled or processed, or as directed by the Engineer.

(G) Construction BMP Training. The Contractor's representative responsible for development of the Site-Specific BMP Plan and implementation of Site-Specific BMPs in the field shall attend the State's Construction Best Management Practices Training. The Contractor shall keep training logs updated and readily available.

209.04 Measurement.

(A) Installation, maintenance, monitoring, and removal of BMP will be paid on a lump sum basis. Measurement for payment will not apply.

(B) The Engineer will only measure additional water pollution, dust and erosion control required and requested by the Engineer on a force account basis in accordance with Subsection 109.06 – Force Account Provisions and Compensation.

209.05 Payment. The Engineer will pay for accepted pay items listed below at contract price per pay unit, as shown in the proposal schedule. Payment will be full compensation for work prescribed in this section and contract documents.

The Engineer will pay for each of the following pay items when included in proposal schedule:

Pay Item	**Pay Unit**
Installation, Maintenance, Monitoring, and Removal of BMP	Lump Sum

Additional Water Pollution, Dust, and Erosion Control Force Account

Permanent Erosion Control Mat Square Foot

An estimated amount for force account is allocated in proposal schedule under ‘Additional Water Pollution, Dust, and Erosion Control’, but actual amount to be paid will be the sum shown on accepted force account records, whether this sum be more or less than estimated amount allocated in proposal schedule. The Engineer will pay for BMP measures requested by the Engineer that are beyond scope of accepted Site-Specific BMP on a force account basis.

No progress payment will be authorized until the Engineer accepts in writing Site-Specific BMP or when the Contractor fails to maintain project site in accordance with accepted BMP.

For all citations or fines received by the Department for non-compliance, including compliance with NPDES Permit conditions, the Contractor shall reimburse State within 30 calendar days for full amount of outstanding cost State has incurred, or the Engineer will deduct cost from progress payment.

The Engineer will assess liquidated damages up to $27,500 per day for non-compliance of each BMP requirement and all other requirements in this section.

Appendix A

The following list identifies potential pollutant sources and corresponding BMPs used to mitigate the pollutants. Each BMP is referenced to the corresponding section of the current HDOT Construction Best Management Practices Field Manual or appropriate Supplemental Sheets. The Manual may be obtained from the HDOT Statewide Stormwater Management Program Website at *http://www.stormwaterhawaii.com/resources/contractors-and-consultants/* under Construction Best Management Practices Field Manual. Supplemental BMP sheets are located at *http://www.stormwaterhawaii.com/resources/contractors-and-consultants/storm-water-pollution-prevention-plan-swppp/* under Concrete Curing and Irrigation Water.

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
Construction debris, green waste, general litter	• *Separate contaminated clean up materials from construction and demolition (C&D) wastes.* • *Provide waste containers (e.g., dumpster or trash receptacle) of sufficient size and number to contain construction and domestic wastes.* • *Inspect construction waste and recycling areas regularly.* • *Schedule solid waste collection regularly.* • *Schedule recycling activities based on construction/demolition phases.* • *Empty waste containers weekly or when they are two-thirds full, whichever is sooner.* • *Do not allow containers to overflow. Clean up immediately if they do.* • *On work days, clean up and dispose of waste in designated waste containers.* • *See Solid Waste Management Section SM-6 for additional requirements.* • *Provide Storm Drain Inlet Protection and/or Perimeter Sediment Controls as applicable.* • *Collect and dispose of all waste materials in trash dumpsters. Place dumpsters, with secure watertight lids, away from storm water conveyances and drains, in a covered materials storage area.* • *Dispose of construction and non- construction solid waste in accordance with State DOH regs.* • *Load removed non- recyclable vegetation directly onto trucks; cover and transport to a licensed facility*	*See Solid Waste Management Section SM-6. Storm Drain Inlet Protection SC-1, and Perimeter Sediment Controls where applicable.*

Pollutant Source	Appropriate Site-Specific BMP to be Implemented	BMP Requirements
Materials associated with the operation and maintenance of equipment, such as oil, fuel, and hydraulic fluid leakage	• *Use off-site wash racks, repair and maintenance facilities, and fueling sites when practical.* • *Designate bermed wash area if cleaning on site is necessary.* • *Place drip pans or drop cloths under vehicles and equipment to absorb spills or leaks.* • *Provide an ample supply of readily available spill cleanup materials.* • *Clean up spills immediately, using dry clean-up methods where possible, and dispose of used materials properly.* • *Do not clean surfaces or spills by hosing the area down.* • *Eliminate the source of the spill to prevent a discharge or a continuation of an ongoing discharge.* • *Inspect on-site vehicles and equipment regularly and immediately repair leaks.* • *Regularly inspect fueling areas and storage tanks.* • *Train employees on proper maintenance and spill practices and procedures and fueling and cleanup procedures.* • *Store diesel fuel, oil, hydraulic fluid, or other petroleum products or other chemicals in water-tight containers and provide cover or secondary containment.* • *Do not remove original product labels and comply with manufacturer's labels for proper disposal.* • *Dispose of containers only after all the product has been used.* • *Dispose of or recycle oil or oily wastes according to Federal, State, and Local requirements.* • *Store soaps, detergents, or solvents under cover or other means to prevent contact with rainwater.* • *See Vehicle and Equipment Cleaning, Maintenance, and Refueling, Sections SM-11, SM-12, and SM-13 and Material Storage and Handling Section SM-2 for additional requirements.*	*See Vehicle and Equipment Cleaning, Maintenance, and Refueling, Sections SM-11, SM-12, and SM-13, and Material Storage and Handling, Section SM-2, and Spill Prevention and Control SM-10.*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
Soil erosion from the disturbed areas	• *Provide Soil Stabilization, Slope Protection, Storm Drain Inlet Protection SC-1, Perimeter Controls and Sediment Barriers, Sediment Basins and Detention Ponds, Check Dams SC-3 ,Level Spreader EC-6, Paving Operations SM-20, Construction Roads and Parking Area Stabilization SC-10, Controlling Storm Water Flowing Onto and Through the Project, Post-Construction BMPs, and Non-Structural BMPs (Construction BMP Training SM-1, Scheduling SM-14, Location of Potential Sources of Sediment SM-15, Preservation of Existing Vegetation SM-17).* • *Delineate, and clearly mark off, with flags, tape, or other similar marking device all natural buffer areas defined in the SWPPP.* • *Preserve native topsoil where practicable.* • *In areas where vegetative stabilization will occur, restrict vehicle/equipment use in areas to avoid soil compaction or condition soil to promote vegetative growth.* • *For Storm Drain Inlet Protection, clean, or remove and replace, the protection measures as sediment accumulates, the filter becomes clogged, and/or performance is compromised.* • *Where there is evidence of sediment accumulation adjacent to the inlet protection measure, remove the deposited sediment by the end of the same day in which it is found or by the end of the following work day if removal by the same day is not feasible.* • *Sediment basins shall be designed and maintained in accordance with HAR Chapter 11-55.* • *Minimize disturbance on steep slopes (Greater than 15% in grade).* • *If disturbance of steep slopes are unavoidable, phase disturbances and use stabilization techniques designed for steep grades.* • *For temporary drains and swales use velocity dissipation devices within and at the outlet to minimize erosive flow velocities.*	*Soil Stabilization* *1. SM-22 Topsoil Management* *2. EC-12 Seeding and Planting* *3. EC-14 Mulching* *4. EC-11 Geotextiles and Mats* *Slope Protection* *1. EC-12 Seeding and Planting* *2. EC-14 Mulching* *3. EC-11 Geotextiles and Mats* *4. EC-4 Slope Roughening, Terracing, and Rounding* *5. EC-7 Slope Drains and Subsurface Drains* *6. EC-9 Slope Interceptor or Diversion Ditches/Berms* *SC-1 Storm Drain Inlet Protection*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	*BMP Requirements*
		Perimeter Controls and Sediment Barriers *1. SC-7 Silt Fence or Filter Fabric Fence* *2. SC-2 Vegetated Filter Strips and Buffers* *3. SC-6 Compost Filter Berm/Sock* *4. SC-8 Sandbag Barrier* *5. SC-9 Brush or Rock Filter* *Sediment Basins and Detention Ponds* *1. SC-4 Sediment Trap* *2. SC-5 Sediment Basin* *SC-3 Check Dams* *EC-6 Level Spreader* *SM-20 Paving Operations* *SC-10 Construction Roads and Parking Area Stabilization*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
		Controlling Storm Water Flowing onto and Through the Project *1. EC-3 Run-On Diversion* *2. EC-5 Earth Dike, Swales and Ditches* *Post Construction BMPs* *1. EC-2 Flared Culvert End Sections* *2. EC-10 Rip-Rap and Gabion Inflow Protection* *3. EC-8 Outlet Protection and Velocity Dissipation Devices* *4. SM-22 Topsoil Management* *Non-Structural BMPs* *1. SM-1 Construction BMP Training* *2. SM-14 Scheduling* *3. SM-15 Location of Potential Sources of Sediment* *4. SM-17 Preservation of Existing Vegetation*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
Sediment from soil stockpiles	• *Locate stockpiles a minimum of 50 feet or as far as practicable from concentrated runoff or outside of any natural buffers identified on the SWPPP.* • *Place bagged materials on pallets and under cover.* • *Provide physical diversion to protect stockpiles from concentrated runoff.* • *Cover stockpiles with plastic or comparable material when practicable.* • *Place silt fence, fiber filtration tubes, or straw wattles around stockpiles.* • *Do not hose down or sweep soil or sediment accumulated on pavement or other impervious surfaces into any storm water conveyance (unless connected to a sediment basin, sediment trap, or similarly effective control), storm drain inlet, or state water.* • *Unless infeasible, contain and securely protect stockpiles from the wind.* • *Provide Storm Drain Inlet Protection and/or Perimeter Sediment Controls as applicable.* *See Stockpile Management Section SM-3 for additional requirements.*	*See Stockpile Management Section SM-3. Storm Drain Inlet Protection SC-1, and Perimeter Sediment Controls where applicable.*
Emulsified asphalt or prime/tack coat	• *Provide training for employees and contractors on proper material delivery and storage practices and procedures.* • *Restrict paving operations during wet weather to prevent paving materials from being discharged.* • *Use asphalt emulsions such as prime coat when possible.* • *Protect drain inlet structures and manholes during application of tack coat, seal coat, slurry seal, and fog seal.* • *Keep ample supplies of drip pans and absorbent materials on site.* • *Inspect inlet protection devices.* • *See Material Storage and Handling Section SM-2 and Paving Operations Section SM-20 for additional requirements.* • *Provide Storm Drain Inlet Protection and/or Perimeter Sediment Controls as applicable.*	*See Material Storage and Handling Section SM-2,* and Stockpile Management Section SM-3, *Paving Operations Section SM-20, Storm Drain Inlet Protection SC-1, and Perimeter Sediment Controls where applicable.*

Pollutant Source	Appropriate Site-Specific BMP to be Implemented	BMP Requirements
Materials associated with painting, such as paint and paint wash solvent	• *Hazardous chemicals shall be well-labeled and stored in original containers.* • *Keep ample supply of cleanup materials on site.* • *Dispose container only after all of the product has been used.* • *Remove as much paint from brushes on painted surface.* • *Rinse from water-based paints shall be discharged into the sanitary sewer system where possible. If not, direct all washwater into a leak-proof container or leak-proof pit. The container or pit must be designed so that no overflows can occur due to inadequate sizing or precipitation.* • *Locate on-site wash area a minimum of 50 feet away or as far as practicable from storm drain inlets, open drainage facilities, or water bodies.* • *Do not dump liquid wastes into the storm drainage system.* • *Filter and re-use solvents and thinners.* • *Dispose of oil-based paints and residue as a hazardous waste.* • *Ensure collection, removal, and disposal of hazardous waste complies with regulations.* • *Immediately clean up spills and leaks.* • *Properly store paints, solvents, and epoxy compounds.* • *Properly store and dispose waste materials generated from painting and structure repair and construction activities.* • *Mix paints in a covered and contained area, when possible, to minimize adverse impacts from spills.* • *Do not apply traffic paint or thermoplastic if rain is forecasted.* • *See Material Storage and Handling Use SM-2, Hazardous Materials and Waste Management Section SM-9, Spill Prevention and Control Section SM-10, and Structure Construction and Painting Section SM-21 for additional requirements.* *Provide Storm Drain Inlet Protection and/or Perimeter Sediment Controls as applicable.*	*See Material Storage and Handling Use Section SM-2, Stockpile Management Section SM-3, Hazardous Materials and Waste Management Section SM-9, Waste Management, Spill Prevention and Control Section SM-10, and Structure Construction and Painting Section SM-21, Storm Drain Inlet Protection SC-1, and Perimeter Sediment Controls where applicable.*

Pollutant Source	Appropriate Site-Specific BMP to be Implemented	BMP Requirements
Industrial chemicals, fertilizers, and/or pesticides	• *Hazardous chemicals shall be well-labeled and stored in original containers.* • *Keep ample supply of cleanup materials on site.* • *Clean up spills immediately, using dry clean-up methods where possible, and dispose of used materials properly.* • *Do not clean surfaces or spills by hosing the area down.* • *Eliminate the source of the spill to prevent a discharge or a furtherance of an ongoing discharge.* • *Dispose container only after all of the product has been used.* • *Retain a complete set of safety data sheets (formerly MSDS) on site.* • *Store industrial chemicals in water-tight containers and provide either cover or secondary containment.* • *Provide cover when storing fertilizers or pesticides to prevent these chemicals from coming into contact with rainwater.* • *Restrict amount of pesticide prepared to quantity necessary for the current application.* • *Do not apply fertilizers or pesticides during or just before a rain event.* • *Do not apply to stormwater conveyance channels with flowing water.* • *Comply with fertilizer and pesticide manufacturer's recommended usage and disposal instructions. Document departures from manufacturer's specifications in Attachment J.* • *Apply fertilizers at the appropriate time of year for the location, and preferably timed to coincide as closely as possible to the period of maximum vegetation uptake and growth.* • *Follow federal, state, and local laws regarding fertilizer application.* • *Do not dispose of toxic liquid wastes (solvents, used oils, and paints) or chemicals (additives, acids, and curing compounds) in dumpsters allocated for construction debris.*	*See Material Storage and Handling Use Section SM-2, Stockpile Management Section SM-3, and Hazardous Materials and Waste Management Section SM-9, and Spill Prevention and Control SM-10*

Pollutant Source	Appropriate Site-Specific BMP to be Implemented	BMP Requirements
	• *Ensure collection, removal, and disposal of hazardous waste complies with regulations. Hazardous waste that cannot be reused or recycled shall be disposed of by a licensed hazardous waste hauler.* *See Material Storage and Handling Use SM-2, and Hazardous Materials and Waste Management Section SM-9 for additional requirements.*	
Hazardous waste (Batteries, Solvents, Treated Lumber, etc.)	• *Do not dispose of toxic materials in dumpsters allocated for construction debris.* • *Ensure collection, removal, and disposal of hazardous waste complies with regulations.* • *Hazardous waste that cannot be reused or recycled shall be disposed of by a licensed hazardous waste hauler.* • *Segregate and recycle wastes from vehicle/equipment maintenance activities such as used oil or oil filters, greases, cleaning solutions, antifreeze, automotive batteries, and hydraulic and transmission fluids.* • *Store waste in sealed containers, which are constructed of suitable materials to prevent leakage and corrosion, and which are labeled in accordance with applicable Resource Conservation and Recovery Act (RCRA) requirements and all other applicable federal, state, and local requirements.* • *All containers stored outside shall be kept away from surface waters and within appropriately sized secondary containment (e.g., spill berms, decks, spill containment pallets). Provide cover if possible.* • *Clean up spills immediately, using dry clean-up methods where possible, and dispose of used materials properly.* • *Do not clean surfaces or spills by hosing the area down.* • *Eliminate the source of the spill to prevent a discharge or a continuation of an ongoing discharge.*	*See Hazardous Materials and Waste Management Section SM-9 and Vehicle and Equipment Maintenance SM-12*

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Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
	• *Ensure collection, removal, and disposal of hazardous waste complies with manufacturer's recommendations and is in compliance with federal, state, and local requirements.* • *See Hazardous Materials and Waste Management Section SM-9 and Vehicle and Equipment Management, Vehicle and Equipment Maintenance SM-12 for additional requirements.*	
Metals and Building Materials	• *Inspect construction waste and recycling areas regularly.* • *Schedule solid waste collection regularly.* • *If building materials or metals are stored on site (such as rebar or galvanized poles) store under cover under tarps or in containers.* • *Minimize the amount of material stored on site.* • *Do not stockpile uncovered metals or other building materials in close proximity to discharge points.* • *See Solid Waste Management Section SM-6 for additional requirements.*	*See Solid Waste Management Section SM-6*
Contaminated Soil	• *See Waste Management, Contaminated Soil Management Section SM-8 and/or Hazardous Materials and Waste Management Section SM-9 for additional requirements.* • *At minimum contain contaminated material soil by surrounding with impermeable lined berms or cover exposed contaminated material with plastic sheets.*	*See Waste Management, Contaminated Soil Management Section SM-8 and/or Hazardous Materials and Waste Management Section SM-9*

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Pollutant Source	Appropriate Site-Specific BMP to be Implemented	BMP Requirements
Fugitive Dust Control and Dust Control Water	• *Do not over spray water for dust control purposes which will result in runoff from the area.* • *Apply water as conditions require.* • *Washing down of debris or dirt into drainage, sewage systems, or State waters is not allowed.* • *Minimize exposed areas through the schedule of construction activities.* • *Utilize vegetation, mulching, sprinkling, and stone/gravel layering to quickly stabilize exposed soil.* • *Direct construction vehicle traffic to stabilized roadways.* • *Cover dump trucks hauling material from the site with a tarpaulin.* *See Dust Control Section SM-19 for additional requirements.*	*See Dust Control Section SM-19*
Concrete Truck Wash Water	• *Disposal of concrete truck wash water via percolation is prohibited.* • *Wash concrete-coated vehicles or equipment off-site or in the designated wash area.* • *Locate on-site wash area a minimum of 50 feet away or as far as practicable from storm drain inlets, open drainage facilities, or water bodies.* • *Runoff from the on-site concrete wash area shall be contained in a temporary pit or level bermed area where the concrete can set.* • *Design the area so that no overflow can occur due to inadequate wash area sizing or precipitation.* • *The temporary pit shall be lined with plastic to prevent seepage of wash water into the ground.* • *Allow wash water to evaporate or collect wash water and all concrete debris in a concrete washout system bin.* • *Do not dump liquid wastes into storm drainage system.* • *Dispose of liquid and solid concrete wastes in compliance with federal, state, and local standards.* • *See Waste Management, Concrete Wash and Waste Management Section SM-4 for additional requirements.*	*See Waste Management, Concrete Wash and Waste Management Section SM-4*

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Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
Sediment Track-Out	• *Include Stabilized Construction Entrance at all points that exit onto paved roads.* • *A sediment trapping device is required if a wash rack is used in conjunction with the stabilized construction entrance/exit.* • *The pavement shall not be cleaned by washing down the street.* • *If sweeping is ineffective or it is necessary to wash the streets, wash water must be contained either by construction of a sump, diverting the water to an acceptable disposal area, or vacuuming the wash water.* • *Use BMPs for adjacent drainage structures.* • *Remove sediment tracked onto the street by the end of the day in which the track-out occurs.* • *Restrict vehicle use to properly designated exit points.* • *Include additional BMPs that remove sediment prior to exit when minimum dimensions cannot be met.* *See Stabilized Construction Entrance/Exit Section SC-11 for additional requirements.*	*See Stabilized Construction Entrance/Exit Section SC-11*
Irrigation Water	• *Consider irrigation requirements.* • *Where possible, avoid species which require irrigation.* • *Design, timing and application methods of irrigation water to eliminate the runoff of excess irrigation water into the storm water drainage system.* *See Seeding and Planting Section EC-12 and California Stormwater BMP Handbook SD-12 Efficient Irrigation included in SWPPP Attachment A for additional requirements.*	*See Seeding and Planting Section EC-12 and California Stormwater BMP Handbook SD-12 Efficient Irrigation*
Hydrotesting Effluent	• *If work includes removing, relocation or installing waterlines, and Contractor elects to flush waterline or discharge hydrotesting effluent into State waters or drainage systems, the Contractor shall prepare and obtain HDOT acceptance of a NOI/NPDES Permit Form F application for HDOT submittal to DOH CWB at least 30 calendar days prior to the start of Hydrotesting Activities if necessary. Site specific BMPs will be included in the NOI/NPDES Permit Form F submittal.*	*Site specific BMPs will be included in the NOI/NPDES Permit Form F submittal.*

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Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
Dewatering Effluent	*If excavation or backfilling operations require dewatering, and Contractor elects to discharge dewatering effluent into State waters or existing drainage systems, Contractor shall prepare and obtain HDOT acceptance of a NOI/NPDES Permit Form G application for HDOT submittal to DOH CWB at least 30 calendar days prior to the start of Dewatering Activities if necessary. See Site Planning and General Practices, Dewatering Operations Section SM-18 for additional requirements.*	*See Dewatering Operations SM-18. Site specific BMPs will be included in the NOI/NPDES Permit Form G submittal.*
Saw-cutting Slurry	• *Saw cut slurry shall be removed from the site by vacuuming.* • *Provide storm drain protection during saw cutting. See Paving Operations Section SM-20 for additional requirements.* *Provide Storm Drain Inlet Protection and/or Perimeter Sediment Controls as applicable.*	*See Paving Operations Section SM-20, Storm Drain Inlet Protection SC-1, Perimeter sediment controls where applicable*
Concrete Curing Water	• *Avoid overspraying of curing compounds.* • *Apply an amount of compound that covers the surface, but does not allow any runoff of the compound.* *See California Stormwater BMP Handbook NS-12 Concrete Curing included in SWPPP Attachment A for additional requirements.*	*See California Stormwater BMP Handbook NS-12 Concrete Curing*

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Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
Plaster Waste Water	• *Direct all washwater into a leak-proof container or leak-proof pit. The container or pit must be designed so that no overflows can occur due to inadequate sizing or precipitation.* • *Locate on-site wash area a minimum of 50 feet away or as far as practicable from storm drain inlets, open drainage facilities, or water bodies.* • *Any significant residual materials remaining on the ground after the completion of construction shall be removed and properly disposed. If the residual materials contaminate the soil, then the contaminated soil shall also be removed and properly disposed of.* • *Plaster waste water shall not be allowed to flow into drainage structures or State waters. See Material, Storage and Handling Use SM-2, Stockpile Management Use Section SM-3, and Hazardous Materials and Waste Management Section SM-9 for additional requirements.*	*See Material, Storage and Handling Use Section SM-2, Stockpile Management Use Section SM-3, and Hazardous Materials and Waste Management Section SM-9*
Water-Jet Wash Water	• *For Water-Jet Wash Water used to clean vehicles, use off site wash racks or commercial washing facilities when practical.* • *See Vehicle and Equipment Cleaning Section SM-11 for additional information.* • *For Water-Jet Wash Water used to clean impervious surfaces, the runoff shall not be allowed to flow into drainage structures or State Waters.*	*See Vehicle and Equipment Cleaning Section SM-11*
Sanitary/Septic Waste	• *Locate Sanitary facilities in a convenient place away from drainage facilities.* • *Position sanitary facilities so they are secure and will not be tipped over or knocked down.* • *Wastewater shall not be discharged to the ground or buried.* • *A licensed service provider shall maintain sanitary/septic facilities in good working order.* • *Schedule regular waste collection by a licensed transporter.* • *See Sanitary Waste Section SM-7 for additional requirements.*	*See Sanitary Waste Section SM-7.*

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612 **END OF SECTION 209**

DIVISION 300 - BASES

SECTION 304 – AGGREGATE BASE COURSE

Make the following amendments to said Section:

(I) Amend **304.04 – Measurement** by revising lines 54 to 55 to read as follows:

"**304.04 Measurement.**

Aggregate base will be paid on a lump sum basis. Measurement for payment will not apply.

(II) Amend **304.05 – Payment** by revising lines 57 to 66 to read as follows:

"**304.05 Payment.** The Engineer will pay for the accepted aggregate base at the contract price per pay unit, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for the following pay item when included in the proposal schedule:

Pay Item	Pay Unit
Aggregate Base Course	Cubic Yard

END OF SECTION 304

DIVISION 400 - PAVEMENT

SECTION 401 – HOT MIX ASPHALT (HMA) PAVEMENT

Make the following amendments to said Sections:

(I) Amend **Section 401.02 Materials**, by adding the following after line 14:

"Warm Mix Asphalt Additive 702.06"

(II) Amend **Section 401.02(A) General**, by adding the following paragraph after line 24:

"The manufacture of HMA may include warm mix asphalt (WMA) processes in accordance with these specifications. WMA processes include combinations of organic additives, chemical additives, and foaming."

(III) Amend **Section 401.02(A) General**, by replacing lines 36 - 37 to read as follows:

"In surface and binder courses, aggregate for HMA may include RAP quantities up to 20 percent of total mix weight."

(IV) Amend **Section 401.02(C) Submittals**, by adding the following paragraph after line 89:

"The Contractor may use warm mix asphalt (WMA) processes in the production of HMA. The Contractor shall submit to the Engineer for approval, the proposed process and how it will be used in the manufacture of HMA. The process submittal shall include the temperature range of the WMA."

(V) Amend **Section 401.03(B)(3) Asphalt Pavers**, from line 200 to include the following:

"**(h)** Equipped with a mean of preventing the segregation of the coarse aggregate particles from the remainder of the bituminous plant mix when that mix is carried from the paver hopper back to the paver augers. The means and methods used shall be approved by the paver manufacturer and may consist of chain curtains, deflector plates, or other such devices and any combination of these.

The following specific requirements shall apply to the identified bituminous pavers:

(1) Blaw-Knox bituminous pavers shall be equipped with the Blaw-Knox Materials Management Kit (MMK).

(2) Cedarapids bituminous pavers shall be those that were manufactured in 1989 or later.

(3) Barber-Green/Caterpillar bituminous pavers shall be equipped with deflector plates as identified in the December 2000 Service Magazine entitled “New Asphalt Deflector Kit {6630, 6631, 6640}”.

Prior to the start of using the paver for placing plant mix, the Contractor shall submit for approval a full description in writing of the means and methodologies that will be used to prevent bituminous paver segregation. Use of the paver shall not commence prior to receiving approval from the Engineer.

The Contractor shall supply a Certificate of Compliance that verifies that the approved means and methods used to prevent bituminous paver segregation have been implemented on all pavers used on the project and is working in accordance with the manufacturer’s requirements.”

(VI) Amend **Section 401.03(F)(1) HMA Pavement Courses One and a Half Inches Thick Or Greater**, from lines 499 to 505 to read as follows:

“**(1) HMA Pavement Courses One and a Half Inches Thick Or Greater.** Where HMA pavement compacted thickness indicated in the contract documents is 1-1/2 inches or greater, compact to not less than 92.0 percent nor greater than 97.0 percent of the maximum specific gravity determined in accordance with AASHTO T 209, modified by deletion of Supplemental Procedure for Mixtures Containing Porous Aggregate.”

(VII) Amend **Section 401.03(F)(3) HMA Pavement Courses One and a Half Inches Thick or Greater In Special Areas Not Designated For Vehicular Traffic**, from lines 530 to 538 to read as follows:

“**(3) HMA Pavement Courses One and a Half Inches Thick or Greater In Special Areas Not Designated For Vehicular Traffic.**

For areas such as bikeways that are not part of roadway and other areas not subjected to vehicular traffic, compact to not less that 90.0 percent of maximum specific gravity determined in accordance with AASHTO T 209, modified by deletion of Supplemental Procedure for Mixtures Containing Porous Aggregate. Increase asphalt content by at least 0.5 percent above that used for HMA pavements designed for vehicular traffic."

(VIII) Amend **Section 401.04 Measurement**, from lines 597 to 603 to read as follows:

"**401.04 Measurement.**

The Engineer will measure asphalt concrete pavement per ton in accordance with the contract documents."

(IX) Amend **Section 401.05 Payment**, from lines 605 to 635, to read as follows:

"**401.05 Payment.** The Engineer will pay for the accepted pay items listed below at the contract price per pay unit, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for each of the following pay items when included in the proposal schedule:

Pay Item	**Pay Unit**
HMA Pavement, Mix No. _____	Ton

(1) 80% of the contract unit price upon completion of submitting a job-mix formula acceptable to the Engineer; preparing the surface, spreading, and finishing the mixture; and compacting the mixture;

(2) 20% of the contract unit price upon completion of cutting samples from the compacted pavement for testing; placing and compacting the sampled area with new material conforming to the surrounding area; protecting the pavement; and final analysis.

The Engineer will pay for cold planing in accordance with and under Section 415 – Cold Planing of Existing Pavement.

The Engineer will pay for adjusting existing frames and covers and valve boxes in accordance with and under Section 604 – Manholes, Inlets and Catch Basins and Section 626 – Manholes and Valve Boxes for Water and Sewer Systems.

The Engineer may, in lieu of requiring removal and replacement, use the sliding scale factor to accept HMA pavements compacted below 92.0 percent and above 97.0 percent. The Engineer will make payment for the material in that production day at a reduced price arrived at by multiplying the contract unit price by the pay factor shown in Table 401.05-1.

Table 401.05-1 – Sliding Scale Pay Factor for Compaction

Percent Compaction	Percentage Payment
> 98.0	Removal
97.1 - 98.0	95
92.0 - 97.0	100
90.0 - 91.9	80
<90.0	Removal

"

END OF SECTION 401

SECTION 415 – COLD PLANING OF EXISTING PAVEMENT

Make the following amendments to said Sections:

(I) Amend **Section 415.04 Measurement**, from line 67 to 68 to read as follows:

"**415.04 Measurement.**

Cold Planing will be paid on a lump sum basis. Measurement for payment will not apply."

(II) Amend **Section 415.05 Payment**, from line 70 to 79 to read as follows:

"**415.05 Payment.** The Engineer will pay for the accepted pay items listed below at the contract price per pay unit, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for one of the following pay items when included in the proposal schedule:

Pay Item	**Pay Unit**
Cold Planing	Lump Sum

END OF SECTION 415

DIVISION 500 - STRUCTURES

SECTION 503 - CONCRETE STRUCTURES

Make the following amendments to said Section:

(I) Amend **503.04 – Measurement** by revising lines 1201 to 1205 to read as follows:

"**503.04 Measurement.** The Engineer will measure the concrete by square yard or cubic yard according to the dimensions shown in the contract or as ordered by the Engineer.

The Engineer will not measure concrete when contracted on a lump sum basis.

The Engineer will not make deductions for the volume occupied by reinforcing steel, piles, floor drains, weepholes, timber bumpers, pipes less than eight (8) inches, conduits, or expansion joint materials.

The Engineer will consider the wingwalls to be a part of the structure."

(II) Amend **503.05 – Payment** by revising lines 1206 to 1223 to read as follows:

"**503.05 Payment.** The Engineer will pay for the accepted quantities of concrete complete in place at the contract unit price per cubic yard, each, or at the contract lump sum price for the pay items listed below and contained in the proposal.

The contract unit price or lump sum amount paid shall be full compensation for the concrete; for placing, curing and finishing; for furnishing materials including admixtures and cement (including extra cement added to concrete deposited under water); for furnishing and installing drains, scuppers, premolded joint fillers, joint seals, waterproofing at construction joints, waterstops, pipes and conduits; for furnishing and installing metal rockers, anchor bolts, structural shapes for expansion joints and other similar items; for timber bumpers, forms, form lining and falsework or centering, bearing pads, structural steel bearing plates; and for equipment, tools, labor, materials and incidentals necessary to complete the work.

The Engineer will pay for the following pay item when included in the proposal schedule:

Pay Item	Pay Unit
Concrete Stairs	Cubic Yard

Concrete Pad	Cubic Yard
Concrete Wheelstop	Each

The Engineer will pay for excavation and backfill for foundations in accordance with and under Section 205 – Excavation and Backfill for Bridge and Retaining Structures and Section 206 – Excavation and Backfill for Drainage Facilities."

END OF SECTION 503

DIVISION 600 - MISCELLANEOUS CONSTRUCTION

Amend **Section 601 - STRUCTURAL CONCRETE** to read as follows:

SECTION 601 - STRUCTURAL CONCRETE

601.01 Description. This section describes structural concrete consisting of Portland Cement, fine aggregate, coarse aggregate, and water. This will include adding admixtures for the purpose of entraining air, retarding or accelerating set, tinting, and other purposes as required or permitted. To reduce the embodied carbon footprint of concrete, concrete design on the island of Oahu shall include the use of carbon dioxide mineralization or equivalent technology. Other methods to reduce the cement content such as use of supplementary cementitious materials (SCMs) or admixtures such as C-S-H nanoparticle-based strength-enhancing admixture (CSH-SEA) or equivalent may also be used to reduce the embodied carbon footprint including the combination thereof the previously mentioned methods.

601.02 Materials.

Portland Cement	701.01
Fine Aggregate for Concrete	703.01
Coarse Aggregate for Portland Cement Concrete	703.02
Admixtures	711.03
Water	712.01

Use coarse aggregate for lightweight concrete conforming to ASTM C330 except Sections 5, 7 and 9.

601.03 Construction.

(A) Quality Control. Portland Cement concrete production requires Contractor responsibility for quality control of materials during handling, blending, mixing, curing, and placement operations.

Sample, test, and inspect concrete to ensure quality control of component materials and concrete. Sampling and testing for quality control in accordance with standard methods shall be performed by certified ACI Concrete Field Technician Grade I. Perform quality control tests for slump, air content, temperature, and unit weight during production of structural concrete other than concrete for incidental construction. Submit quality control test results.

(B) Design and Designation of Concrete. Design concrete mixture for concrete work specified. Submit mix design using State Highways Division form DOT 4-151 or an Engineer accepted equivalent form. Do not start work until the Engineer accepts mix design. The Engineer will accept concrete mix design using information given in Table 601.03-1 - Design of Concrete, and other pertinent requirements.

Whenever 28-day compressive strength, f'_c, is 4,000 psi or greater, designate concrete by required minimum 28-day compressive strength.

The 28-day compressive strength, f'_c, less than 4,000 psi listed in Table 601.03-1 – Design of Concrete, is for design information and designation of class only.

Proportion concrete designated by compressive strength such that concrete conforms to required strength.

Design concrete placed in bridge decks and pavements exposed to traffic wear, with air content of 3 percent, including entrapped and entrained air. Maintain air content for plastic concrete within tolerance of 1 percent air content, plus or minus, during the work.

Use Class BD concrete in bridge deck unless concrete is designated by compressive strength. Incorporate anti-corrosion and shrinkage reduction, water-reducing and set-retarding admixture into concrete mix design, with capability of varying degree of retardation without adversely affecting other characteristics of concrete. Submit design admixture dosage.

Class A concrete shall be used when type of concrete is not indicated in the contract documents.

Design concrete as specified in Table 601.03-1 – Design of Concrete.

TABLE 601.03-1 - DESIGN OF CONCRETE (800 Maximum Cement Content lbs./c.y.)					
Class of Concrete	**28-Day Strength** f'_C, psi.	**Minimum Cement Content lbs./c.y.**	**Maximum Water-Cement Ratio, lb./lb.**	**Minimum Cement Content with Mineralized CO2 lbs./c.y.**	**Maximum Water-Cement Ratio with Mineralized CO2 lb./lb.**
A	3000	532	0.59	504	0.62
B	2500	475	0.66	450	0.70
C	2000	418	0.75	396	0.79
D	1500	380	0.85	360	0.87
BD	3750	610	0.49	NA	NA
SEAL	3000	610	0.55	NA	NA
Designated by Strength f'_c or $^*f'_r$	As Specified	610	0.49	NA	NA
$^*f'_r$ = Specified Modulus of Rupture					

Concrete Design – Projects on Oahu will utilize CO_2 Mineralization technology or equivalent. Supplementary cementitious materials (SCMs), CSH-SEA or equivalent or combination thereof the previously mentioned methods may also be used. Concrete design shall allow a reduction of portland cement content while maintaining the concrete design strength, durability and other requirements. See Table 601.03-1 Design of Concrete specified limits for adjusted minimum cement content and water cement ratio when using CO_2 mineralization. Material certifications for the above shall include a list of at least 3 projects that used the technology, SCMs, admixtures or combination thereof.

Use the absolute volume method to proportion concrete materials in accordance with requirements of concrete designated by class, cement content in pounds per cubic yards, or specified 28-day compressive strength. Use absolute volumetric proportioning methods as outlined in the American Concrete Institute (ACI) Standard 211.1, "Recommended Practices for Selecting Proportions for Normal and Heavyweight Concrete."

Use coarse aggregate size No. 57 (one inch to No. 4) or No. 67 (3/4 inch to No. 4) for concrete. For concrete placed in bottom slabs and stems of box girders, use No. 67 size aggregate. Smaller size aggregates may be permitted when encountering limited space between forms and reinforcement or between reinforcement when accepted by the Engineer in writing. Maximum aggregate size shall not be greater than 1/3 of the space between reinforcing steel bars or reinforcing steel and the form.

Use the following standard methods in Table 601.03-2 – Standard Methods for determining compliance with requirements indicated in this subsection:

TABLE 601.03-2 – STANDARD METHODS

Sampling Fresh Mixed Concrete	AASHTO T 141
Mass Per Cubic Meter (Cubic Foot) Yield and Air Content (Gravimetric) of Concrete	AASHTO T 121
Slump of Hydraulic Cement Concrete	AASHTO T 119
Air Content of Freshly Mixed Concrete by the Pressure Method	AASHTO T 152
Specific Gravity and Absorption of Fine Aggregate	AASHTO T 84
Specific Gravity and Absorption of Coarse Aggregate	AASHTO T 85
Temperature of Freshly Mixed Portland Cement Concrete	ASTM C1064
Making and Curing Concrete Test Specimens in the Field	AASHTO T 23
Compressive Strength of Molded Concrete Cylindrical Specimens	AASHTO T 22 (4 inch by 8 inch or 6 inch by 12 inch cylinders)
Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)	AASHTO T 97

When concrete is designated by compressive strength, f'_c, or flexural strength, f'_r, or includes CO2 Mineralization technology, CSH-SEA or SCMs, the Engineer will require prequalification of materials and mix proportions proposed for use before placing such concrete. The Engineer will prequalify concrete based on past performance records using statistical computations of population sizes and (n-1) weighting, or trial batch test reports in compliance with computed minimum average strength for material and mix proportions. The Engineer will determine minimum average strength on probability of not more than one in 20 tests falling below specified strength for the following conditions:

(1) When past performance records are available, furnish the following documented performance records:

(a) Minimum of 15 consecutive 28-day strength tests from projects having same materials and mix proportions.

(b) Two groups totaling 30 or more test results representing similar materials in which mix proportion strengths are within 20 percent of specified strength, from data obtained within one year of proposed use.

The Engineer will analyze performance records to establish standard deviation.

(2) When sufficient past performance records are not provided, the Engineer will assume current standard deviation to be 500 psi for compressive strength, f'_c, and 50 psi for flexural strength, f'_r.

Unless sufficient performance records are available from other projects at DOT Materials Testing and Research Branch, submit test performance records or trial test reports for prequalifications, based on data of most recent tests made on concrete of proposed mix design, and data obtained within one year of proposed use.

When shrinkage reducing admixtures are used, submit test results showing compliance to the Contract Documents' requirements.

Include the following information in test data and trial batch test reports: date of mixing; mixing equipment and procedures used; size of batch in cubic yards and weight, type, and source of ingredients used; slump of concrete; air content of concrete when using air entraining agent; age at time of testing; and strength of concrete cylinders tested.

Show that concrete strength tests equal or exceed minimum average strength in trial test reports. Test is average 28-day test results of five consecutive concrete cylinders or concrete beams taken from single batch. No cylinder or beam shall have strength less than 85 percent of minimum average strength.

Submit test data and trial test reports signed by official of firm that performed tests.

The Engineer reserves the right to stop work when a series of low strength tests occur. Do not continue concrete work until cause is established and the Engineer is informed of and accepts, necessary corrective action to be taken.

(C) Batching. Measure and batch materials in accordance with the following provisions:

(1) Portland Cement. Either sacked or bulk cement may be used. Do not use fraction of sack of cement in concrete batch unless cement is weighed.

Weigh bulk cement on weighing device accepted by the Engineer. Seal and vent bulk cement-weighing hopper properly to preclude dusting during operation. Do not suspend discharge chute from weighing hopper. Arrange discharge chute so that cement will not lodge in hopper or leak from hopper.

Batching accuracy shall be within 1 percent, plus or minus, of required weight.

(2) Water. Measure water by volume or by weight. Use readily adjustable device for measurement of water, with accuracy within 1 percent, plus or minus, of quantity of water required for batch. Arrange device so that variable pressure in water supply line does not affect measurements. Equip measuring tanks with outside taps and valves or other accepted means to allow for checking calibration.

(3) Aggregates. When storing and stockpiling aggregates, avoid separation of coarse and fine particles within each size, and do not intermix various sizes before proportioning. Protect stored or stockpiled aggregates from dust or other foreign matter. Do not stockpile together, aggregates from different sources and of different gradations.

When transporting aggregates from stockpiles or other sources to batching plant, ensure uniform grading of material is maintained. Do not use aggregates that have become segregated or mixed with earth or foreign matter. Stockpile or bin aggregates at least 12 hours before batching. Produce or handle aggregates by hydraulic methods and wash and drain aggregates. If aggregates exhibit high or non-uniform moisture content, the Engineer will order storage or stockpiling for more than 12 hours.

Proportion aggregates by weight, with the exception that aggregates in concrete for minor structures, curbs, and sidewalks may be proportioned by either volume or weight. For volumetric proportioning, use measuring boxes of known capacity to measure quantity of each aggregate size.

Use batch weight based on dry materials plus total weight of moisture (both absorbed and surface) contained in aggregate. Measure individual aggregates to within 2 percent, plus or minus, of required weight, and total weight of aggregates to within 1 percent, plus or minus, of required weight.

(4) Admixtures. Store, proportion, and dispense admixtures in accordance with the following provisions:

(a) Liquid Admixtures. Dispense chemical admixtures, air entraining admixtures, and corrosion inhibiting admixtures in liquid form. Use mechanical dispensers for liquid admixtures with sufficient capacity to measure prescribed quantity for each batch of concrete. Include graduated measuring unit in each dispenser to measure liquid admixtures to within 5 percent, plus or minus, of prescribed quantity for each batch. Read graduations accurately from point of measuring unit, and control proportioning operations to permit visual check of batch accuracy before discharging. Mark each measuring unit clearly for type and quantity of admixture.

Arrange with supplier to provide sampling device consisting of valve located in safe and accessible location for sampling admixtures.

When using more than one liquid admixture for concrete mix, use separate measuring unit for each liquid admixture and dispense separately to avoid interaction that may interfere with admixture efficiency and adversely affect concrete. Dispense liquid admixture by injecting so as not to mix admixture at high concentrations.

When using liquid admixtures in concrete that is completely mixed in paving or continuous mixers, operate dispensers automatically with batching control equipment. Equip such dispensers with automatic warning system that shall provide visible or audible signals at points where proportioning operations are controlled, when the following occurs:

a. Quantity of admixture measured for each batch of concrete varies from pre-selected dosage by more than 5 percent; or

b. Entire contents of measuring unit from dispenser is not emptied into each batch of concrete.

Unless liquid admixtures are added to batch with pre-measured water, discharge liquid admixtures into stream of water that disperses admixtures uniformly throughout batch. An exception is that air-entraining admixtures may be dispensed directly into moist sand in batching bins, provided adequate control of concrete air content can be maintained.

Measure and disperse special admixtures, as recommended by admixture manufacturer, and as accepted by the Engineer. Special admixtures include high-range water reducers requiring dosages greater than capacity of conventional dispensing equipment. For site-added, high-range water reducers, use calibrated, portable dispenser supplied by manufacturer.

(b) Mineral Admixtures. Protect mineral admixtures from exposure to moisture until used. Pile sacked material of each shipment to permit access for tally, inspection, and identification.

Provide adequate facilities to ensure that mineral admixtures meeting specified requirements are kept separate from other mineral admixtures and that only specified mineral admixtures are allowed to enter into the work. Provide safe and suitable facilities for sampling mineral admixtures at weigh hopper or in feed line immediately in advance of hopper.

Incorporate mineral admixtures into concrete using equipment conforming requirements for Portland Cement weigh hoppers and charging and discharging mechanisms specified in ASTM C94 and Subsection 601.03(C) - Batching.

When concrete is completely mixed in stationary paving or continuous mixers, weigh mineral admixture in separate weigh hopper. Introduce mineral admixture and cement simultaneously into mixer, proportionately with aggregate.

When interlocks are required for cement-charging mechanisms, and cement and mineral admixtures are weighed cumulatively, interlock their charging mechanisms to prevent introduction of mineral admixture until mass of cement in weigh hopper is within tolerances specified in Subsection 601.03(C)(1) - Portland Cement.

In determining maximum quantity of free water that may be used in concrete, consider mineral admixture and supplementary cementitious materials (SCMs) to be cement.

(5) Bins and Scales. At batching plant, use individual bins, hoppers, and scale for each aggregate size. Include separate bin, hopper, and scale for bulk cement and fly ash.

Except when proportioning bulk cement for pavement or structures, cement weigh hopper may be attached to separate scale for individual weighing or to aggregate scale for cumulative weighing. If cement is weighed cumulatively, weigh cement before other ingredients.

When proportioning for pavement or structures, keep bulk cement scale and weigh hopper separate and distinct from aggregate weighing equipment.

Use springless-dial or beam-type batching scales. When using beam-type scales, make provisions to show operator that required load in weighing hopper is approaching. Use devices that show condition within last 200 pounds of load and within 50 pounds of overload.

Maintain scale accuracy to 0.5 percent throughout range of use. Design poises to lock to prevent unauthorized change of position. Use scales inspected by the State Measurement Standards Branch of the Department of Agriculture to ensure their continued accuracy. Provide not less than ten 50-pound weights for testing scales.

Batching plants may be equipped to proportion aggregates and bulk cement by automatic weighing devices.

(6) Batching and Hauling. When mixing is to be performed at work site, transport aggregates from batching plant to mixer in batch boxes, vehicle bodies, or other containers of adequate capacity and construction. Use partitions to separate batches and prevent spilling from one compartment to another while in transit or during dumping.

Transport bulk cement to mixer in tight compartments carrying full quantity of cement required for batch. Once cement is placed in contact with aggregates, batches shall be mixed and placed within 1-1/2 hours of contact. Cement in original shipping packages may be transported on top of aggregates. Ensure that each batch contains number of sacks required by job mix.

Deliver batches to mixer intact. Charge each batch into mixer without loss of cement. When carrying more than one batch on truck, charge batch into mixer without spilling material from one batch compartment into another.

(D) Mixing. Mix concrete in mechanically operated mixers.

Use stationary or truck mixers that distribute materials thoroughly and produce concrete uniform in color and appearance. When there is variation in mixed concrete attributable to worn pickup or throw-over blades, the Engineer will inspect mixer. If inspection reveals that blades are worn more than one inch below original height of manufacturer's design, repair or replace blades. Upon request, make copy of manufacturer's design, showing dimensions and arrangement of blades.

Charge batches into central or truck mixers so that portion of mixing water enters ahead of cement and aggregates. Deliver uniform flow of water. Place entire amount of batch water in mixer by end of first quarter of mixing period. When mixers with multiple compartment drums are used, time required to transfer material between compartments will be included as mixing time. Use drum rotation speed as designated by manufacturer. If mixing does not produce concrete of uniform and smooth texture, provide additional revolutions at same speed until thorough mixing of each concrete batch is attained. Begin measuring mixing time from time cement, aggregates, and 60 percent of water are in drum. Do not exceed manufacturer's rated capacity for volume of concrete mixed in each batch.

Equip central or truck mixers with attachment for automatically timing mixing of each concrete batch. Timing device shall include automatic feature for locking discharge chute and device for warning operator when required mixing duration has been met. If timing or locking device fails to operate, immediately furnish clock or watch that indicates seconds, to mixer operator. If timing device is not repaired within three days after becoming inoperative, shut down batching operation until timing device is repaired.

For stationary mixers, use mixing time between 50 seconds and 5 minutes. Select mixing time, as necessary, to produce concrete that meets uniformity criteria when tested in accordance with Section 11.3.3 of ASTM C94. The Contractor may designate mixing time for which uniformity tests are to be performed, provided mixing time is not less than 50 seconds or more than 5 minutes. Before using concrete for pavements or structures, mix concrete to meet specified uniformity requirements. The Contractor shall furnish labor, sampling equipment, and materials required for conducting uniformity tests of concrete mixture. The Engineer will furnish required testing equipment, including scales, cubic measure, and air meter; and will perform tests. The Engineer will not pay separately for labor, equipment, materials, or testing, but will consider the costs incidental to concrete. After batching and mixing operational procedures are established, the Engineer will not allow changes in procedures without the Contractor re-establishing procedures by conducting uniformity tests. Repeat mixer performance tests whenever appearance of concrete or coarse aggregate content of samples is not conforming to requirements of ASTM C94. For truck mixers, add four seconds to specified mixing time if timing starts as soon as skip reaches its maximum raised position.

Unless otherwise indicated in the contract documents or accepted by the Engineer, concrete shall be mixed at proportioning plant. Operate mixer at agitating speed while in transit. Concrete may be truck-mixed only when cement or cement and mixing water are added at point of delivery. Begin mixing truck-mixed concrete immediately after introduction of mixing water to cement and aggregates, or introduction of cement to aggregates.

Inclined-axis, revolving drum truck mixers shall conform to Truck Mixer, Agitator and Front Discharge Concrete Carrier Standards TMMB 100-01, 15th Revision, published by Truck Mixer Manufacturers Bureau. Truck mixers shall produce thoroughly mixed and uniform mass of concrete and shall discharge concrete without segregation.

Manufacturer's standard metal rating plate shall be attached to each truck mixer, stating maximum rating capacity in terms of volume of mixed concrete for various uses and maximum and minimum mixing speeds. When using truck mixers for mixing, adhere to maximum capacity shown on metal rating plate for volume of concrete in each batch.

Operate truck mixers at mixing speed designated by manufacturer, but at not less than 6 or more than 18 revolutions per minute. Mix truck-mixed concrete initially between 70 and 100 revolutions at manufacturer-designated mixing speed, after ingredients, including water, are in mixer. Water may be added to mixture not more than two times after initial mixing is completed. Each time that water is added, turn drum an additional 30 revolutions or more at mixing speed until concrete is mixed uniformly.

When furnishing shrink-mixed concrete, transfer partially mixed concrete at central plant to truck mixer. Apply requirements for truck-mixed concrete. The Engineer will not credit number of revolutions at mixing speed for partial mixing in central plant.

When accepted by the Engineer, hand mixing may be allowed. The entire concrete placement at one location shall not exceed 1/3 cubic yard. It shall be hand mixed on a watertight, level platform. Use no aluminum to construct platform. Measure proper amount of coarse aggregate in measuring boxes and spread on platform. Spread fine aggregate on that coarse aggregate layer. Limit coarse and fine aggregate layers to total depth of one foot. Spread dry cement on this mixture. Turn whole mass not less than two times dry. Add sufficient clean water, distributed evenly. Turn whole mass again, not less than three times, not including placing in carriers or forms.

(E) Transporting Mixed Concrete. Transport central-mixed concrete to delivery point in truck agitators or truck mixers operating at speed designated by equipment manufacturer as agitating speed; or in non-agitating hauling equipment, provided consistency and workability of mixed concrete upon discharge at delivery point is suitable for placement and consolidation in place; and provided mixed concrete after hauling to delivery point conforms to uniformity criteria when tested as specified in Section 12.5 of ASTM C94.

For revolving drum truck mixers transporting central-mixed concrete, limit concrete volume to manufacturer's rated capacity for agitator operation. Maintain agitating speed for both revolving drum mixers and revolving blade type agitators as designated on manufacturer's data plate. Equip truck mixers or truck agitators with electrically or mechanically actuated counters. Actuate counters after introducing cement to aggregates.

Bodies of non-agitating hauling equipment shall be smooth, watertight, metal containers equipped with gates to permit control of concrete discharge. Protect open-topped haul vehicle against weather with cover accepted by the Engineer.

When hauling concrete in non-agitating trucks, complete discharge within 30 minutes after introducing mixing water to cement and aggregates.

When truck mixer or agitator is used for transporting central-mixed concrete to delivery point, complete discharge within 1-1/2 hours, or before 250 revolutions of drum or blades, whichever comes first after introduction of mixing water to cement and aggregates, or cement to aggregates. For truck-mixed concrete, complete concrete discharge within 1-1/2 hours, or before 300 revolutions of drum or blades, whichever comes first. These limitations are permitted to waived if concrete is of such slump after the 1-1/2 hour time or 300-revolution limit has been reached, that it can be placed, without addition of water to the batch.

Submit delivery tickets from manufacturers of truck-mixed concrete and central-mixed concrete with each truckload of concrete before unloading at jobsite. Printed, stamped, or written delivery ticket shall include the following information:

(1) Name of concrete plants.

(2) Serial number of ticket.

(3) Date and truck number.

(4) Name of Contractor.

(5) Specific project, route, or designation of job (name and location), and truck overweight permit number when required.

(6) Specific class or designation of concrete in accordance with contract documents.

(7) Quantity of concrete in cubic yards.

(8) Time of loading batch or mixing of cement and aggregates.

(9) Water added by receiver of concrete and receiver's initials.

(10) Information necessary to calculate total mixing water added by producer. Total mixing water includes free water on aggregates, water, and water added by truck operator from mixer tank.

(11) Readings of non-resettable revolution counters of truck mixers after introduction of cement to aggregates, or introduction of mixing water to cement aggregates.

(12) Supplier's mix number or code.

Furnish additional information designated by the Engineer and required by job specifications upon request.

(F) Consistency. Regulate quantity of water used in concrete mixes so that concrete consistency, as determined by AASHTO T 119 test method, is within nominal slump range specified in Table 601.03-3 - Slump for Concrete or as stated on the accepted concrete mix design. If concrete slump exceeds nominal slump, adjust mixture of subsequent batches. If slump exceeds maximum slump, the Engineer will reject concrete unless deemed satisfactory for its use.

The Engineer will also reject harsh or unworkable concrete that cannot be properly placed. Remove rejected concrete at no increase in contract price or contract time.

Slump for concrete shall be as specified in Table 601.03-3 – Slump for Concrete.

TABLE 601.03-3 - SLUMP FOR CONCRETE

Type of Work	Nominal Slump Inches	Maximum Slump Inches
Concrete Pavements	0 – 3	3-1/2
Reinforced Concrete Structures: Sections Over 12 Inches Sections 12 Inches Thick or Less	 0 – 4 2 – 5	 5 6
Non-Reinforced Concrete Facilities	1 – 3	4
Concrete Placed Underwater	6 – 8	9
Bridge Decks	0 – 3	3-1/2

In adverse or difficult conditions that may affect placement of concrete, the above slump limitations may be exceeded for placement workability, with the addition of admixture conforming to Subsection 711.03 - Admixtures, if accepted by the Engineer in writing and provided water-cement ratio is maintained. Provide additional cement and water, or admixture at no increase in contract price or contract time.

(G) Forms. Construct forms in accordance with applicable sections.

(H) Placing Concrete. Place concrete in accordance with applicable sections.

(I) Finishing Concrete Surfaces. Finish concrete surfaces in accordance with applicable sections.

(J) Curing Concrete. Cure concrete in accordance with applicable sections.

601.04 Measurement. The Engineer will measure concrete in accordance with the applicable sections.

601.05 Payment. The Engineer will pay for the accepted concrete under the applicable sections.

END OF SECTION 601

SECTION 603 – CULVERTS AND STORM DRAINS

Make the following amendments to said Section:

(I) Amend **603.03(C)(1) - Culverts** by revising lines 106 to 108 to read as follows:

"Spacing between multi-barrel culverts shall be a minimum of 18 inches or 0.5 the culvert width, whichever is greater. The minimum spacing shall be 1 foot when placing controlled low strength material (CLSM) as backfill. Anchor the culverts in such a manner that the horizontal and vertical alignment of the culverts does not change."

(II) Amend **603.04 – Measurement** by revising lines 282 to 292 to read as follows:

"**603.04 Measurement.**

The Engineer will measure cleaning of existing drainage stuctures on a force account basis in accordance with Subsection 109.06 - Force Account Provisions and Compensation and as ordered by the Engineer."

(III) Amend **603.05 – Payment** by revising lines 294 to 349 to read as follows:

"**603.05 Payment.** The Engineer will pay for the accepted pay items listed below at the contract price per pay unit, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and contract documents.

The Engineer will pay for each of the following pay items when included in the proposal schedule:

Pay Item	**Pay Unit**
Clean Existing Drainage Structure	Lump Sum

END OF SECTION 603

Make the following Section a part of the Standard Specification:

"SECTION 608 – EXISTING CONDITIONS – ASBESTOS / LEAD / HAZARDOUS MATERIAL SURVEY

608.01 General

(A) This section includes the results of the survey for hazardous materials and is provided for the Contractor's information.

(B) Related Sections include Section 609 – REMOVAL AND DISPOSAL OF ASBESTOS CONTAINING MATERIAL for requirements of all work that disturbs Asbestos Containing Materials.

608.02 Asbestos Containing Materials.

(A) The structures to be renovated or demolished under this contract have been surveyed for the presence of asbestos containing materials (ACM). A copy of the initial survey report is included in the Section.

(1) The report is included, even when no ACM was found, for the Contractor's information. Review the attached report for the reason any negative ACM finding was made. Further asbestos surveys in areas where asbestos is suspected and where work is to be performed may be performed. If ACM is found, notify the Contracting Officer immediately.

(2) If there is ACM or suspected ACM in areas outside those where work is to be performed, do not disturb such materials in any way.

(B) Notify employees, subcontractors and all other persons engaged in the demolition and renovation work of the presence of asbestos in accordance with the requirements of Chapter 110, Article 12-110-2 (f) (1) (B) of the Occupational Safety and Health Standards, State of Hawaii.

(C) In the event that work is required in any area on the site other than those designated in the project, request asbestos survey reports for each such area and use them to notify all persons on the project as indicated in paragraph 1.02 B.

608.03 Lead-Containing Paint.

(A) The report is included, even when no lead-containing paint was found. The Contractor shall ensure that he understands the contents of the report referring to areas in which work is to be performed. Testing was for design purposes only and does not satisfy the requirements of HIOSH Chapter 12-148.

608.04 Survey.

(A) Attached,_____

END OF SECTION 608

Make the following Section a part of the Standard Specification:

"SECTION 609 - REMOVAL AND DISPOSAL OF ASBESTOS CONTAINING MATERIAL (ACM)

609.01 Description.

(A) This Section specifies the requirements for protection of workers, prevention of contamination of adjacent areas, performing asbestos abatement, post-abatement cleaning, and appropriate disposal of removed materials.

(B) Related Sections include the following

SECTION 608 – EXISTING CONDITIONS – ASBESTOS / LEAD HAZARDOUS MATERIAL SURVEY
for requirements of all work that disturbs Asbestos Containing Materials.

(C) In performing this project, all possible safeguards, precautions and protective measures shall be utilized to prevent exposure of any individual to asbestos particulates.

(D) Furnish all labor, materials, and equipment necessary to carry out the safe removal and disposal of ACM in compliance with all applicable Federal, State and Local laws and regulations from all areas as identified in the Project. The asbestos abatement work shall include, but may not be not limited to:

(1) Removal and disposal of approximately 5 square feet of asbestos containing non-friable vent pipe sealant located on the roof of the Subject Property.

(2) The Contractor is responsible for conducting his own site visit to verify all quantities and material locations. There shall be no change orders issued for the abatement of additional ACM discovered in the course of the abatement activities.

(E) Cleaning shall include the pre-cleaning, wet wiping and HEPA vacuuming of surfaces where abatement will take place.

(F) The asbestos abatement work shall include removal of all ACM within the work area as specified herein.

(G) Comply with all Federal, State and local regulations pertaining to asbestos removal. If there is a conflict with the Specifications, the more stringent requirement shall apply.

(H) The principal items of the asbestos removal work shall be as follows:

(1) Worker protection

(2) Decontamination system

(3) Preparation of work area

(4) Removal and disposal of ACM

(5) Removal of protective sheeting

609.02 Applicable Regulations and Industry Standards.

The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only, and include but are not limited to, the following:

(A) CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1926.103	Respiratory Protection
29 CFR 1926.51	Sanitation
29 CFR 1926.200	Accident Prevention Signs and Tags
29 CFR 1926.59	Hazard Communication
29 CFR 1926.1101	Asbestos, Tremolite, Anthophyllite Actinolite
29 CFR 1910. 134	Respiratory Protection
40 CFR 61-SUBPART A	General Provisions
40 CFR 61-SUBPART M	National Emission Standard for Asbestos
40 CFR 763 Asbestos	Containing Material in Schools
49 CFR 172	Hazardous Materials, Tables, and Hazardous Materials Communications Regulations
49 CFR 178	Shipping Container Specification

(B) ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 560/5-85-024 Guidance for Controlling ACM in Buildings

(C) HAWAII OCCUPATIONAL SAFETY AND HEALTH (HIOSH)

12-114.2	Personal Protective Equipment
12-121.2	Fall Protection
12-122.2	Materials Handling, Storage, Use, and Disposal
12-145.1	Asbestos
12-151	Hazardous Waste Operations and Emergency Response
12-206-13	Asbestos

(D) AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z9.2	(1979; R 1991) Fundamentals Governing the Design and Operation of Local Exhaust Systems
ANSI Z88.2	(1992) Respiratory Protection

(E) AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 732	(1995) Aging Effects of Artificial Weathering on Latex Sealants
ASTM D 532	(1993;Rev. A) Mandrel Bend Test of Attached Organic Coatings
ASTM D 1331	(1989; R 1995) Surface and Interfacial Tension of Solutions of Surface-Active Agents
ASTM D 2794	(1993) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM E 84	(1995;Rev. B) Surface Burning Characteristics of Building Materials
ASTM E 96	(1995) Water Vapor Transmission of Materials
ASTM E 119	(1995; Rev. A) Fire Tests of Building Construction and Materials
ASTM E 736	(1992) Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
ASTM E 1368	(1990) Visual Inspection of Asbestos Abatement Projects

ASTM E 1494 (1992) Encapsulants for Spray- or Trowel-Applied Friable Asbestos-Containing Building Materials

(F) UNDERWRITERS LABORATORIES INC. (UL)

UL 586 (1990) High-Efficiency, Particulate, Air Filter Units

609.03 Construction Requirements.

(A) Definitions.

(1) Abatement: Procedure to control fiber release from asbestos containing material.

(a) Removal: Shall adhere to all specified procedures herein and shall include the proper removal and disposal of asbestos containing material as per all applicable Federal, State and local rules, regulations, and industry standards.

(b) Post-Removal Surface Encapsulation: Procedures necessary to coat surfaces from which ACM have been removed to control any residual fiber release.

(2) Amended Water: Water containing a wetting agent or surfactant with a maximum surface tension of 2.9 Pa (29 dynes per square centimeter) when tested in accordance with ASTM D 1331.

(3) Area Sampling: Sampling of asbestos fiber concentrations which approximates the concentrations of asbestos in the theoretical breathing zone but is not actually collected in the breathing zone of an employee.

(4) Asbestos: The term asbestos include chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, and actinolite asbestos and any of these minerals that has been chemically treated or altered.

(5) Asbestos Containing Material (ACM): Materials that contain one percent asbestos or more as determined by

Polarized Light Microscopy or Transmission Electron Microscopy.

(6) Asbestos Control Area: That area where asbestos removal operations are performed which is isolated by physical boundaries which assist in the prevention of the uncontrolled release of asbestos dust, fibers, or debris.

(7) Asbestos Fibers: Those fibers having an aspect ratio of at least 3:1 and longer than 5 micrometers as determined by NIOSH Method 7400.

(8) Asbestos Permissible Exposure Limit (PEL): 0.1 fibers per cubic centimeter of air as an 8-hour time weighted average measured in the breathing zone as defined by 29 CFR 1926.1101 or other Federal legislation having legal jurisdiction for the protection of workers health. If an employee is exposed to asbestos particulates for more or less that 8 hours in a work day, the PEL shall be determined by the following formula:

PEL (micrograms per cubic meter of air) = 0.8 fibers per cubic centimeter of air/# hours worked per day

(9) Authorized Representative of the State: The person or persons designated by the State to act on its behalf.

(10) Background: The ambient airborne asbestos concentration in an uncontaminated area as measured prior to any asbestos hazard abatement efforts. Background concentrations for other (contaminated) areas are measured in similar but asbestos free locations.

(11) Certified Clean: Certification that a work area has no visible signs of fibrous materials or other contamination, and does not have levels of airborne fibers above the defined air clearance criteria.

(12) Competent Person: As used in this section, refers to a person employed by the Contractor who is trained in the recognition and control of lead hazards in accordance with current federal, State, and local regulations and has the authority to take prompt corrective actions to control the asbestos hazards.

(13) Contractor: The Contractor is that individual, or entity engaged under contract to the State or General Contractor to remove, encapsulate and/or dispose of ACM.

(14) Decontamination Facility (DF) or Area: A series of connected rooms or spaces including Clean, Shower, and Contaminated Equipment Areas, used for both the decontamination of all workers, equipment and their personal protective equipment upon departing an asbestos removal work area, and for access to such work areas.

(15) Fixed Object: A unit of equipment or furniture in the work area which cannot be removed from the work area without dismantling.

(16) Friable Asbestos Material: ACM that can be crumbled, pulverized, or reduced to powder by hand pressure when dry.

(17) High Efficiency Particulate Air (HEPA) Filter Equipment: HEPA filtered vacuum and/or exhaust ventilation equipment with a filter system capable of collecting and retaining asbestos fibers. Filters shall retain 99.97 percent of particles 0.3 microns or larger as indicated in UL 586.

(18) Monitoring Specialist: The monitoring specialist enters the work area to set up air monitoring devices and then collects the various air samples to be sent to the laboratory for analysis. The monitoring specialist has working experience in the asbestos abatement industry and a working knowledge of all applicable State and Federal occupational safety and health regulations and formal training in occupational safety and health. The Monitoring Specialist shall have currently attended and passed the AHERA Project Monitor course as specified in Hawaii Administrative Rules, Chapter 11, 504. This course shall be approved by a State of Hawaii Accreditation Program. The Monitoring Specialist shall also have demonstrable experience in asbestos air monitoring techniques and respiratory protection.

(19) Non-Friable ACM: ACM in which the asbestos fibers have been immobilized by a bonding agent, coating, binder, or other material so that the asbestos is well bound and will not normally release asbestos fibers during any appropriate

use, handling, storage or transportation. It is understood that Non-Friable ACM may release asbestos fibers under other conditions such as demolition, removal, or mishap.

(20) Personal Sampling: Air sampling which is performed to determine asbestos fiber concentrations within the breathing zone of a specific employee, as performed in accordance with 29 CFR 1926.1101.

(21) Post-Removal Encapsulant: A liquid material applied to surfaces from which ACM has been removed, to control the possible release of residual fibers, either by creating a membrane over the surface (bridging encapsulant) or by penetrating into the material and binding its components (penetrating encapsulant).

(22) Surfactant: A chemical wetting agent added to water to improve penetration, thus reducing the quantity of water required for a given operation or area.

(23) Wetting Agent: A chemical added to water to reduce the water's surface tension thereby increasing the water's ability to soak into the material to which it is applied.

(B) Authority to Stop Work.

(1) The authorized representative of the State will stop the abatement work if they determine that conditions are not within the drawing/ specification requirements and applicable regulations. Work stoppage shall continue until corrective steps have been taken and specified conditions restored to the satisfaction of the authorized representative of the State. Standby time required to resolve violations shall be at the Contractor's expense. Stop Work Orders may be issued for, but shall not be limited to the following:

(a) Excessive airborne fibers inside (>0.5 f/cc) and/or outside (>0.01 f/cc) the work area.

(b) Visible emissions of dust or debris going beyond the work area boundaries.

(C) Submittals.

(1) Section 105.02 - SUBMITTALS. Submit nine (9) copies of each submittal for approval. Five (5) copies shall be retained by the

State, the Engineer and the State's authorized representatives and four (4) copies shall be returned to the Contractor. More copies shall be provided to the above parties as requested.

(2) Detailed Schedule: Submit the actual start date and completion dates for the each phase of the asbestos removal.

(3) Notices: As regulated by each agency and before commencement of any on-site project activity send written notice of the proposed asbestos abatement work as early as possible but at least 10 working days prior to commencement of work in accordance with 40 CFR Part 61.145 of SUBPART M. Send notice with copies to the authorized representative of the State and to the following agencies:

(a) The Administrator of the Environmental Protection Agency (EPA) Regional 9 who has the jurisdiction over the project.

(b) State of Hawaii, Department of Health, "Notification of Demolition and Renovation" form. Send to: Noise, Radiation and Indoor Air Quality Branch, Asbestos Abatement Office, State of Hawaii, 591 Ala Moana Blvd., Honolulu, Hawaii 96813.

(4) Permits and Licenses: Submit copies of all permits, licenses and arrangement for removal, transportation and disposal of ACM no later than 20 consecutive working days from notice of award unless otherwise instructed in writing by the authorized representative of the State.

(5) Landfill Approval: Submit written evidence that the landfill for disposal is approved for asbestos disposal by the EPA and Hawaii regulatory agency(s).

(6) Manufacturer's Data: Submit copies of manufacturer's specifications, installation instructions and field test materials for all equipment related to asbestos handling and abatement, including any other data that may be required to demonstrate compliance with these Specifications and proposed uses.

(7) Samples: Submit samples of the following items for approval prior to ordering materials:

(a) Asbestos encapsulant(s): Copies of manufacturer's literature including all laboratory data, MSDS, and application instructions.

(b) Plastic sheeting: Three 8-1/2 by 11-inch pieces of each thickness and type with labels indicating actual mil thickness.

(c) Surfactant: Copies of manufacturer's literature including all laboratory data, MSDS, and mixing and application instructions.

(d) Tapes and adhesives: Copies of manufacturer's literature including all laboratory data.

(e) Warning labels and signs.

(f) Protective clothing: Copies of manufacturer's literature on all protective clothing and one sample of each item. Samples submitted will be returned to the Contractor.

(g) Respiratory equipment: Copies of manufacturer's literature on all respiratory equipment and one sample of each item along with a description of where and how each item will be used. Samples submitted will be returned to the Contractor.

(8) Shop Drawings: Submit no later than 10 consecutive working days from award notice, copies of shop drawings for the following items as a minimum:

(a) Description of any equipment to be employed not discussed in this Section.

(b) Security provisions, if any, in and around the project area.

(c) Outline of work procedures to be employed.

(d) Location and construction of all airtight barriers.

(e) Staging of the work.

(f) Entrances and exits to the work place.

(g) Location and construction of worker and equipment decontamination units.

(h) Type of respiratory protection to be used.

(i) Water filtration system for all contaminated water.

(j) Existence and location of negative air exhaust ports and containment.

(9) Asbestos Abatement Plan: Contractor shall develop, submit for approval to the authorized representative of the State no later than 15 consecutive days from notice of award, and implement a work procedure for abatement work describing work practices and engineering controls to be used to prevent emissions of asbestos from the work site, ensure maximum site safety and safeguard the public, workers and the environment from asbestos exposure. The Asbestos Abatement Plan will be a detailed plan of the safety precautions such as lockout-tagout, fall protection, and equipment, and work procedures to be used in the removal of ACM. The plan shall be prepared, signed, and sealed by the State of Hawaii Accredited Project Designer. Such plan shall include but not be limited to the precise personal protective equipment protection, the location of asbestos control areas including clean and dirty areas, buffer zones, showers, storage areas, change rooms, removal method, interface of trades involved in the construction, sequencing of asbestos related work, disposal plan, type of wetting agent and asbestos sealer to be used, locations of local exhaust equipment, and a detailed description of the method to be employed in order to control environmental pollution. This plan must be approved in writing prior to starting any asbestos work. The Contractor and the authorized representative of the State shall meet prior to the start of work to discuss in detail the standard operating procedures. Once approved by the authorized representative of the State, the plan will be enforced as if an addition to the Specification.

(10) Documentation of Training: Submit no later than 10 consecutive working days from notice of award, documentation that each and every individual, including foreman, supervisors, other company personnel or agents, and any other individual who may be exposed to airborne asbestos fibers and who may be responsible for any aspects of abatement activities which may occur, has currently attended and passed the AHERA Abatement Worker and/or AHERA Abatement Contractor/Supervisor course, whichever is relevant to that workers responsibilities, as specified in

40 CFR Part 763, “Asbestos Materials in Schools”. These courses shall be EPA-approved or approved by a State Accreditation Program in the most current listing of the Federal Register. No worker shall be allowed on site if they are found to have either an expired accreditation certificate or do not comply with the requirements set forth in 40 CFR Part 763 on training. The Contractor shall be responsible for keeping the documentation up to date and submitting subsequent documentation to the authorized representative of the State before any additional employee or individual, not currently on the list, is allowed within the project site.

(11) Documentation of Instructions: Submit no later than 10 consecutive working days from notice of award, documentation that all personnel or agents who may be exposed to airborne asbestos fibers and who may be responsible for any aspects of abatement activities which may occur have had instructions on the nature of the activities and operations which create a risk of asbestos exposure and the necessary protective steps, on use and fitting of respirators in accordance with qualitative procedures as detailed in HIOSH 12-145 Appendix C, Qualitative and Quantitative Fit Testing.

(12) Laboratory Qualifications: The Contractor shall submit no later than 10 consecutive working days from notice of award the name, address, phone number and valid and up-to-date Proficient Analytical Testing (PAT) program qualifications for asbestos analysis of the independent industrial hygiene testing laboratory hired by the Contractor.

(13) Monitoring Specialist Qualifications: The Contractor shall submit no later than 10 consecutive working days from notice of award the Contractor’s monitoring specialist’s name, contact information, valid qualifications, and current certification of completion of the AHERA Contractor/Supervisor or Project Monitor course as specified in 40 CFR Part 763.SUBPART E “Asbestos Model Accreditation Plan for States”.

(14) Documentation From Physician: Submit no later than 10 consecutive working days from notice of award, documentation from a licensed medical doctor that all employees or agents who may be required to wear a respirator have been provided with an opportunity to be medically monitored to determine whether they are physically capable of working while wearing the required respirator without suffering adverse health effects. In addition, document that all individuals permitted within the project site have

received medical monitoring or had such monitoring made available to them as required in HIOSH 12-145.1. The Contractor must be aware of and provide information to the examining physician about unusual conditions in the work place environment (e.g. high temperatures, humidity, chemical contaminants) that may impact the employee's ability to perform work activities. The Contractor shall keep and make available to all affected individuals a record and the results of such examinations.

(15) Medical Surveillance Program: Submit no later than 10 consecutive days from notice of award, all medical examinations for employees to be used on this project and a copy of the Contractor's medical surveillance program prepared in accordance with all applicable Federal, State and local laws.

(16) Respiratory Protection Program: Submit no later than 10 consecutive working days from notice of award, a copy of the Contractor's Respiratory Protection Program prepared in accordance with all applicable laws. The Contractor shall also submit fit test records on all employees to be used on this project who may be required to wear a respirator.

(17) Hazard Communication Program: Submit no later than 10 consecutive working days from notice of award, a copy of the Contractor's Hazard Communication Program prepared in accordance with all applicable laws.

(18) Safety Program: Submit no later than 10 consecutive working days from notice of award, a copy of the Contractor's Health and Safety Plan prepared in accordance with all applicable laws.

(19) HEPA Vacuums: Submit no later than 10 consecutive working days from notice of award, manufacturer's certification that vacuums conform to ANSI Z9.2-79, Fundamentals Governing the Design and Operation of Local Exhaust Systems as applicable to this project.

(20) Rental Equipment: When rental equipment is to be used in abatement areas or to transport asbestos contaminated waste, a written notification concerning intended use of the rental equipment must be provided to the rental agency with a copy submitted to the authorized representative of the State.

(21) Visitor/Worker Entry Log: Maintain a log of all personnel including the Contractor's employees and agents who enter the work area while asbestos abatement operations are in progress, until final clearance is passed. The log shall contain the following information as a minimum and certified copies shall be submitted to the authorized representative of the State weekly:

(a) Date of visit.

(b) Visitor's name, employer, business address, and telephone number.

(c) Time of entry and exit from work area.

(d) Purpose of visit.

(e) Type of protective clothing and respirator worn.

(f) Certificate of release signed and filed with the Contractor.

(22) Field Test Reports

(a) Employee Exposure Sampling Results: Submit test results to the authorized representative of the State and the affected Contractor's employees within three (3) working days, signed by the testing laboratory employee performing the analysis.

(b) Asbestos Disposal Quantity Report.

(23) Waste Disposal Manifest Forms: Submit copies of all transport manifests, trip tickets and disposal receipts for all asbestos containing waste materials no later than 10 consecutive working days from the date the waste is removed from the work area during the abatement process.

(24) Testing Laboratory: Submit name, address and telephone number of testing laboratory responsible for analysis and report of airborne fiber concentration for compliance with HIOSH 12-145, along with evidence that the air monitoring testing laboratory is a successful participant in the American Industrial Hygiene Association's (AIHA) Proficiency Analytical Testing (PAT) program for phase contrast microscopy (PCM).

(25) Emergency Planning and Procedures: Contractor shall submit an emergency plan prior to abatement initiation for review and acceptance by the authorized representative of the State.

(a) Emergency procedures shall be in written form and prominently posted adjacent to the Health and Safety Plan. Prior to entering the work area, everyone must read and sign these procedures to acknowledge receipt of emergency exits and emergency procedures.

(b) Emergency planning shall include notification of police, fire, and emergency medical personnel of the work schedule of the planned abatement activities, and of the layout of the work area, particularly any barriers that may affect response capabilities.

(c) Emergency planning shall include considerations of fire, explosion, toxic atmosphere, electrical hazards, slips, trips and falls, confined spaces, and heat related injury. Written procedures shall be developed and employee training procedures shall be provided in the Contractor's plan.

(D) Product Handling.

Delivery and Storage of Materials: Deliver materials to the site in original packaging, containers or bags fully identified with manufacturer's name, brand and lot number. Store materials in a dry well-ventilated space, under cover, off the ground and away from surfaces subject to dampness or condensation as approved by the authorized representative of the State. Material that becomes contaminated with asbestos shall be disposed of in accordance with applicable regulations. Replacement materials shall be stored outside the contaminated work area until abatement is completed.

(E) Protection.

(1) Site Security:

(a) The work area is to be restricted only to authorized, trained, and protected personnel. These may include the Contractor's employees, the authorized representative of the State, State and local inspectors and any other designated

individuals. A list of authorized personnel shall be established prior to job start.

(b) Entry to the work area by unauthorized individuals shall not be permitted without the express approval of the authorized representative of the State and any such entry shall be reported immediately to the authorized representative of the State by the Contractor.

(c) A Visitor/Worker Entry Log shall be maintained.

(d) The Contractor shall have control, subject to approval of the authorized representative of the State, of security in the work area and in proximity of Contractor's equipment and materials.

(2) Site Protection and Safety: As a minimum, follow the requirements of all applicable Federal, State and local regulations. Take all necessary precaution to ensure there is no asbestos contamination to those areas not included in the work schedule.

(3) Protective Covering: The Contractor shall provide and install protective covering as required or upon request by the authorized representative of the State. Protective covering shall be unused plastic sheets.

(4) Safeguarding of Property: The Contractor shall take whatever steps necessary to safeguard his work area, any property of the State of Hawaii, and all other individuals in the vicinity of his work area during the execution of this Contract. The Contractor shall be responsible for and shall compensate to the injured party's satisfaction any and all damages resulting from their employee's negligence.

(F) Abbreviations.

(1) ANSI: American National Standards Institute, Inc.

(2) CFR: Code of Federal Regulations

(3) HIOSH: Division of Occupational Safety and Health, Department of Labor and Industrial Relations, State of Hawaii

(4) EPA: U.S. Environmental Protection Agency

(5) NESHAP: National Emission Standards for Hazardous Air Pollutants

(6) NIOSH: National Institute for Occupational Safety and Health

(7) OSHA: Occupational Safety and Health Administration

(8) The State: The State of Hawaii

(G) General Requirements.

(1) The Contractor shall examine and have at all times in his possession at his office (one copy) and in view at each job site office (one copy) the following materials:

(a) Hawaii Administrative Rules, Title 11, Chapters 501, 502, 503 and 504;

(b) Title 29 Code of Federal Regulations Part 1926.62; Safety and Health Standards;

(c) Title 29 Code of Federal Regulations Part 1910.134; Respiratory Protection;

(d) Title 40 Code of Federal Regulations Part 261; Identification and Listing of Hazardous Waste;

(e) Title 40 Code of Federal Regulations Part 262; Standards Applicable to Generators of Hazardous Waste;

(f) Title 40 Code of Federal Regulations Part 263; Hazardous Waste Transporters;

(g) Copies of any other applicable Federal, State and local regulations, standards, documents and codes;

(h) Documentation of the adequacy of compressed air systems and respiratory protection system including a list of compatible components and specifications of the types and maximum number of respirators that may be used with the system;

(i) Copies of the procedures for the use of the decontamination enclosure system or any other procedures

which have been established to prevent contamination or areas outside the work area;

(j) Copies of procedures to be followed during medical emergencies, including phone numbers of the nearest hospital or other emergency facility, which shall be posted by the nearest telephone;

(k) Copies of the Contractor's Respiratory Protection Program, Hazardous Communication Program, Safety Program, Lead Based Paint Disturbance/Removal Plan and Work Procedure and Waste Management Plan;

(l) Copies of Material Safety Data Sheets for all chemicals used;

(m) Copies of all relevant certificates held by abatement workers and abatement contractors/supervisors actively engaged in the abatement project;

(n) Certification of the project designer who wrote procedures for the job;

(o) Copies of bulk sampling results, including inspector and laboratory names of all suspect material to be disturbed that is not assumed to be asbestos-containing; and

(p) Records of all air sampling as required in HIOSH section 12-145-5.

(2) Comply with the above requirements and any applicable Federal, State and local regulations. Where there is any conflict or inconsistency among requirements, the more stringent requirement shall apply. Ignorance of the above requirements and any applicable State and City & County Regulation resulting in additional cost to the Contractor shall not be reimbursable or billable to the State.

(3) All regulations shall govern over these Specifications, except when the Specifications are providing greater protection against asbestos exposure, injury, loss or liability. Questions regarding conflict or inconsistency between Specifications and/or regulations should be directed to the authorized representative of the State.

(4) Whenever approval of the authorized representative of the State is required prior to proceeding with other work, the Contractor shall comply with the following:

(a) Give, at a minimum, five (5) days notification to the authorized representative of the State prior to the start of any asbestos work.

(b) Do not begin any work without the authorized representative of the State present onsite.

(c) Allow the authorized representative of the State 24 hours from notification to respond to the request for site inspection(s).

(d) Designate one person (either a foreman or superintendent) who will be authorized to request inspections. The name of the designated person shall be submitted in writing to the authorized representative of the State prior to commencing work. Requests from any other person will not be considered official requests.

(e) The designated person requesting an inspection shall provide the following information:

(i) Name of caller.
(ii) Building and rooms to be inspected.
(iii) Work phase of inspection, as specified.

(H) Materials.

(1) Plastic Sheeting: 6-millimeter-minimum-thickness polyethylene film.

(2) 6-mil Plastic Bags: Transparent, 6-millimeter-minimum-thickness seamless bottomed polyethylene bags. All bags used to transport ACM must carry the DOT class 9 label, a space for generator information and the following warning:

DANGER CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

(3) Tape: Tape shall be capable of sealing joints of adjacent sheets of polyethylene, attaching polyethylene sheeting to finished

or unfinished surfaces of dissimilar materials and adhering under both dry and wet conditions such as when amended water is used.

(4) Adhesives: Adhesive shall be capable of sealing joints of adjacent sheets of polyethylene, attaching polyethylene sheeting to finished or unfinished surfaces of dissimilar materials and adhering under both dry and wet conditions such as when amended water is used.

(5) Post-Removal Encapsulation: The encapsulant shall be capable of being applied to surfaces from which asbestos-containing material has been removed to control the possible release of residual fibers. The encapsulant shall be capable of either creating a membrane over the surface (i.e. a bridging encapsulant) or by penetrating into the material and binding its components (i.e. a penetrating encapsulant) and shall be compatible with the existing finishes.

(6) Surfactant (Wetting Agent): 50 percent polyoxyethylene ester and 50 percent polyoxyethylene ether, or equivalent, and shall be mixed with water to provide a minimum concentration of one ounce of surfactant to five (5) gallons of water.

(7) Warning Labels, Tape and Signs: As required by OSHA 29 CFR 1926.1101 and HIOSH regulation 12-145.1.

(8) Protective Clothing: The Contractor shall have all the coveralls required for this project on site prior to the start of work.

(9) Other Products: Provide all other materials including but not limited to, lumber, plywood, nails, fasteners, metal studs, hardware, sealants, and caulking which may be required to properly prepare and complete this project.

(I) Tools and Equipment.

(1) Provide sufficient and suitable tools for the asbestos abatement procedures, including but not limited to:

(a) Water Sprayer: Airless or pressure sprayer for amended water application as applicable.

(b) Paint/Encapsulant Sprayer: Airless type only.

(c) HEPA vacuum.

(d) Ladders or Scaffolds: All ladders and scaffolds shall be OSHA approved, and shall be of sufficient dimensions and quantities so that all work surfaces can be easily and safely accessed by the workers, the authorized representative of the State and other inspectors. Scaffold joints and ends shall be sealed with tape to prevent migration of asbestos fibers.

(e) Electrical Equipment: All electrical equipment shall be Underwriter's Laboratory listed and approved, and shall have ground fault circuit interrupter protection, installed by a licensed electrician.

(f) Hand Power Tools: All hand power tools shall be equipped with HEPA–filtered local exhaust ventilation if used to drill, cut or otherwise disturb ACM.

(g) Other tools and equipment as necessary.

(J) Electrical Equipment Protection.

(1) Non-current carrying metal parts of fixed, portable and plug-connected equipment shall be grounded. Portable tools and appliances protected by a UL approved system of double insulation need not be grounded. Light and power circuits in the asbestos removal area shall be protected by ground fault circuit interrupters.

(2) Extension cords shall be the 3-wire type, protected from damage, and shall not be fastened with staples, hung from nails, or suspended with wires. Splices shall have soldered wire connections with insulation equal to the cable. Worn or frayed cords shall not be used.

(3) Safe lighting equipment for each work area shall be provided by the use of wire guard protected floodlights. Temporary wiring shall be properly insulated and substantially supported. Circuits shall be properly designed and fused. All temporary lighting inside the asbestos removal area shall be weather-proofed.

(K) Personal Protection Requirements.

(1) The contractor acknowledges that he alone is responsible for instruction and for enforcement of personal protection requirements

and that these specifications provide only a minimum acceptable standard.

(2) Personal Protective Equipment (PPE)

(a) Respirators: Provide personnel engaged in pre-cleaning, cleanup, handling, removal and demolition of asbestos materials with respiratory protection as indicated in 29 CFR 1926.1101, - 29 CFR 1926.103 and 29 CFR 1910.134. Respirators shall be worn at all times within the work area and any other areas where workers may be exposed to asbestos.

(b) Outer protective clothing: Provide personnel exposed to asbestos with disposal “non-breathable,” whole body outer protective clothing, head coverings, gloves, and foot coverings. Provide disposal plastic or rubber gloves to protect hands. Cloth gloves may be worn inside the plastic or rubber gloves for comfort, but shall not be used alone. Make sleeves secure at the wrists, make foot coverings secure at the ankles, and make clothing secure at the neck by the use of tape. Reusable whole body outer protective clothing shall not be used.

(c) Additional safety equipment (e.g. hardhats meeting the requirements of ANSI Z89.11981, eye protection meeting the requirements of ANSI Z41.1-1967, disposable PVC gloves), as necessary, shall be provided to all workers.

(L) Decontamination Area.

(1) The decontamination area as outlined below shall be employed during the removal work.

(2) General: Construct the decontamination area, acceptable to the authorized representative of the State, adjacent to the work area. The decontamination area shall consist of an area covered by an impermeable drop cloth on the floor or horizontal working surface. The area must be of sufficient size as to accommodate cleaning of equipment and removing personal protective equipment without spreading contamination beyond the area.

(3) Work clothing and personal protective equipment must be cleaned in the decontamination area with a HEPA vacuum prior to

removal. All equipment and surfaces or containers filled with ACM must be cleaned in the decontamination area prior to removal.

(4) Clean Area: The Contractor shall establish a clean area adjacent to the decontamination area with sufficient space for storage of any worker's and agent's street clothes, personal effects and other non-contaminated items.

(M) Wastewater Filtering System.

(1) All wastewater that will be discharged into the sanitary sewer system shall be treated as contaminated with asbestos and shall be filtered using two in-line filter cartridges with 2" inlets and outlets. The outlet of the first cartridge shall connect to the inlet of the second cartridge. The first cartridge shall contain six 100-micron prefilters and the second cartridge shall contain six 0.5-micron filters or equivalent staging according to type of filtering unit.

(2) One spare set of 100-micron prefilters shall be maintained at the site at all times to replace prefilters during cleaning. Maintain at least one set of 0.5-micron or equivalent filters at the site at all times for replacements as necessary.

(3) When prefilters become clogged, replace with spares, and wash out the prefilters in the Wash Area allowing drainage from the cleaning operation to go through the filtering system.

(4) When the final filters become clogged, remove the filters, replace with new, and dispose of the clogged filters as contaminated waste.

(5) Provide a holding tank for contaminated wastewater as required to prevent backup of water into the shower when the amount of water generated exceeds the flow rate of the filters.

(N) Work Area Preparation.

(1) Posting of Danger Signs: Post danger signs in and around the work area to comply with 29 CFR 1926.1101, HIOSH 12-145.1 and all other Federal, State and local requirements. Signs shall be posted at a distance sufficiently far enough away from the work area to permit a person to read the sign and take the necessary protective measure to avoid exposure.

(2) Inspect the Building Openings: At the beginning of each work day, the Contractor shall inspect and ensure that all doors, windows and other openings of affected buildings are closed and locked.

(3) Decontamination Area: Provide a decontamination area as described in section 3.01.

(4) Plastic: Objects which may be contaminated during abatement or will be difficult to clean after abatement shall be taped and sealed in 6 mil plastic.

(5) Temporary Electricity: Existing Electrical service to the facility may be used for temporary electrical power during abatement and replacement work. However, the electrical power within the work area must be shut off. The contractor shall verify the locations of available electrical service or use generators as needed.

(6) Temporary Light: Provide a minimum of 35 foot-candles of illumination on surfaces for finishing operations and 100 foot-candles of illumination for removal operations. Provide 24 volt safety lighting.

(7) Temporary Water: Existing water services to the facility may be used as a temporary water source during construction. Locations of line tie-ins must be approved by the authorized representative of the State.

(8) Temporary Sanitation Facilities: The Contractor shall provide toilet facilities for the use of Contractor personnel and agents during abatement work. Maintain toilet facilities in a clean and sanitary condition in compliance with all applicable Federal, State and local regulations.

(9) Temporary Fire Protection: The Contractor shall provide and maintain temporary fire protection equipment during the asbestos abatement operations. Equipment shall be of the appropriate type to fight fires associated with the materials to be found within the work area.

(10) Work Area Isolation and Protection: The Contractor shall isolate the work area for the duration of the project. The work area shall be protected subject to the approval of the authorized representative of the State.

(11) Warning Signs: The Contractor shall post warning signs that meet the requirements of OSHA 29 CFR 1926.1101 (k)(1) and (k)(2)(ii) at the outside door to the Decontamination System. The authorized representative of the State may also require that the Contractor post additional warning signs around the work area or at other potential exposure points.

AFTER THE POSTING, SEALING AND TEMPORARY FACILITY WORK HAS BEEN COMPLETED, NOTIFY THE AUTHORIZED REPRESENTATIVE OF THE STATE FOR APPROVAL BEFORE PROCEEDING WITH THE ABATEMENT.

(O) Work Procedure.

(1) Perform asbestos related work in accordance with 29 CFR 1926.1101, 40 CFR 61-SUBPART M, and as specified herein. Personnel shall wear and utilize protective clothing and equipment as specified herein. Eating, smoking, drinking, chewing gum, using tobacco, or applying cosmetics shall not be permitted in asbestos work or regulated area. Personnel of other trades not engaged in the removal of ACM shall not be exposed at any time to airborne asbestos unless all the personal protection and training provisions of this Specification are complied with. Establish critical barriers over all openings and penetrations which may lead to areas outside the asbestos control area. If an asbestos fiber release or spill occurs outside the asbestos control area, stop work immediately, correct the condition to the satisfaction of the authorized representative of the State prior to resumption of work.

(P) Removal of Asbestos Containing Roof Sealant Material.

(1) Wet the asbestos containing roofing material with a wetting agent (amended water) using a fine mist sprayer prior to the start of abatement. Wetting agent shall continuously be applied to control the release of asbestos fibers from the ACM prior to and during removal.

(2) Carefully remove asbestos containing roofing materials by lifting them in whole and unbroken pieces to the greatest extent possible. Continue to apply the wetting agent during removal to control dust. Avoid breaking and pulverizing the roofing material.

(3) Methods that create excessive amounts of dust and debris are prohibited.

(4) Asbestos containing roofing material that has been removed from the roof shall not be dropped or thrown to the ground. Material shall be carried or passed to the ground by hand or lowered to the ground via covered, dust-tight chute, crane or hoist.

(5) Intact asbestos containing roofing materials and any debris that is not intact shall be lowered to the ground as soon as is practicable, but in no event later than the end of the work shift. While the material is on the roof it shall either be kept wet, placed in an impermeable waste bag, or wrapped in plastic sheeting. Once lowered, unwrapped material shall be transferred to a closed receptacle.

(6) Waste debris shall be bagged and sealed in properly labeled 6-mil plastic bags immediately after removal. The Contractor shall no allow removed ACM to accumulate in work area. All gross debris created by the removal process shall be bagged and sealed before the main break and again at the end of each workday.

(7) After inspection and approval by the authorized representative of the State, the Contractor shall seal all abated and cleaned surfaces with at least one (1) coat of an approved penetrating encapsulant.

(8) The Contractor shall minimize contamination of the work floor, the exterior of disposal containers, and all other surfaces within the work area.

(Q) Clean Up.

(1) Contaminated equipment and tools used for removal work shall be washed and cleaned in the work area prior to removing them from the work area. No washing of contaminated equipment and tools will be allowed outside the work area.

(R) Clearance of Removal Work Area.

(1) Remove all visible accumulation of ACM and debris by HEPA vacuums, sponging, and wet-wiping.

(2) The authorized representative of the State will visually inspect the affected areas for residual asbestos debris and wastes. The Contractor shall re-clean areas showing asbestos debris and wastes. If re-cleaning is required, the authorized representative of

the State will visually inspect for asbestos debris and wastes after re-cleaning. This process will be repeated until the authorized representative of the State deems the area free of visible asbestos debris and wastes.

(3) The work area shall be visibly clean before the remaining material is encapsulated. After the visual inspection has been passed, encapsulate all remaining materials.

(4) Remove all signs, temporary barriers and materials when their use is no longer required.

(S) Air Sampling.

(1) Sampling for airborne concentrations of asbestos fibers shall be performed by the authorized representative of the State. Sampling of airborne concentrations of asbestos fibers shall be performed in accordance with 29 CFR 1926.1101 and as specified herein. Unless otherwise specified, NIOSH Method 7400 will be followed for all sampling and analysis.

(a) Sampling Prior to Asbestos Work: Baseline air sampling may be conducted by the authorized representative of the State one-day prior to the masking and sealing operations for each removal site.

(b) Sampling During Asbestos Work: The Contractor shall provide own personal sampling of 25% of his workers or minimum of two workers, whichever is greater as indicated in 29 CFR 1926.1101 and governing environmental regulations.

(c) In addition, the performance and execution of the Contractor's work shall be closely and continuously monitored by the authorized representative of the State. Air monitoring and inspection by the authorized representative of the State shall be performed inside the work area, in the work area surroundings and in any occupied adjacent buildings to ensure full compliance with the Specification and all applicable regulations. Provide full cooperation and support to the authorized representative of the State and to their technicians throughout the work.

(2) Air Monitoring With Respect To Contractor's Employees

(a) The Contractor shall be responsible for all personal air monitoring as required by OSHA regulations. All personal air monitoring will be conducted by an agent of the Contractor who is currently certified by the Hawaii Department of Health to conduct personal air sampling.

(b) Laboratory performing analysis shall be an independent party, not financially or managerially connected with the Contractor.

(c) Results of sample analysis shall be provided to the authorized representative of the State within forty-eight (48) hours of collection.

(3) All other air sampling for compliance with these Specifications shall be performed by the authorized representative of the State.

(T) Disposal of Asbestos Containing Material.

(1) Collect asbestos waste, asbestos contaminated water, scrap, debris, bags, containers, equipment, and asbestos contaminated clothing which may produce airborne concentrations of asbestos fibers and place them in properly labeled transparent 6-mil plastic seamless bottomed bags. Wastes within the bags must be adequately wet in accordance with 40 CFR 61-SUBPART M.

(2) Affix a warning and Department of Transportation (DOT) label to each bag or use bags preprinted with the approved warnings and DOT labeling. The name of the waste generator and the location at which the waste was generated shall be clearly indicated on the outside of each container.

(3) Vehicles used for transporting waste to the disposal sites shall have a completely enclosed, lockable storage compartment. Storage compartments shall be covered and sealed with a minimum of one layer of 6-mil plastic sheeting on the sides and top and two layers of 6-mil plastic sheeting on the floor. Compartments shall be thoroughly wet-cleaned and HEPA vacuumed following the disposal of each load at the approved disposal sites.

(4) Workers unloading bags at the disposal sites shall wear full body protective clothing and dual HEPA cartridge full face air purifying respirators.

(5) Waste disposal manifest forms shall be properly completed to verify custody and ensure disposal of all ACM and asbestos contaminated waste at approved disposal sites. Forms shall be kept on file as directed by the authorized representative of the State. Copies shall be submitted to the authorized representative of the State no later than the next working day after each trip. It is the Contractor's responsibility to assure that any landfill used for disposal of asbestos containing or asbestos contaminated waste is approved for that purpose.

609.04 Measurement.

(A) The Engineer will not measure removal and disposal of asbestos containing materials mitigation.

(B) Engineer will only measure removal and disposal of Asbestos mitigation required on a lump sum basis.

609.05 Payment. The Engineer will pay for the accepted pay items listed below at the contract lump sum price, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for each of the following pay items when included in the proposal schedule:

Pay Item	**Pay Unit**
Removal and Disposal of Asbestos Mitigation	Lump Sum

END OF SECTION 609

Make the following Section a part of the Standard Specifications:

"SECTION 615 – SELECTIVE DEMOLITION

615.01 Description. This section describes all work required for selective demolition for this Project

(A) Provide all labor, tools, and equipment necessary to complete all demotion work as described in the drawings. Work shall be phased as required since the DOT Material Testing Lab will be in operation during the construction of this Project.

(B) Extent of selective demolition work is indicated on drawings. Work shall be phased to allow for the continued use of school facilities.

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

(D) Selective demolition work includes but is not limited to selective demolition, removal, and subsequent disposal of all materials indicated or required to be removed and salvaged for reuse for the State.

(E) Execute all work in an orderly and careful manner with due consideration for all items of work to remain.

(F) Concrete coring shall be a part of this section, and shall be accomplished by personnel experienced in type of work. 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 Drawings and/or described herein, or may vary therefrom.

(G) All barricades and phasing shall allow NFPA 101 and ICBO UBC safe exiting of the remaining facilities at all times unless otherwise allowed in writing by the Contracting Officer. Provide temporary features as necessary to conform to this requirement. All debris of any kind accumulated from the work of this Section shall be disposed off the site.

(H) Burning of any debris on-site will not be permitted.

(I) Clean and deliver salvaged items not reinstalled on location as directed by the Contracting Officer.

(J) Permits, Notice, 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 of electrical or other utility lines in the area which may interfere with the removal work, and all such lines where necessary shall be properly disconnected or relocated before commencing with the work.

615.02 Materials. None

615.03 Construction.

(A) Submittals

Schedule: Submit six copies of schedule indicating proposed methods and sequence of operations for selective demolition work to the Contracting Officer for review prior to commencement of work. Include coordination for temporary shut-off and continuation of utility services as required, together with details for dust and noise control protection. All demolition and removal work must be coordinated with the Contracting Officer.

(B) Job Conditions

(1) Condition of Structure: The State assumes no responsibility for actual condition of items or portions of structure and appurtenances to be demolished or removed.

(2) Conditions existing at time of commencement of contract will be maintained by the State as practical

(3) Do not interfere with use of adjacent occupied spaces. Maintain free and safe passage to and from occupied spaces.

(4) Partial Demolition and Removal: Items indicated to be removed but not indicated for either reinstallation at the same or new location or for salvage by the State but of salvageable value to Contractor, may be removed from

structure as work progresses. Materials to be reinstalled or for salvage by the State shall be carefully removed by workmen skilled in the installation of similar materials. Transport salvaged items for the State from site to a storage location as they are removed.

(5) Store materials indicated to be reinstalled in a manner that protects the material from damage or deterioration.

(6) Deliver materials to be salvaged for the State to a location at the as directed by the Contracting Officer.

(7) Storage or sale of removed items on site will not be permitted.

(8) Protections: Provide temporary barricades and other forms of protection as required to protect the general public from injury due to selective demolition work and to maintain security.

(A) Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or elements to be demolished, and adjacent facilities or work to remain.

(B) Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.

(C) Life safety procedures and provisions shall be in conformance with all applicable Federal, State, and City and County regulations, including HOSHA. Remove protections at completion of work.

(9) Damages: Promptly repair damages caused to adjacent facilities by demolition work at no cost to the State.

(10) Traffic: Conduct selective demolition operations and debris removal in a manner to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close, block or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from the Contracting Officer. Provide alternate routes around closed or obstructed traffic ways if required by

governing regulations, as directed by the Contracting Officer.

(11) Explosives: Use of explosives will not be permitted.

(12) Utility Services: The existence of above and below ground utility lines other than those shown on the drawings is not definitely known. Should any other utility lines be encountered, the Contractor shall immediately notify the Contracting Officer and follow his direction as to procedure. Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations. Do not interrupt existing utilities serving occupied buildings or facilities, except when authorized in writing by the Contracting Officer. Outages and interruptions must be approved in advance by the Contracting Officer. Submit written notice of outages and interruptions not less than fourteen days in advance of intended outage. Report damage, however slight, immediately. Do not repair or reconstruct any pipe, conduit, or installation without authorization, except perform emergency repairs immediately.

(13) Dust Control:

(A) Keep dust within acceptable levels at all times, including non-working hours, weekends, and holidays, in conformance with Chapter 60.1 - Air Pollution Control of the DOE Department of Health, Public Health Regulations, latest edition.

(B) Only wet grinding or cutting of concrete and masonry will be allowed on exterior surfaces. Concrete slurry shall be vacuumed immediately and not allowed to enter the storm drain system.

(C) Mechanical dry sweeping not permitted. Vacuuming, wet mopping, approved limited dry hand, wet, or damp sweeping is acceptable.

(D) During loading operations, water down debris and waste materials to allay dust.

(E) The method of dust control and all cost incurred thereof shall be the responsibility of the Contractor.

(14) Noise Control:

(A) Noise shall be kept within acceptable levels at all times in conformance with State Department of Health, Title II, Administrative Rules, Chapter 46 - Community Noise Control.

(B) The Contractor shall obtain and pay for community noise permit from the State Department of Health when the construction equipment or other devices emit noise at level exceeding the allowable limits.

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

(D) Starting up of on-site vehicular equipment meeting allowable noise limits shall not be done prior to 6:45 a.m. without prior approval of the Contracting Officer. Equipment exceeding allowable noise limits shall not be started prior to 7:00 a.m.

(15) Other Controls:

(A) Wherever trucks and/or vehicles leave the site and enter surrounding paved streets, the Contractor shall prevent any material from being spilled onto the pavement. Wastewater shall not be discharged into existing streams, waterways, or drainage systems such as gutter and catch basins unless treated to comply with Department of Health pollution regulations.

(B) Trucks hauling materials shall be covered as required by PUC regulation. Trucks hauling fine materials shall be covered.

(C) Noxious fumes and offensive odors shall be kept within acceptable levels at all times including non-working hours. Sufficient ventilation shall be employed, especially in confined areas, to minimize the effects of the fumes and odors.

(D) Whenever truck and/or vehicles cross any hardstand, taxiway, runway or other area utilized by aircraft, the Contractor shall prevent any material from being spilled. Should any material be spilled, it shall be removed immediately to prevent a FOD problem.

(C) Contract Zone Limits

The Contract Zone Limits shall generally be as indicated on the key plans and/or site plans, however, work outside the Zone Limits necessary to complete the project shall be included.

(D) Maintaining Traffic

(1) The Contractor shall conduct operations with minimum interference streets, driveways, sidewalks, etc.

(2) 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.

(E) Execution

(1) INSPECTION: Prior to commencement of selective demolition work, inspect areas in which work will be performed. Inventory existing conditions of structure surfaces, equipment or surrounding properties, which could be misconstrued as damage resulting from selective demolition work; photograph, video or otherwise document and file with the Contracting Officer prior to starting work.

(F) Preparation

(1) Provide temporary security and phasing barriers as indicated or as directed by the Contracting Officer.

(2) Refer to notes on drawings regarding work on exterior utilities. Provide by-pass connections as necessary to maintain continuity of service to adjacent occupied buildings.

(3) Water and sewer facilities shall be available and in operating condition at all times. All dust shall be suppressed by a fog spray or other approved method.

The Contractor shall visit the project site, examine the premises and note all existing conditions and the extent involved for the complete and proper execution of all work as called for on the plans and as herein-after specified.

(G) Barricades

(1) Erect temporary barricades as required, to prevent people from entering into project area to the extent as acceptable to the Contracting Officer. The extent of barricade may be adjusted as necessary with the acceptance of the Contracting Officer. This work shall be accomplished at no extra cost to the State.

(2) 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.

(H) Selective Demolition

(1) Perform selective demolition work, including all exterior improvements indicated on the drawings, in a systematic manner. Use such methods as required to complete work indicated on drawings in accordance with demolition schedule and governing regulations.

(2) Demolish concrete, masonry, and stone work in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.

(3) Provide services for effective air and water pollution controls as required by local authorities having jurisdiction. All dust shall be suppressed by a fog spray or other methods acceptable to the Contracting Officer.

(4) Water and sewer facilities shall be available and in operating condition at all times.

(5) Demolish and remove existing materials as required within the Contract Zone Limits, with the exception of any structures to remain and any active water, drainage, electrical, etc., lines, and boxes, unless otherwise directed by the Contracting Officer.

(6) If unanticipated mechanical, electrical or structural elements which conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to the Contracting Officer in written, accurate detail. Pending receipt of directive from the Contracting Officer rearrange selective demolition schedule as necessary to continue overall job progress without delay.

(7) Abandoned utility lines shall be removed if within the demolition depth, and plugged and abandoned in place if below this depth.

(8) Trenches, holes, depressions, and pits left by the removal of miscellaneous improvements shall be backfilled to the satisfaction of the Contracting Officer. Backfill with suitable material and compact to 95% maximum dry density as determined by ASTM Test Method D 1557.

(I) Disposal of Demolished Materials: Remove debris, rubbish, and other materials resulting from demolition operations from building site daily. Transport and legally dispose of materials off site.

(1) If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.

(2) Burning of removed materials is not permitted on project site.

(3) Contractor shall submit a disposal manifest to the Contracting Officer.

(J) Clean Up and Repair

(1) Upon completion of demolition work, remove tools, equipment, and demolished materials from site. Remove protections and leave interior areas broom clean.

(2) Repair demolition performed in excess of that required. Return structures and surfaces to remain to condition existing prior to commencement of selective demolition

work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

(3) All existing grass areas disturbed or damaged due to construction or ingress or egress to the site shall be repaired to its original conditions. Grass areas shall be recultivated, topsoiled, and then grassed with the same kind and type of material as existing, in a manner acceptable to the Contracting Officer.

615.04 Measurement.

(A) The Engineer will measure demolition of existing ceilings and grids in Lum Sum in accordance with the contract documents.

(B) The Engineer will measure demolition of existing “Baldwin” and doors per each in accordance with the contract documents.

(C) The Engineer will measure demolition of existing gutters, roof flashing/counterflashing down to substrate per Linear Feet in accordance with the contract documents.

(D) The Engineer will measure demolition of roof down to roof deck per Square Feet in accordance with the contract documents.

615.05 Payment. The Engineer will pay for the accepted pay items listed below at the contract pay unit price, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for each of the following pay items when included in the proposal schedule:

Pay Item	**Pay Unit**
Demolition of Existing Ceilings and Grids	Lump Sum
Demolition of Existing “Baldwin”	Each
Demolition of Existing Doors	Each
Demolition of Existing Gutters	Linear Feet
Demolition of Existing Roofing down to roof deck	Square Feet
Demolition of Roof Flashing/Counterflashing down to substrate	Linear Feet

END OF SECTION 615

Make the following Section a part of the Standard Specifications:

"SECTION 618 – METAL FABRICATIONS

618.01 Description. This section describes metal fabrications work.

(A) Provide all materials, labor, equipment and tools necessary to complete all metal fabrication work as indicated on the drawings and specified herein and includes the following:

(1) Steel framing and supports for overhead doors.

(2) Steel framing and supports for mechanical and electrical equipment.

(3) Steel framing and supports for applications where framing and supports are not specified in other Sections.

(4) Shelf angles.

(5) Miscellaneous steel trim including steel angle corner guards and steel edging.

(6) Metal bollards.

(7) Steel block supports:

(8) Minimum 16 gauge for grab bars.

(9) Minimum 20 gauge for other components such as toilet paper dispenser, paper towel dispenser, etc.

(10) Backing gauge for casework shall be minimum 20 gauge.

(B) Related Sections Include the following:

(1) Section 681 – PAINTING

618.02 Materials

(A) Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

(B) Steel Plates, Shapes, and Bars: ASTM A36/A36M.

(C) Stainless-Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 316L.

(D) Stainless-Steel Bars and Shapes: ASTM A276, Type 316L.

(E) Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A 283/A283M, Grade C or D.

(F) Rolled-Stainless-Steel Floor Plate: ASTM A793.

(G) Abrasive-Surface Floor Plate: Steel plate with abrasive material metallically bonded to steel.

(H) Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

(I) Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

(J) Aluminum Plate and Steel: ASTM B209, Alloy 6061-T6.

(K) Aluminum Extrusions: ASTM B221, Alloy 6063-T6,

(L) Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.

(M) Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

618.03 Construction.

(A) Coordination

(1) Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

(2) Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

(B) Construction Requirements

(1) Submittals

(a) Product Data: For the following:

1. Non-slip aggregates and non-slip aggregate surface finishes.

2. Paint products.

3. Grout.

(b) Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Steel framing and supports for mechanical and electrical equipment.

2. Steel framing and supports for applications where framing and supports are not specified in other Sections.

3. Metal floor plate and supports.

4. Miscellaneous steel trim including steel angle corner guards and steel edgings.

5. Metal bollards.

(c) Additional Submittals:

1. Welding Certificates.

2. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

3. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1 M, "Structural Welding Code – Steel".

4. Welding Qualifications: Qualify procedures and personnel according to the following:

I. AWS D1.1/D1.1M, “Structural Welding Code – Steel”.

II. AWS D1.2/D1.2M, “Structural Welding Code – Aluminum”.

III. AWS D1.6/D1.6M, “Structural Welding Code – Stainless Steel”.

(2) Field Conditions

Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

(C) Fasteners

(1) General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

(a) Provide stainless-steel fasteners for fastening aluminum.

(b) Provide stainless-steel fasteners for fastening stainless steel.

(c) Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and where indicated, flat washers.

(d) High-Strength Bolts, Nuts and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.

(e) Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed, stainless-steel bolts, ASTM F593; with hex nuts, ASTM F594; and where, indicate, flat washers; Alloy 2.

(f) Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563, and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is to be galvanized.

(g) Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

(h) Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated, galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329.

(i) Post-Installed Anchors:

1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.

2. Material for Exterior Locations and Where Stainless Steel is indicated: Alloy Group 2, stainless steel bolts, ASTM F593, and nuts, ASTM F594.

(D) Miscellaneous Materials

(1) Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

(2) Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

(3) Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C1107/C1107M. Provide grout specifically

recommended by manufacturer for interior and exterior applications.

(E) Fabrication, General

(1) Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural valve of joined pieces. Clearly mark units for reassembly and coordinated installation.

(2) Cut, drill and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

(3) Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

(4) Form exposed work with accurate angles and surfaces and straight edges.

(5) Weld corners and seams continuously to comply with the following:

(a) Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

(b) Obtain fusion without undercut or overlap.

(c) Remove welding flux immediately.

(d) At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness sows after finishing and counter of welded surface matches that of adjacent surface.

(e) For exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

(f) Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

(g) Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

(h) Provide for anchorage of type indicated, coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

(i) Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch thick hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise noted.

(F) Miscellaneous Framing and Supports

(1) General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

(a) Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

(b) Fabricate units from slotted channel framing where indicated.

(c) Furnish inserts for units installed after concrete is placed.

(d) Fabricate supports for operable partitions from continuous steel beams of sizes recommended by partition manufacturer with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

(e) Galvanize miscellaneous framing and supports where indicated.

(f) Prime miscellaneous framing and supports with primer where indicated.

(G) Metal Floor Plate

(1) Fabricate from rolled-aluminum-alloy tread plate of thickness indicated below:

(a) Thickness from ¼-inch unless otherwise indicated.

(2) Provide grating sections where indicated fabricated from extruded-aluminum plank grating. Limit openings in gratings to no more than ½ inch in least dimension.

(3) Provide aluminum angle supports as indicated.

(4) Include aluminum angle stiffeners, and fixed and removable sections as indicated.

(5) Provide flush aluminum bar drop handles for lifting removable sections, once at each end of each section.

(H) Steel Door Frames

(1) Fabricate structural-steel door frames from steel shapes, plates, and bars of size and to dimensions indicated, fully welded together, with 5/8-by-1-1/2-inch steel channel stops, unless otherwise indicated. Plug-weld built-up members and continuously weld exposed joints. Secure removable stops to frame with countersunk machine screws, uniformly spaced at not more than 10 inches o.c. Reinforce frames and drill and tap as necessary to accept finish hardware.

(a) Provide with integrally welded steel strap anchors for securing door frames into adjoining concrete or masonry.

(2) Extend bottom of frame to floor elevation indicated with steel angle clips welded to frames for anchoring frame to frame with expansion shields and bolts. Prime steel frame with primer

(I) Miscellaneous Metal Trim

(1) Unless otherwise indicated, fabricate units from steel shapes, plates, and bar of profiles shown with continuously

welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

(2) Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

(3) Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

(4) Prime miscellaneous steel trim with primer.

(J) Metal Bollards

(1) Fabricate metal bollards from Schedule 80 steel pipe ¼-inch wall thickness rectangular steel tubing.

(2) Fabricate sleeves for bollard anchorage from steel pipe or tubing with ¼-inch thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and ¾-inch larger than OD bollard.

(K) Steel Weld Plates and Angles

(1) Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

(L) Finishes, General

(1) Finish metal fabrications after assembly.

(2) Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

(M) Steel Finishes

(1) Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel hardware and with ASTM A123/A123M for other steel products.

(a) Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

(2) Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

(3) Shop prime steel items not indicated to be galvanized, unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

(N) Aluminum Finishes

(1) As-Fabricated Finish: AA-M12.

(2) Clear Anodic Finish: AAMA 611, Class 1, AA-M12C22A41.

(O) Execution

(1) Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in locations, alignment, and elevation; with edges and surfaces level, plumb, true and free of rack; and measured from established lines and levels.

(2) Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size imitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

(3) Field Welding: Comply with the following requirements;

(a) Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

(b) Obtain fusion without undercut or overlap.

(c) Remove welding flux immediately.

(d) At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

(4) Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle-bolts, through-bolts, lag screws, wood screws, and other connectors.

(5) Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

(6) Corrosion Protection: Coat concealed surfaces of aluminum that come into contract with grout, concrete, masonry, wood or dissimilar metals with the following:

(a) Extruded Aluminum: Two coats of clear lacquer.

(P) Installation of Miscellaneous Framing and Supports

(1) General: Install framing and supports to comply with requirements of items being supported, including manufacturer's written instructions and requirements indicated on Shop Drawings.

(2) Anchor supports for ceiling hung toilet partitions, operable partitions, and overhead doors securely to, and rigidly brace from, building structure.

(3) Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry to concrete or with bolts through top plates of pipe columns.

(a) Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "installing Bearing and Leveling Plates" article.

(Q) Installing Metal Bollards

(1) Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.

(2) Anchor bollards in concrete with pipe sleeves preset and anchored into concrete.

(3) Fill bollards solidly with concrete, mounding top surfaces to shed water.

(R) Installing Bearing and Levelling Plates

(1) Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

(2) Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with non-shrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

(S) Adjusting and Cleaning

(1) Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

(a) Apply a brush or spray to provide a minimum 2.0 mil dry film thickness

(b) Touch-up Painting: Cleaning and touchup painting of field welds, bolted connections, and repaired areas of shop paint are specified in Section 681 - PAINTING.

618.04 Measurement. The Engineer will measure metal fabrications in lump sum in accordance with the contract documents.

618.05 Payment. The Engineer will pay for the accepted pay items listed below at the contract lump sum price, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for each of the following pay items when included in the proposal schedule:

Pay Item	**Pay Unit**
Metal Fabrications	Lump Sum”

END OF SECTION 618

Make the following Section a part of the Standard Specifications:

"SECTION 621 – WOOD TREATMENT

621.01 Description. This section describes the wood treatment.

(A) Provide plant preservative and insecticide treatment of lumber, plywood and other wood products specified in other Sections of this Specification by pressure and dip methods.

(B) Field treatment of field cut or drilled lumber.

(C) Related Work Specified Elsewhere:

(1) **Section 636 – FINISH CARPENTRY**: Lumber products treatments.

(2) **Section 666 – WOOD DOORS**: Doors for treatment.

621.02 Materials. None

621.03 Construction.

(A) Submittals

(1) Product Data. Provide data on all treatment products, including field application instructions if applicable. Provide manufacturer's Material Safety Data Sheets on all products, and hazardous materials.

(2) Preserver Certifications. Provide a Certificate of Treatment showing compliance with these specifications for the following:

(a) Kiln drying

(b) Method of treatment performed, including dip treatment.

(3) Contractor's Certification. Provide a certification letter stating that all wood used on this job including cuts and penetration were treated and coated with preservatives in compliance with requirements of this contract.

(4) Guaranty. Submit guaranty as noted under item entitled "GUARANTY" here in below.

(B) Guaranty.

(1) Provide a two (2) year written guaranty to replace all treated wood which is attacked by subterranean termites up to a total cost of $20,000.00 over the guaranty period from the project acceptance date as verified by General Conditions Force Account Method cost accounting.

(2) Provide a five-year guaranty to replace all treated wood which is attacked by dry wood termites or deteriorates due to dry rot. The Surety shall not be held liable beyond two years of the project acceptance date.

(C) Regulatory Requirements. Comply with State OSHL (Occupancy Safety and Health Law) and pollution controls regulations of the State Department of Health and EPA.

(D) Delivery, Storage and Handling. Protect AWPA C31 inorganic boron treated wood from contact with the ground, rain or other sources of liquid water until permanent installation of covering construction.

(E) General.

(1) Mill lumber to finish size and shape prior to treating, and treat before assembly. Plywood may be treated in regular panel sizes.

(2) Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece, or omit marking and provide certificates of treatment compliance issued by inspection agency.

(F) Pressure Treatment with Water-Borne Preservatives

(1) Treating solutions. Inorganic boron (SBX).

(2) Treatment Methods.

(a) General.

(i) All water-borne treatment methods require incising of lumber of nominal 2-inch thickness (1-1/2 inches actual dimension).

(ii) Choice of treatment method and conditions of use of each treating solution shall conform to the treatment schedule contained in Part 3.

(b) SBX.
Treatment method shall conform to AWPA C31. Treating solution retention shall be a minimum of 0.28 pounds per cubic foot (equivalent to 0.42 DOT).

(3) Drying.

(a) Before SBX Treatment.
Wood having a moisture content higher than 28% is acceptable when treating with SBX.

(b) After Treatment.
All 1-inch and 2-inch lumber and all plywood shall be dried to a moisture content of 19 percent or less after treatment.

(G) Pressure Treatment with Oil-Borne Preservatives.

(1) Treating Solution.

(a) 0.50 percent by weight chlorpyrifos, 0.75 percent by weight 3-iodo-2-propynyl butyl carbamate (IPBC). The solvent used in formulating the preservative solution shall meet the requirements of AWPA hydrocarbon solvent Type C, Standard P9, Paragraph 3.1.

(b) For interior application use low odor mineral spirits as solvent.

(2) Treatment Methods.
Treated wood shall attain the following net retention requirements: 0.0175 pounds of Chlorpyrifos per cubic foot of wood, 0.035 pound of 3-Iodo-2 propynyl butyl carbamate per cubic foot of wood.

(3) Drying.

(a) Before Treatment. All wood treated with oil-borne preservatives shall be kiln-dried to an average moisture content of 12% to 15% per AWPA standards.

(b) After Treatment. Wood shall be thoroughly dried and virtually odor-free prior to installation.

(i) Stack lumber and plywood in a well-ventilated area so that air circulates around each piece.

(ii) Wood must be thoroughly dried before staining, painting, or plastic laminate application.

(H) Preservation by Dip Treatment.

(1) Treating Solution.

(a) Oil-Borne Preservatives as described in Paragraph 2.03 A. 1. here in above.

(b) A solution of 1 quart chlopyrifos in 55 gallons of a 0.50 percent IPBC solution.

(2) Treatment Methods.

(a) Immersion treat for a minimum period of 15 minutes.

(b) Do not incise lumber scheduled to be left unpainted or receive a clear finish.

(3) Drying After Treatment.
Wood shall be thoroughly dried and virtually odor-free prior to installation.

(a) Stack lumber and plywood in a well-ventilated area so that air circulates around each piece.

(b) Wood must be thoroughly dried before staining, painting, or plastic laminate application.

(I) Field Treatment.

(1) Treatment Method.

(a) Treat in accordance with AWPA Standard M4-98 using two heavy brush coats of a treating solution.

(b) Doors shall be treated after manufacture.

(J) Schedule of Treatments.

(1) Species.

(a) Treat all wood species except all-heart redwood.

(b) All water-borne and oil-borne treatment solutions are applicable to douglas-fir and hem-fir species.

(2) Application.

(a) Pressure Treatment.

(i) General.
Unless otherwise stipulated, all lumber and plywood shall be pressure treated.

(ii) Exposed lumber that will be unpainted or receive a clear finish shall be and pressure treated with oil-borne preservative. Do not incise lumber.

(iii) SBX treated wood shall not be used in areas exposed to direct precipitation (e.g., exposed decking, trellises, fencing, etc.) unless painted or covered with a finish material.

(b) Pressure or Dip Treatment.
All finish lumber shall be either pressure or dip treated, at the Contractor's option, with old borne preservative.

(c) Field Cuts.
Treat end cuts, notches and penetrations into treated lumber or plywood. Exception: Cuts and penetrations made in SBX treated wood 2-inches or less in nominal thickness need not be field treated.

621.04 Measurement. The Engineer will measure wood treatment in Lump Sum in accordance with the contract documents.

621.05 Payment. The Engineer will pay for the accepted pay items listed below at the contract lump sum price, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The price includes full compensation for electrical work and furnishing labor, tools, materials, equipment and incidentals necessary to complete the work."

Pay Item	Pay Unit
Wood Treatment	Lump Sum”

END OF SECTION 621

SECTION 629 - PAVEMENT MARKINGS

Make the following amendments to said Section:

(I) Amend **Subsection 629.03(B) – Temporary Pavement Markings** by revising the third paragraph from line 62 to 63 to read:

"Maintain and replace temporary pavement markings, flexible delineators, and barricades."

(II) Amend **Table 629.03 – 1 – Temporary Pavement Markings** to read as follows:

"TABLE 629.03-1 TEMPORARY PAVEMENT MARKINGS	
TYPE	**PAVEMENT MARKINGS**
Passing Permitted - Both Sides	Single 4-inch yellow stripe 5 feet in length spaced 20 feet on center with Type D markers spaced 40 feet on center and located on center of 5-foot length of stripe.
Passing Prohibited - Both Sides	Double solid 4-inch yellow stripes with Type D markers placed 20 feet on center on one of 4-inch yellow stripes selected by the Engineer.
Passing Permitted - One Side Only	Single continuous 4-inch yellow stripe with Type D markers placed on stripe 20 feet on center on no-passing side and single 4-inch yellow stripes 5 feet in length spaced 20 feet on center on passing side.
Lane Lines - Lane Changing Permitted	Single 4-inch yellow or white stripe 5 feet in length spaced 20 feet on center with Type C or Type D markers spaced 40 feet on center.
Lane Lines - Lane Changing Prohibited	Double solid 4-inch white stripes with Type C markers placed 20 feet on center on one of the 4-inch white stripes selected by the Engineer.
Crosswalk	Two 12-inch white transverse lines spaced 8 feet on center or as ordered by the Engineer.
Stop Line	Single 12-inch white transverse line.
Note: Paint may be used for temporary markings in areas where final paving is not complete."	

(III) Amend **629.04 – Measurement** by revising lines 292 to 294 to read as follows:

629.04 Measurement.

(A) The Engineer will measure thermoplastic and preformed pavement marking tape per linear foot in accordance with the contract documents. The longitudinal pavement markings will be measured per linear foot as a single stripe for the width specified in the contract and in the proposal. The Engineer will include the longitudinal gaps for skip striping, up to thirty (30) feet long, in the measurement.

The Engineer will measure the transverse markings by the linear foot, per lane, or per each according to the contract.

The Engineer will not measure the crosswalk markings when contracted on a lump sum basis.

The Engineer will not measure the thermoplastic and pavement marking tape when contracted on a lump sum basis.

The Engineer will not measure temporary pavement markings including flexible delineator posts with reflector makers or Type I Barricades and temporary signs installed for the longitudinal guidance of public traffic over reconstructed areas, cold planed surfaces, newly paved surfaces or other unmarked or scarified areas for payment.

The Engineer will measure the temporary pavement markings and temporary signs installed as ordered by the Engineer for special temporary traffic patterns on a force account basis, if the contract specifies payment in the proposal.

The Contractor shall consider the work required for the removal of pavement markings incidental to the various contract items, except as provided in the proposal or elsewhere in the contract. If the contract stipulates that the Engineer will make payment for the removal of pavement markings, the Engineer will measure the removal of pavement markings.

(B) The Engineer will measure the pavement markers per each for the types shown in the proposal.

The Engineer will not measure the pavement markers when contracted on a lump sum basis.

(C) The Engineer will measure the painted stripes that are twelve (12) inches wide or less as a single stripe. The Engineer will measure the painted stripes over twelve (12) inches wide as two (2) stripes. The Engineer will measure the double stripes that are twelve (12) inches or

less in total width including the transverse space between the stripes as a single stripe.

The Engineer will not measure the painted pavement striping including curb markings when contracted on a lump sum basis.

The Engineer will measure the longitudinal pavement markings by the linear foot or per gallon according to the contract. Longitudinal gaps for skip striping that are 30 feet or less will be included in the measurement.

The Engineer will measure the transverse markings by the linear foot, per lane, per each or per gallon according to the contract.

The Engineer will not measure the crosswalk markings when contracted on a lump sum basis.

The Engineer will measure the curb markings by the linear foot or per gallon according to the contract."

(IV) Amend **629.05 – Payment** by revising lines 296 to 330 to read as follows:

629.05 Payment.

(A) The Engineer will pay for thermoplastic and preformed pavement marking tape at the contract price per linear foot or on a lump sum basis according to the contract, complete in place, including primers.

The Engineer will pay for double four (4) inch striping with a four (4) inch space between stripes at the contract price per linear foot or on a lump sum basis according to the contract.

The Engineer will pay for crosswalk markings at the contract price per lane of traffic marked, per each or on a lump sum basis according to the contract.

The Engineer will pay for pavement arrows (single and multiple heads), symbols, and words at the contract price per each according to the contract.

The contract unit price paid shall be full compensation for furnishing labors, materials, tools, equipment and incidentals and for doing the work involved in furnishing and installing pavement markings complete in place according to the contract.

The Engineer will not pay for the temporary pavement markings including flexible delineator posts with reflector markers or Type I Barricades and temporary signs installed for the longitudinal guidance of public traffic over reconstructed areas, cold planed surfaces, newly paved surfaces or other unmarked or scarified areas for payment if not shown in the proposal separately. The Engineer will consider them incidental to the various contract items.

If the contract specifies payment for temporary pavement markings installed as ordered by the Engineer for special temporary traffic patterns, the Engineer will pay from an allowance for "Temporary Construction Zone Markings".

The Engineer will compute the actual amount paid to the Contractor for force account work according to Subsection 109.06 – Force Account Provisions and Compensation.

If the contact specifies payment for removal of pavement markings under unit price pay items, the Engineer will pay for the accepted quantities at the contract unit prices bid. The prices shall be full compensation for removing such items according to the contract.

(B) The Engineer will pay for the various types of pavement markers at the contract price per each or on a lump sum basis according to the contract, complete in place, including adhesives.

(C) The Engineer will pay for painted pavement striping at the contract price per linear foot or on a lump sum basis according to the contract.

The Engineer will pay for quantities of crosswalk marking at the contract price per lane of traffic marked, per each or on a lump sum basis according to the contract.

The Engineer will pay for pavement arrows (single or multiple arrow heads), symbols, and words at the contract price per each according to the contract.

The Engineer will pay for the accepted quantities of curb markings at the contract price per linear foot or on a lump sum basis.

The Engineer will pay for the following pay items when included in the proposal schedule:

Pay Item	Pay Unit
_____ - Inch Pavement Striping	Linear Foot

(Thermoplastic Extrusion)

_____ Pavement Symbol
(Thermoplastic Extrusion) Each

Removal of _____ Linear Foot

END OF SECTION 629

SECTION 634 – PORTLAND CEMENT CONCRETE SIDEWALKS

Make the following amendment to said Section:

(I) Amend **Section 634.04 - Measurement** by replacing lines 60 to 61 to read:

"**634.04 Measurement.** The Engineer will measure Portland cement concrete sidewalks by the square yard of finished surface.

The Engineer will not measure Portland cement concrete sidewalks when contracted on a lump sum basis."

(II) Amend **Section 634.05 – Payment** by replacing lines 62 to 72 to read:

"**634.05 Payment.** The Engineer will pay for the accepted quantities of Portland cement concrete sidewalk at the contract unit price per square yard complete in place or lump sum price as shown in the proposal.

Payment will be full compensation for work prescribed in this section and contract documents.

The Engineer will pay for following pay item when included in proposal schedule:

Pay Item	**Pay Unit**
Portland Cement Concrete Sidewalk	Square Yard

The Engineer will pay for excavation of unsuitable material and backfill with material acceptable to the Engineer under Section 203 – Excavation and Embankment. If no pay item exists, refer to Subsection 104.02 – Changes."

END OF SECTION 634

Make the following Section a part of the Standard Specifications:

"SECTION 652 – ROUGH CARPENTRY

652.01 Description. This section describes the Rough Carpentry.

(A) Provide all rough carpentry, complete, including but not limited to wall studs, eave framing, roof rafters, rough bucks, blocking, furring strips, and rough hardware.

(B) All wood specified in this section shall be wood treated.

(C) Related Work Specified Elsewhere:

(1) **Section 621 – WOOD TREATMENT**. Lumber products treatments.

652.02 Materials

(A) Lumber, General. Factory-mark each piece of lumber with type, grade, mill and grading agency, except omit marking from surfaces to be exposed with transparent finish or without finish.

Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.

(1) Provide dressed lumber, S4S, unless otherwise indicated.

(2) Provide seasoned lumber with 15% maximum moisture content at time of dressing.

(B) Framing Lumber.

(1) Light Framing Lumber. 2-inches through 4-inches thick, less than 6-inches wide, such as studs, plates, blocking, rough bucks, furring, etc., provide Construction grade, Douglas Fir / Larch.

(C) Miscellaneous Materials.

(1) Fasteners and Anchorages. Provide size, type, material and finish as indicated and as recommended by applicable standards, complying with applicable Federal Specifications and ANSI for nails, staples, screws, bolts, nuts, washers and anchoring devices. Provide metal hangers and framing anchors

of the size and type recommended by the manufacturer for each use including recommended nails. Provide all fasteners and anchorages with a hot-dip zinc coating (ASTM A 153).

(2) Moisture Barrier. ASTM D 226, Type II (No. 30) asbestos-free, asphalt roofing felt.

(D) Other Materials.

(1) All other materials not specifically listed herein or shown on the drawings, but required for the successful installation and completion of the work are included and are subjected to approval of the Project Coordinator.

652.03 Construction Requirements.

(A) Submittals.

(1) Certificates. Submit certificate of treatment showing compliance with the specifications, and a certificate of dryness for all wood specified to be dried after treatment.

(B) Quality Assurance.

(1) Grading Marks. Factory mark each piece of lumber with type, grade, mill, and grading agency identification. Certificate of inspection and grading by a recognized agency may be submitted with each shipment in lieu of factory marking, at Contractor's option.

(2) Wood Preservative Treatment. In accordance with Section 621 Wood Treatment.

(C) Job Conditions.

(1) Coordination. Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, rough bucks, blocking and similar supports to allow proper attachment of other work.

(D) Product Handling.

Delivery and Storage: Keep materials dry at all times. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and provide air circulation within stacks.

(E) Execution.

(1) General. Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.

(a) Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.

(b) Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes. For interior application use low odor mineral spirits as solvent.

(c) Use common wire nails, except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

(2) Wood Blocking, Rough Bucks, and Furring Strips. Provide wherever shown and where required for attachment of other work. Form to shapes as shown and cuts as required for true line and level of work to be attached. Coordinate location with other work involved. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown.

(3) Retreat cut and penetrated lumber in accordance with **SECTION 621 – WOOD TREATMENT**.

652.04 Method of Measurement. The Engineer will not measure rough carpentry for payment.

652.05 Basis of Payment. The Engineer will not pay for the rough carpentry separately. The Engineer will consider the price for the rough carpentry included in the contract price for **Section 621 – WOOD TREATMENT**.

The price includes full compensation for rough carpentry and furnishing labor, tools, materials, equipment and incidentals necessary to complete the work."

END OF SECTION 652

Make the following Section a part of the Standard Specifications:

"SECTION 657 – JOINT FIRE STOP

657.01 Description. This section describes all joint fire stop penetration work required for this project.

(A) Provide all materials, labor, equipment and tools necessary to complete joint fire stop work as indicated on the drawings and specified herein and includes the following:

(1) Joints in or between fire-resistance rated constructions

(2) Joints in smoke barriers

657.02 Materials.

(A) Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

(B) Joints in or between Fire-Resistance Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1996 or UL 2079.

(C) Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

(D) F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.

(E) Joints in Smoke Barriers: Provide fire-resistive joint systems with rating determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg.

(F) L-Rating: Not exceeding 5.0 cfm/sq. ft. of joint at both ambient and elevated temperatures.

(G) Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively per ASTM E 84.

(H) Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

657.03 Construction

(A) Submittals.

(1) Product Data.

(2) Product Schedule. For each penetrating firestopping system. Include locations, illustration of firestopping system, and design designation of qualified testing agency.

(3) Qualification Data. For Installer

(4) Product Test Reports: For each joint firestopping system, for tests performed by qualified testing agency.

(5) Closeout Submittals: Installer certificate from installer Indicating that joint firestopping systems have been Installed in compliance with requirements and manufacturer's written instructions.

(B) Quality Assurance.

Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors", or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

(C) Execution

(1) Examination

(a) Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

(b) Proceed with installation only after unsatisfactory conditions have been corrected.

(2) Preparation

(a) Surface Cleaning: Before installing fire resistive joint systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements.

(b) Remove from surfaces of joint substrates foreign materials that cold interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.

(c) Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.

(d) Remove laitance and form-release agents from concrete.

(e) Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

(3) Installation

(a) General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

(b) Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings:

(c) After installing elastomeric fill materials and allowing them to fully cure, remove combustive forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

(d) Install elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:

(e) Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.

(f) Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.

(g) For elastomeric fill material that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

(D) Field Quality Control

(a) Inspecting Agency: State may engage a qualified testing agency to perform tests and inspections according to ASTM E 2393.

(b) Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

(c) Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

(E) Cleaning and Protection

(a) Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing be joint firestopping system manufacturers and that do not damage materials in which joints occur.

(b) Provide final protection and maintain conditions during and or after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

657.04 Measurement. The Engineer will measure fire stop in Lump Sum in accordance with the contract documents.

657.05 Payment. The Engineer will pay for the accepted pay items listed below at the contract lump sum price, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The price includes full compensation for electrical work and furnishing labor, tools, materials, equipment and incidentals necessary to complete the work."

Pay Item	Pay Unit
Fire Stop	Lump Sum"

END OF SECTION 657

Make the following Section a part of the Standard Specifications:

"SECTION 658 – THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

658.01 Description. This section describes the thermoplastic polyolefin roofing system work.

(A) Application of an thermoplastic polyolefin roofing system.

(B) Related Sections include the following:

(1) **Section 661 – SHEET METAL FLASHING AND TRIM**

(2) **Section 627 – ROUGH CARPENTRY**

658.02 Materials.

(A) Self-Adhering, thermoplastic polyolefin (TPO) roofing system.

(B) Substrate board.

(C) Vapor retarder.

(D) Roof insulation.

(E) Cover board.

(F) Walkways.

Products

(A) Performance Requirements

(1) All roof underlayments, roof coverings, and roof accessories shall comply to meet the latest ASTM Standards for high wind uplift forces and Section 1507 in the State Building Code, whichever is greater for Building C which is a storm shelter.

(2) General Performance: Installed roofing system and flashing shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings shall remain watertight.

(3) Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.

(4) Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D 3746, ASTM D 4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

(5) Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

(6) Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897.

(a) Zone 1 (Roof Area Field): *64* lbf/sq.ft.

(b) Zone 2 (Roof Area Perimeter): *100* lbf/sq.ft. Location: From roof edge to inside roof edge.

(c) Zone 3 (Roof Area Corners): *136* lbf/sq.ft. Location: In each direction from each building corner.

(B) Thermoplastic Polyoelfin Roofing (TPO)

(1) TPO Sheet: ASTM D 6878/D 6878M, internally fabric or scrim reinforced self-adhering TPO sheet.

(2) Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.

(3) Thickness: 80 mils nominal.

(4) Backing: Polyester Fleece Backing.

(5) Exposed Face Color: White.

(6) Solar Reflective Index (SRI), 3 year aged: 64 or greater.

(7) Energy Star Listing: Roofing system shall be listed on the Department of Energy's Energy Star "Roof Products Qualified Product List" for low slope roof products.

(8) Energy Performance: Roofing system shall have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.

(9) Exterior Fire Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

(10) Fire-Resistance Ratings: Comply with fire-resistance rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

(C) Auxilliary Roofing Materials

(1) General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.

(2) Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.

(3) Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 55 mils thick, minimum, of same color as TPO sheet.

(4) Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

(5) Roof Vents: As recommended by roof membrane manufacturer. Size: Not less than 4-inch diameter.

(6) Bonding Adhesive: Manufacturer's standard.

(7) Slip Sheet: Manufacturer's standard, of thickness required for application.

(8) Vented Base Sheet: ASTM D 4897/D 4897M, Type II; non-perforated, asphalt-impregnated fiberglass reinforced, with mineral granular patterned surfacing on bottom surface.

(9) Metal Termination Bars: Manufacturer's standard, pre-drilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

(10) Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, pre-punched.

(11) Fasteners: Factory coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.

(12) Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

(D) Vapor Retarder

(1) Self-Adhering Sheet Vapor Retarder: ASTM D 1970/D 1970M, polyethylene film laminated to layer of rubberized asphalt adhesive, minimum 40-mil total thickness; maximum permeance rating of 0.015 perm, cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor retarder manufacturer.

(E) Roof Insulation

(1) General: Preformed roof insulation boards manufactured or approved by TPO roof membrane manufacturer, approved for use in FM Approvals; RoofNav-listed roof assemblies.

(2) Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 2, Grade 3, glass fiber mat facer bonded to a core of isocyanurate foam.

(a) Compressive Strength: 25 psi.

(b) Size: 48 by 96 inches.

(c) Thickness: Required to meet required R-value.

(d) Base Layer: 1-1/2 inches.

(3) Tapered Insulation: Provide factory-tapered insulation boards.

(a) Material: Match roof insulation.

(b) Minimum Thickness: ¼-inch.

(c) Slope: As shown on drawings.

(d) Roof Field: ¼-inch per foot unless otherwise indicated on Drawings.

(e) Saddles and Crickets: ½ inch per foot unless otherwise indicated on Drawings.

(4) Insulation Accessories

(a) General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.

(b) Fasteners: Factory-coated steel fasteners with metal or plastic plates complying with corrosion resistance provisions in

FM Approvals 4470, designed for fastening roof insulation and cover boards to substrates, and acceptable to roofing system manufacturer.

(c) Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

i. Modified asphaltic, asbestos-free, cold-applied adhesive.

ii. Bead-applied, low-rise, one-component or multi-component urethane adhesive.

iii. Full-spread, spray-applied, low-rise, two-component urethane adhesive.

(d) Gypsum-Based Cover Board: Non-combustible, water-resistant gypsum core with embedded glass mat facers, complying with ASTM C 1177/C 1177M, and with the following additional characteristics, DensDeck Prime Eonic, or equal:

i. (Size: 48 inches (1220 mm) by 96 inches (2440 mm), nominal.Exception: Board to be attached using adhesive or asphalt may be no larger than 48 inches (1220 mm) by 48 inches (1220 mm), nominal.

ii. Thickness: 0.50 inch.

iii. Surface Water Absorption: 2.0 g, maximum, when tested in accordance with ASTM C 473.

iv. Surface Burning Characteristics: Flame spread of 0, smoke developed of 0, when tested in accordance with ASTM E 84.

v. Combustibility: Non-combustible, when tested in accordance with ASTM E 136.

vi. Mold Growth Resistance: Zero growth, when tested in accordance with ASTM D 3273 for minimum of 4 weeks.

(5) Protection Mat: Woven or non-woven polypropylene, polyolefin, or polyester fabric; water permeable and resistant to UV

degradation; type and weight as recommended by roofing system manufacturer for application.

(F) Walkways

(1) Walkway Roof Pavers: Heavyweight, hydraulically pressed concrete units, square edged, with top edges beveled 3/16 inch, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C 140/C 140M; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C 67; and as follows:

(a) Size: 24 by 24 inches. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch in length, height, and thickness.

(b) Weight: 22 lb/sq. ft.

(c) Compressive Strength: 7,500 psi minimum.

(d) Colors and Textures: As selected by Architect from manufacturer's full range of colors.

658.03 Construction.

(A) Submittals:

(1) Product Data: For each type of product including insulation

(2) Shop drawings to include the roof plans, sections, details, attachment to other work, including the following:

(a) Layout and thickness of insulation.

(b) Base flashings and membrane termination details.

(c) Flashing details at penetrations.

(d) Tapered insulation layout, thickness, and slopes.

(e) Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacing, and patterns for mechanically fastened roofing system.

(f) Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

(g) Tie-in with adjoining air barrier.

(3) Manufacturer's Installation Instructions. Submit all data sheets available from the manufacturer on the installation of the roofing system applicable to this work.

(4) Manufacturer's Certificate. Certify products meet or exceed specified requirements.

(5) Applicator Qualifications. Applicator of roofing material shall be a manufacturer approved applicator. Proof of qualifications shall be in writing from the manufacturer.

(B) Quality Control.

(1) Membrane Manufacturer**.** Company specializing in manufacturing the products specified in this section with ten (10) years documented experience.

(2) Applicator. Contractor specializing in performing the work of this section with three (3) years documented experience and approved by system manufacturer for warranted membrane installation.

(3) Manufacturer's Technical Representative. A representative of the roofing material manufacturer shall be on the roof during job start. Provide a written inspection report of each site visit and submit the reports to the Roofing Contractor. The manufacturer's representative shall approve the application process at specific stages of completion.

(4) Final Inspection. Manufacturer's representative shall provide a comprehensive final inspection after completion of the roof system. All application errors must be addressed and final punch list completed.

(C) Delivery, Storage and Handling.

(1) Deliver materials to site in manufacturer's unopened and undamaged containers.

(2) Store and protect materials from damage and weather.

(3) Store materials under cover at temperatures between 55 and 90 degrees F.

(4) Do not permit construction materials or equipment to be used or stored in such a manner as to damage decking or completed roofing.

(D) Environmental Requirements.

(1) Weather Limitations. Proceed with installation only when existing and forecasted weather conditions permit.

(2) Do not apply over water saturated surfaces.

(3) Do not apply during, or 24 hours preceding, inclement weather including rain, fog, mist, dew or freezing temperatures.

(4) Do not apply when surface or air temperature is below 50 degrees F.

(5) Do not apply when surface or air temperature exceeds 110 degrees F.

(E) Warranty.

(1) Waterproofing Warranty. Provide roofing manufacturers standard warranty, where the manufacturer agrees to provide replacement materials at its own expense as needed to repair any areas where water penetration has occurred due to material defects for a period of 10-years from the date of project acceptance.

(2) Installers Warranty. Submit roofing Installer's 2-year warranty signed by Installer, covering the Work of this Section, 2 years from roofing system installation completion date.

If there are defects in the existing roof deck, make corrections to make the roof deck acceptable to the roofing materials manufacturer.

(3) Warranty shall include:

(a) Warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards, vapor retarder, substrate board, roof pavers and other components of roofing system.

(b) Warranty Period: 10 years shall commence from the project acceptance date.

(c) Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:

Execution

(A) Examination

(1) Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

(2) Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.

(3) Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

(4) Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05310 "Steel Decking".

(5) Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.

(6) Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than 75 percent, or as recommended by roofing system manufacturer, when tested according to ASTM F 2170.

(7) Test Frequency: One test probe per each 1,000 sq. ft. or portion thereof, of roof deck, with not less than three tests probes.

(8) Submit test reports within 24 hours after performing tests.

(9) Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.

(10) Proceed with installation only after unsatisfactory conditions have been corrected.

(B) Preparation

(1) Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.

(2) Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

(3) Perform fastener-pullout tests according to roof system manufacturer's written instructions. Submit test result within 24 hours after performing tests.

(4) Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

(5) Install sound-absorbing insulation strips according to acoustical roof deck manufacturer's written instructions.

(C) Roofing Installation

(1) Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

(2) Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning Work on adjoining roofing.

(3) Coordinate installation and transition of roofing system component serving as an air barrier.

(D) Substrate Board Installation

(1) Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches in adjacent rows.

(2) At steel roof decks, install substrate board at right angle to flutes of deck.

(a) Locate end joints over crests of steel roof deck.

(b) Tightly butt substrate boards together. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.

(c) Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.

(d) Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field or roof according to roofing system manufacturers' written instructions.

(e) Loosely lay substrate board over roof deck.

(E) Vapor Retarder Installation

(1) Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 and 6 inches, respectively.

(2) Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.

(3) Continuously seal side and end laps with adhesive.

(4) Self-Adhering Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 and 6 inches, respectively.

(5) Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

(F) Insulation Installation

(1) Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

(2) Comply with roofing system and roof insulation manufacturer's written instruction for installing roof insulation.

(3) Installation Over Metal Decking:

(a) Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows, end joints staggered not less than 12 inches, and with long joints continuous at right angle to flutes of decking.

(b) Locate end joints over crests of decking.

(c) Where installing composite and non-composite insulation in two or more layers, install non-composite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.

(d) Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.

(e) Make joints between adjacent insulation boards not more than ¼ inch in width.

(f) Trim insulation so that water flow is unrestricted.

(g) Fill gaps exceeding ¼ inch with insulation.

(h) Cut and fit insulation within ¼ inch of nailers, projections, and penetrations.

(i) Mechanically attach base layer of insulation and substrate board using mechanical fasteners specifically designed and sized for fastening specified boar-type roof insulation to metal decks.

(j) Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.

(k) Staggered end joints within each layer not less than 24 inches in adjacent rows.

(l) Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.

(m) Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.

(n) Make joints between adjacent insulation boards not more than ¼ inch in width.

(o) At internal roof drains, slop insulation to create a square drain sump with each side equal to the diameter to the drain bowl plus 24 inches.

(p) Trim insulation so that water flow is unrestricted.

(q) Fill gaps exceeding ¼ inch with insulation.

(r) Cut and fit insulation within ¼ inch of nailers, projections, and penetrations.

(s) Adhere each layer of insulation to substrate using adhesive according to FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:

i. Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.

ii. (Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

iii. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

(t) Installation Over Concrete Deck:

i. Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows and end joints staggered not less than 12 inches in adjacent rows.

ii. Where installing composite and non-composite insulation in two or more layers, install non-composite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.

iii. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.

iv. Make joints between adjacent insulation boards not more than ¼ inch in width.

v. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.

vi. Trim installation so that water flow is unrestricted.

vii. Fill gaps exceeding ¼ inch with insulation.

viii. Cut and fit insulation within ¼ inch of nailers, projections, and penetrations.

ix. Adhere base layer of insulation to vapor retarder according to FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:

(a) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

(b) Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.

(c) Staggered end joints within each layer not less than 24 inches in adjacent rows.

(d) Install with long joint continuous and with end joints staggered not less than 12 inches in adjacent rows.

(e) Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.

(f) Make joints between adjacent insulation boards not more than ¼ inch in width.

(g) At internal roof drains, slope insulation boards not more than ¼ inch in width.

(h) Fill gaps exceeding 1/4 inch with insulation.

(i) Cut and fit insulation within ¼ inch of nailers, projections, and penetrations.

(j) Adhere each layer if insulation to substrate using adhesive according the FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:

i. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

(G) Installation of Cover Board

(1) Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.

(2) Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.

(3) At internal roof drains, conform to slope of drain sump.

(a) Trim cover board so that water flow is unrestricted.

(b) Cut and fit cover board tight to nailers, projections, and penetrations.

(c) Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.

(d) Install slip sheet over cover board and beneath roof membrane.

(H) Self-Adhered Roofing Installation

(1) Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.

(2) Unroll roof membrane and allow to relax before installing.

(3) Start installation of roofing in presence of roofing system manufacturer's technical personnel.

(4) Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

(5) Fold roof membrane to expose half of sheet width's bottom surface.

(6) Remove release liner on exposed half of sheet.

(7) Roll roof membrane over substrate while avoiding wrinkles.

(8) Fold remaining half of roof membrane to expose bottom surface.

(9) Remove release liner on exposed half of sheet.

(10) Roll roof membrane over substrate while avoiding wrinkles.

(11) In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.

(12) Apply roof membrane with side laps shingled with slope of roof deck where possible.

(13) Seams: Clean seam areas, overlap roof membrane, and hot-air weld side and end laps of roof membrane and sheet flashings, to ensure a watertight seam installation.

(14) Test lap edges with probe to verify seam weld continuity.

(15) Apply lap sealant to seal cut edges of roof membrane and flashing sheet.

(16) Verify field strength of seams a minimum of twice daily, and repair seam sample areas.

(17) Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

(18) Spread sealant bed over deck drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

(I) Base Flashing Installation

(1) Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instruction.

(2) Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

(3) Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

(4) Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

(5) Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

(6) Follow and adhere to manufacturer's installation requirements at roof/wall installation. No seams or exposed fasteners.

(J) Walkway Installation

(1) Roof Paver Walkways: Install walkway roof pavers according to manufacturer's written instructions.

(2) Install roof paver walkways at the following locations:

(a) Perimeter of each rooftop unit.

(b) Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.

(c) Between each roof hatch and each roof top unit location or path connecting rooftop unit locations.

(d) Top and bottom of each roof access ladder.

(e) Between each roof access ladder and each rooftop unit location or path connection rooftop unit locations.

(f) Locations indicated on Drawings.

(g) As required by roof membrane manufacturer's warranty requirements.

(h) Provide 3 inches of space between adjacent roof pavers.

(K) Field Quality Control

(1) Testing Agency: Engage a qualified testing agency to perform tests and to inspect substrate conditions, surface preparation, roof membrane application, sheet flashings, protection, and drainage components and furnish reports to Architect.

(2) Perform the following tests:

(a) Flood Testing: Floor Test each roof area for leaks, according to recommendations in ASTM D 5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.

(b) Perform tests before overlying construction is placed.

(c) Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of base flashing.

(d) Flood each area for 48 hours.

(e) After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installation are watertight.

(f) Cost of retesting is Contractor's responsibility.

(g) Testing agency shall prepare survey report indicating locations of initial leaks, if any, and final survey report.

(h) Contractor shall adequately protect building from any water infiltration during any flood testing.

(i) Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation

on completion, in presence of Contracting Officer, and to prepare inspection report.

(j) Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

(k) Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

(L) Protecting and Cleaning

(1) Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

(2) Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

(3) Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

(M) Roofing Installer's Warranty**:**

Provide per Sample below:
WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner:

2. Address:

3. Building Name/Type:

4. Address:

5. Area of Work:

6. Acceptance Date:

7. Warranty Period:

8. Expiration Date:

(1) AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period.

(2) NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

(3) This Warranty is made subject to the following terms and conditions:

i. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, cause by:

a. Lightning;

b. Fire;

c. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition.

d. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetration of the work;

e. Vapor condensation on bottom of roofing; and

f. Activity on roofing by others, including construction contractors, maintenance personnel, other person, and animals, whether authorized or unauthorized by Owner.

ii. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has

been repaired by Roofing Installer and until cost and expense thereof have been paid by responsible party so designated.

iii. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.

iv. During Warranty Period, if Owner allow alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetration, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void an date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

(4) During Warranty Period, if original use of roof is changed and it becomes use for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.

(5) Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.

(6) This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

(7) IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____

2. Name: _____

3. Title: _____

658.04 Measurement. The Engineer will measure items in this section in Square Feet or per Each in accordance with the contract documents.

658.05 Payment. The Engineer will pay for the accepted pay items listed below at the contract price per pay unit, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for each of the following pay items when included in the proposal schedule:

Pay Item	Pay Unit
Thermoplastic Polyolefin Roofing	Square Feet
Cover Board, ½" thick	Square Feet
Vapor Barrier	Square Feet
Rigid Insulation	Square Feet
VTR Flashing, 2"	Each

END OF SECTION 658

Make the following Section a part of the Standard Specifications:

SECTION 660 – GENERAL MECHANICAL REQUIREMENTS

660.01 Description.

This section includes the general mechanical requirements.

660.02 Materials. None

660.03 Construction.

1) General Requirements.

(A) These general mechanical requirements apply to all sections of plumbing, HVAC, controls and fire sprinkler sections of this project specifications, unless specified otherwise in the individual sections.

(B) "Provide" shall mean "furnish and install" when used herein. Connect building systems to exterior utility systems at five (5) feet beyond the building line and as shown on the drawings.

2) Quality Assurance.

(A) The Contractor shall furnish all labor, materials, tools and equipment and perform all work and services necessary for complete and properly operated mechanical systems, as shown on the drawings and as specified, in accordance with provisions of the Contract Documents and completely coordinate his work with that of all other trades.

(B) The Contractor shall completely examine the Contract Documents and shall report to the Engineer any error, inconsistency or omission he discovers. Bidders are cautioned to review the Technical Specifications carefully and thoroughly. The submittal of a bid shall be considered as acceptance of the specifications as published. Protests concerning the Technical Specifications lodged after bid opening shall not be considered.

(C) The Contractor shall visit the site and examine the conditions affecting his work before submitting his proposal. The submission of the proposal shall be considered evidence that the Contractor has visited the site. Extra payments will not be allowed to the Contractor on account of extra work made necessary by his failure to visit the site.

(D) Provide all supplementary or miscellaneous items, hangers, support structure, details, appurtenances and devices incidental to or necessary

for a sound, secure and complete mechanical system where work required is not specifically indicated.

(E) Drawings and specifications shall be taken together. Provide work specified or stated in one or the other document as though mentioned in both.

(F) Substitution of another manufacturer's product for materials or equipment specified and for items with "approved equal" after the brand name requires approval in accordance with GENERAL PROVISIONS. “Equal” products are acceptable in lieu of those specified hereinafter by specific manufacturer and model number.

(G) The Contractor shall warrant that all materials and equipment, furnished under this Contract, will be new and that all work will be of good quality, free from faults and defects, in conformance with the Contract Documents for a guarantee period of one (1) year, commencing after thirty (30) consecutive days of trouble-free operation after the Project Acceptance Date or the equipment acceptance date, if earlier than the Project Acceptance Date, against all defects in material and workmanship.

(H) The Contractor shall maintain at the site, a minimum of one (1) copy of all drawings, specifications, addenda, approved shop drawings, change orders and other modifications, in good order and marked to record all changes made during construction. These shall be made available to the Engineer.

(I) The Contractor, at all times, shall keep the premises free from accumulation of waste materials or rubbish caused by his operations. Upon completion of the work, the Contractor shall remove all his waste materials and rubbish from and about the project, as well as all his tools, construction equipment, machinery and surplus materials and shall clean all new equipment and accessories.

(J) The Contractor shall give the Engineer timely notice of its readiness for testing any work, including the data arranged so the Engineer may observe such testing. The Contractor shall bear all cost of such tests.

(K) Workmanship And Materials:

(1) Workmanship shall be of the best quality and none, but competent mechanical workers, skilled in their trades and thoroughly familiar with the work involved, shall be employed. The Contractor shall furnish the services of an experienced superintendent, who will be constantly in charge of the work, until completed and accepted.

(2) Reference to standards is intended to be the latest revision of the standard specified.

(3) Unless otherwise specified later in this section, each article of its kind shall be the standard product of a single manufacturer.

(4) Whenever the words “or approved equal” or other words of similar intent or meaning are used, implying that judgment is to be exercised, it is understood that it is the judgment of the Engineer that is referred to.

(5) All manufactured materials shall be delivered and stored in their original containers. Equipment shall be clearly marked or stamped with the manufacturer’s name and rating. Equipment and materials shall be carefully handled, properly stored and adequately protected to prevent damage before and during installation, in accordance with the manufacturer’s recommendations and as approved by the Engineer. Damaged or defective items, in the opinion of the Engineer, shall be replaced at no cost to the State.

(L) The Engineer shall have the right to accept or reject materials, equipment and/or workmanship and determine when the Contractor has complied with the contract documents.

3) Contract Drawings.

(A) Contract drawings are essentially diagrammatic, indicating general layout and approximate locations toward establishing the scope for uniform estimating basis for all bidders. They are not intended to be detailed construction working drawings. Equipment, fixtures, ductwork and piping arrangements shall fit into space allotted and shall allow adequate clearances for servicing and maintenance. Reasonable modifications to indicated locations and arrangement to suit job conditions shall not constitute basis for requesting additional funds from the State.

(B) Because of the small scale of drawings, it is not possible to indicate all offsets, fittings, and accessories which may be required. Contractor shall carefully investigate structural and finish conditions affecting his work and arrange such work accordingly, furnishing such fittings, traps, valves, ductwork, piping, supports, and accessories as may be required to meet such conditions.

(C) Verification of Dimensions: The Contractor shall be responsible for the coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work and working

conditions, to verify all dimensions in the field, and to advise the Engineer of any discrepancy before performing any work.

4) Submittals.

(A) Submit in accordance with Division 100 - GENERAL PROVISIONS.

(B) Within thirty (30) calendar days after award of contract and before installation of any materials or equipment is begun, Contractor shall submit to the Engineer for approval a complete list of materials and equipment together with names and addresses of manufacturers, catalog numbers, and trade names; and annotated descriptive data showing the specific model, type, and size of each item the Contractor proposes to furnish. Prepare working drawings on sheets not smaller than 24 inches by 36 inches, and include data essential to the proper installation of the system. Do not commence work until the design of the system and the various components have been approved.

(C) Approval of materials will be based on manufacturer's published rating. Any materials and equipment which are not in accordance with these specifications may be rejected.

(D) Prior to start of any field work, required copies of to scale shop drawings of equipment, fixtures, ductwork, piping and controls shall be submitted for review. No work shall be started without approval from the Engineer. Where apparatus and equipment have been indicated on the contract drawings, dimensions have been taken from typical equipment of the class indicated. The shop drawings shall show the details of construction and installation of the particular equipment or fixture furnished. The shop drawings shall be fully dimensioned to show that the equipment and connections fit the space provided.

(1) Contractor shall check the submittals and shop drawings and certify that they are correct and in compliance with the contract drawings and specifications.

(2) Review of shop drawings is confined to arrangement of equipment and fixtures only and does not relieve the Contractor from responsibility for proper fit, performance and construction. Any deviation from the Contract drawings and specifications shall be clearly noted on the shop drawings. Since manufacturing methods vary, reasonable variations from the Contract Documents are acceptable; however, performance and material requirements are minimum and the State retains the right to judge the equality of any variation.

(E) Submit eight (8) copies of each submittal required for approval.

(F) Substitution Requests: Substituted material or equipment may be used if qualified by written permission from the Engineer.

(G) Shop Drawings: Submit prints of dimensioned shop drawings, indicating equipment layout, piping, hangers, equipment bases, support details, wiring diagrams for control and interlock, and locations and sizes of pipe sleeves and duct openings. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices and components. Coordinate drawings with other trades to avoid interferences. Drawings shall be minimum 24 inches by 36 inches in size, except as specified elsewhere. Approval of shop drawings does not relieve the Contractor from responsibility of a complete installation or proper performance. Work shall not commence until shop drawings are approved by the Engineer.

(1) The Contractor shall review, stamp with his approval, and submit all shop drawings required by the Contract documents or subsequently by the State.

(2) At the time of submission, the Contractor shall inform the Engineer in writing of any deviation in the shop drawings from the requirements of the Contract Documents.

(3) By approving and submitting shop drawings, the Contractor certifies that he has determined and verified all field measurements and obstructions, field construction criteria, materials, catalog numbers and similar data, that he has checked and coordinated each shop drawing with the requirements of the work and of the contract documents and that all equipment fits within designated spaces.

(4) Drawings shall verify and indicate piping locations and inverts.

(H) Product Data:

(1) Product data of equipment, fixtures and trim showing manufacturer's name, trade name, catalog model or number, project specification and paragraph reference, material specifications, performance data, certified dimensions, motor sizes and if applicable, sound power levels by octave bands.

(2) Contractor shall clearly indicate (highlight, arrow, etc.) on product data submittals the project related information and delete (X or cross-out) the non-applicable information.

(I) Schedule: Submit schedules of mechanical equipment which include a complete list of materials and equipment together with names and addresses of manufacturers, catalog numbers, and trade names.

(J) Certified Test Reports: Before delivery of materials and equipment, certified copies of all test reports, specified in the individual sections shall be submitted for approval.

(K) Certificates of Conformance or Compliance:

(1) Manufacturers Certification: Submit certification from the manufacturer attesting that the materials and equipment, to be furnished for this project comply with the requirements of this specification and of the reference publications. Preprinted certifications will not be acceptable; certifications shall be in the original, and dated and signed by an authorized officer of the manufacturer. The certification shall not contain statements that could be interpreted to imply that the product does not meet all requirements specified, such as “as good as”, “achieve the same end use and result as materials formulated in accordance with the referenced publication”, “equal or exceed the service and performance of the specified material.” The certification shall simply state that the product conforms to the requirements specified.

(2) Contractor’s Warranty: Submit certificate of Warranty as detailed in “Warranty and Certificate” paragraph in this section.

(3) Standards Compliance: When materials or equipment must conform to the standards of organizations such as the International Association of Plumbing and Mechanical Officials (IAPMO), proof of such conformance shall be submitted to the Engineer for approval.

(L) Operating and Maintenance Instructions: Prior to final inspection, submit bound copies of the Operating and Maintenance Instructions on all equipment and the system as a whole and as required by the individual technical sections.

5) Field Posted As-Built Drawings.

(A) Maintain and submit for all work as specified in Division 100 - GENERAL PROVISIONS.

(B) Record changes from the contract drawings of all concealed piping. Show exact locations and sizes, as actually installed, of mechanical equipment, fixtures, piping, isolating valves and items requiring maintenance or inspection. Dimension underground piping from a visible

point on structure. Keep at the job site a complete, accurate record of all approved deviations from the contract drawings, shop drawings and specifications. Keep these changes on reproducible prints of the drawings affected and submit to the Engineer at the completion of the project.

6) Laws, Regulations and Code.

The following shall govern where applicable; the Uniform Plumbing Code – 2018 as adopted by the City and County of Honolulu, the International Building Code – 2018 as adopted by the City and County of Honolulu, the Wastewater Division of the City and County of Honolulu, State of Hawaii Department of Health Regulations, OSHA Rules and Regulations and all other codes and standards referenced in these specifications. Where requirements differ in these codes and standards, the more stringent shall apply.

7) Permits and Inspections.

(A) Obtain and pay for all fees, permits, licenses, assessments, connection charges and inspections required for this project.

(B) The Contractor shall apply and pay for all necessary inspections required by any public authority having jurisdiction.

8) Manufacturer's Recommendations.

(A) Equipment installed under this division of the specifications shall be installed in accordance with all manufacturer's recommendations, unless otherwise shown on the drawings or specified in this section. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the equipment being installed, printed copies of these recommendations shall be furnished to the Engineer, prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations may be cause for rejection of the equipment.

(B) Certain specified construction and details may not be regularly included in the manufacturer's catalogued product. In such instances, the Contractor shall provide the material or equipment complete as specified.

9) Operating and Maintenance Instructions.

(A) Bound Instructions: Unless otherwise indicated, submit eight (8) copies of an operation, maintenance, and troubleshooting manual for each item of equipment and the system as a whole. Furnish the manual,

bound in hardback binders or an approved equivalent. Furnish one (1) complete manual prior to the time that equipment tests are performed and furnish the remaining manuals before the contract is completed. Inscribe the following identification on the cover; the words OPERATION AND MAINTENANCE MANUAL, the name and location of the building, the name of the Contractor, the name of the Consultant, date, and the contract number. The manual shall include the names, addresses and telephone numbers of each subcontractor installing equipment and of the local representatives for each item of equipment. Also, include a list of equipment by manufacturer, with the model number and serial number, tag number, quantity of each unit, location of unit, and area served. When standard manufacturers brochures are used, adequately indicate (highlight, arrow, etc.) the project related information and delete (X or cross-out) the non-applicable information. Flysheet shall be placed before instructions covering each subject.

(B) The instruction sheets shall be approximately 8-1/2 by 11 inches, with large sheets of drawings folded in. The manual shall have a table of contents and be assembled to conform to the table of contents with the tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in. The manual shall include:

(1) System layout showing piping and interceptor layout.

(2) Description of the function of each principle item of equipment;

(3) Shutdown instructions;

(4) Maintenance instructions;

(5) Manufacturer's bulletins, cuts and descriptive data;

(6) Safety precautions, test procedures; performance data; and the manual shall be complete in all respects for equipment, fixtures, controls, accessories and associated appurtenances provided.

10) Substitution of Equipment or Material.

(A) Design is based on equipment, fixtures and material as described in the drawings. The space available for some equipment installation is limited. Any changes in equipment, fixtures, bases, piping, connections or equipment specified and required by approved substitutions shall be made by Contractor at no additional cost to the State. Contractor shall ensure proper fit, clearances, operation and maintainability for any equipment or material that is substituted for that indicated.

11) Discrepancies.

(A) The drawings and specifications are intended to be cooperative. Any materials, fixtures, equipment or system related to this division and exhibited on the drawings, but not mentioned in the specifications are to be executed to the intent and meaning thereof, as if it were both mentioned in the specifications and set forth on the drawings.

(B) In case of differences between the drawings and specifications, the specifications shall govern first, and then the drawings. Large scale details shall take precedence over small scale drawings, as to the shape and details of construction. Specifications shall govern as to materials.

(C) Should any discrepancy or apparent difference occur between drawings and specifications or should error occur in the work of others affecting the work, the Contractor shall notify the Engineer at once. If the Contractor proceeds with the work affected without instructions from the Engineer. The contractor shall make good any resultant damage, rework, extra work or defect at no additional cost to the State. All interpretations of drawings and specifications shall be clarified by the Engineer.

12) Omissions.

It is the intent of the Project to provide a complete installation. Should there be omissions, the Contractor shall call the attention of the Engineer to such omissions so that the necessary corrections can be made.

13) Warranty and Certificate.

(A) The Contractor shall guarantee and certify in writing the following items:

(1) All equipment and material furnished for a period of one (1) year commencing after thirty (30) consecutive days of trouble-free operation after the Project Acceptance Date or the equipment acceptance date, if earlier than the Project Acceptance Date, against all defects in material and workmanship. If any equipment, piping or material fails, does not operate satisfactorily or shows undue wear, the Contractor will be notified, and shall be required to correct the defect and damage to other work caused by such defect, immediately and at no additional cost to the State.

(2) All equipment, piping and materials to provide the results specified or shown.

(3) All equipment and fixtures to be properly installed in strict accordance with manufacturer's recommendations.

(4) All piping to be drip free and properly installed to be free of vibration, pounding or objectionable noise.

(B) The above Warranty shall not be interpreted as voiding, limiting or reducing any equipment manufacturer's warranty or any guarantee permitted by law.

(C) The Engineer shall have the right to require a written certificate, dated and signed by a responsible employee of the Contractor, evidencing the performance of any portion of the work, or any testing; as a condition precedent to the acceptance of any work or the result of any test. Whenever a regulatory agency performs inspections or tests of any portion of the work, a certificate shall be furnished by the Contractor that the inspection or test was satisfactorily passed.

(D) The Contractor shall be held responsible for all damages to any part of the premises, building or contents caused by leaks or other defects in pipe, fixtures, equipment or materials provided under this specification for a period of one (1) year after the Project Acceptance Date.

(E) Terms of this Warranty are in addition to other Warranty provisions of the specifications, and do not substitute for other more stringent terms, if any.

14) Product, Delivery, Storage and Handling.

Furnish new equipment, materials, piping and accessories bearing the manufacturer's identification. Coordinate deliveries to avoid interference or construction delays. Protect products during delivery, storage, installation, and the remainder of the contract period after installation.

15) Inspection of Site.

This Contractor shall visit the site and examine the conditions affecting his work before submitting his proposal. The submission of the proposal shall be considered evidence that the Contractor has visited the site and no extra payments will be allowed to the Contractor on account of extra work made necessary by his failure to visit the site. If there are any questions or discrepancies in the design, the Contractor shall bring it to the attention of the Engineer before submitting his proposal.

16) Continuity of Services, Phasing.

(A) Examine site and become familiar with existing local conditions affecting work.

(B) Examine all Drawings and Specifications (i.e. work from other trades) and become familiar with the types and systems of construction to be used. Determine how such types and systems will affect the installation of mechanical work.

(C) Investigate, determine and verify locations of any overhead utilities on or near the site. Determine such locations in conjunction with all public and private utility companies and with all authorities having jurisdiction.

17) Openings, Cutting and Repairing.

(A) The Mechanical Contractor shall cooperate with the work to be done under other Sections of these specifications in providing information as to work required to complete the project.

(B) Any drilling or cutting required for the performance of work under this Section shall be the responsibility of this Contractor and the cost shall be borne by him.

(C) Holes in Concrete: The Mechanical Contractor shall pay all costs for cutting holes. All holes through existing concrete shall be either core drilled or saw cut. All holes required shall have the approval of the Engineer prior to cutting and drilling.

(D) It shall be the responsibility of this Contractor to ascertain that all openings are properly located.

18) Materials and Equipment.

(A) As specified in all plumbing, HVAC, controls and fire sprinkler sections.

(B) Materials, fixtures and equipment shall be cataloged products of manufacturers regularly engaged in production of such materials, fixtures or equipment and shall be manufacturer's latest design that complies with the specification requirements. Materials, fixtures and equipment shall duplicate items that have been in satisfactory commercial or industrial use at least two (2) years in Hawaii prior to bid opening. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the items need not be the products of the same manufacturer, except where

specified. Each item of equipment shall have the manufacturer's nameplate. Name of the distributing agent will not be acceptable.

(C) All materials shall be new, of equivalent or better quality than of materials specified. For ease of maintenance and parts replacement, select equipment from a single manufacturer as much as possible. Substitutions require pre-bid approval.

(D) The Contractor shall provide all necessary options and accessories to comply with the applicable equipment specification requirements. Installation of options and accessories shall be in accordance with the manufacturer's requirements. The complete assembly shall be warranted by the respective manufacturer.

19) Nameplates.

(A) Each item of equipment shall have manufacturer's nameplate of corrosion resisting metal attached in a conspicuous location. Nameplate data shall include manufacturer's name, address, model number, serial number, capacity, rating and such other performance data as required to completely identify the item. In addition, the manufacturer shall provide a separate corrosion resisting metal tag, unless specified otherwise, to carry the equipment designation as shown on drawings. Except as otherwise specified, nameplate lettering shall be stamped in upper case. Nameplates shall be fastened by means of corrosion resisting metal screws, rivets or minimum 14-gage wire.

20) Tools and Supplies.

(A) Special tools and supplies shall be provided to maintain equipment provided for this project. 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.

21) Substitutions.

(A) Specific product listings in these specifications shall not preclude alternative product selections of equivalent or superior quality. Contractor may make reasonable substitutions after the bid, provided that these are submitted to the Engineer for acceptance in accordance with GENERAL PROVISIONS. The Contractor shall be responsible for design changes to accommodate the substituted product, at no additional cost to the State.

(B) In addition to submittal requirements required in other sections of this specification, all mechanical substitution requests must be attached with the following minimum documents in order for the item to be considered:

(1) A list of all deviant features of the substitution item compared with the specified item. If any deviations are found that are not specifically noted, it will be rejected. If any deviations are found after construction is ongoing or completed, the contractor shall replace it with a new installation that meets the specifications.

(2) A certified letter signed by the manufacturer or their authorized representative on letterhead that if approved, will accept responsibility for all re-design, construction changes and associated costs to accommodate their product as approved by the Engineer. If a Contractor decides to use the substituted product, he shall also co-sign the letter. The letter shall also unconditionally absolve the Design Engineer and the State of any responsibility for problems related to the substitution.

(3) Complete dimensioned drawings that clearly indicate that the substituted item will fit within the space, that all utility connections are compatible with the existing facility and indicate any design changes required to properly operate and maintain the item. Drawings shall include complete design of the electrical system, controls, compressed air, sound generation, corrosion protection and physical size. These drawings shall be signed by the Manufacturer as correct and accurate and shall also be co-signed by the Contractor if he decides to use the product.

(4) Manufacturer qualifications for any group of products will not be accepted. Each item shall be considered individually and shall be itemized.

(5) It shall be understood that the drawings and specification only indicate the specified product. It does not in any way represent that another product will fit, operate and function properly in the same application.

(6) The Contractor shall be responsible for any effort regarding modification and re-processing of the building permit if the substitution changes any design aspect of the project.

(7) The Contractor agrees that the substitution of any item absolves the Engineer of design responsibility for any issues related to that item.

22) Installation and Workmanship.

(A) Provide competent and qualified manufacturer's factory trained and certified field service personnel on-site to be responsible for execution of all diagnostic testing in accordance with equipment manufacturer's installation and start-up certification requirements and warranty terms and conditions. Perform work using skilled personnel skilled in the appropriate trades and provide adequate supervision and management of the work.

(B) All workmanship shall be of the highest standard. The piping systems shall be laid out to insure a neat, systematic and orderly arrangement of all work. Vertical piping lines shall be plumb and lines that are grouped shall be parallel and as direct as possible. Exposed pipe where indicated, shall be run parallel with walls.

23) Verification of Dimensions.

The Contractor shall check all dimensions at the site and shall establish all lines and levels. The Contractor shall be responsible for correctness of all dimensions and fitting of equipment and piping 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 decisions.

24) Protection of Work in Progress.

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.

25) Local Technical Support.

(A) Provide manufacturers field service personnel on-site to be responsible for execution of all diagnostic testing in accordance with equipment manufacturers installation and startup certification requirements and warranty terms and conditions.

(B) The Contractor shall provide certified manufacturers representatives and/or service technicians for any field modification to equipment. The Contractor shall ensure that any modifications to equipment will not invalidate manufacturers warranties.

(C) The mechanical equipment supplier shall have a Hawaii office within 500 miles of the project site, staffed with factory trained Engineers fully capable of providing instruction, routine maintenance and emergency maintenance service on all system components.

(D) The control system supplier shall have a Hawaii office within 500 miles of the project site, staffed with factory trained Engineers fully capable of providing instruction, routine maintenance and emergency maintenance service on all system components.

26) Cutting and Patching.

The Contractor shall arrange for all cutting, fitting and patching necessary to accommodate the plumbing work as the job progresses and such cutting and patching shall be done by that trade experienced in the particular type of work required.

27) Piping Identification.

(A) Identification of all new pipe lines shall be by means of colored, waterproof, all temperature, self-adhering labels and directional arrow.

(B) All exposed pipes, whether insulated or not shall be identified. Labels may be omitted from piping where the use is obvious, due to its connection to equipment and where the appearance would be objectionable in finished rooms, as approved by direction.

(C) Identification labels shall be placed as follows:

(1) Near each valve and branch connection.

(2) Wherever piping merges or disappears from view from the floor of the room in which it is installed.

(3) Labels shall not be more than 50 feet apart.

(D) All new valves shall be tagged and the tag information filled out on a "Valve Tag Log." An example of the log is given at the end of this specification section.

28) Equipment Identification.

Identify all equipment with symbol and service conforming to that indicated on the drawings. Identification shall be on 1-1/4 inch by 3 inch laminated plastic nameplates securely fastened to the equipment. Leave manufacturer's nameplate clean, legible, and unpainted.

29) Coordination of Work as Specified in other Sections.

The Mechanical Contractor is responsible for coordination with the General Contractor to assure proper layout, size, and location of mechanical equipment. Mechanical Contractor shall ensure that power and control wiring are provided and installed.

30) Inspections.

(A) All work and materials are subject to field observation at any and all times by the Engineer.

(B) Contractor shall notify the Engineer a minimum of two days prior to testing any piping which must be witnessed and approved before they are covered up or enclosed. Should the Contractor fail to notify the Engineer at the times prescribed, it shall then be the Contractor's responsibility to make accessible any concealed lines, or demonstrate the acceptability of any part of the system. Any extra cost caused by the removal of such work shall be borne by the Contractor.

(C) If observer finds any material or work not conforming to these Specifications, Contractor within three days of being notified shall remove said materials from the premises and replace with approved material, at no cost to the State.

31) Operational Acceptance Test.

The Mechanical Contractor shall perform all tests of the installed work and shall provide all services, labor, equipment, materials and instruments needed for the tests. During pressure tests all items in the system to be tested, not designed for test pressures, shall be removed or isolated from the system and shall be reconnected or unblocked after tests are completed. Should operating tests require the presence of manufacturers' representatives, the Mechanical Contractor shall cooperate with them and shall place at their disposal all assistance, materials and services required to perform such test. The Mechanical Contractor shall certify in writing that all work has passed all required tests and shall complete the attached Operational Performance Tests form.

32) Posted Operated Instruction.

Furnish approved operating instructions for each principal item of equipment for the use of the operation and maintenance personnel. Operating instruction shall be printed or engraved and shall be framed under glass or in approved laminated plastic and posted where directed by the Engineer. Operating instructions shall be attached to or posted adjacent to each principal item of equipment including start

up, procedure in the event of equipment failure and other items of instruction as recommended by the manufacturer of each item of equipment. Operating instructions shall be secured to prevent easy removal or peeling.

33) Instruction to Personnel.

(A) The Contractor shall provide the services of competent instructors who will give full instruction to the designated personnel in the adjustment, operation and maintenance, including pertinent safety requirements, of the equipment or system specified. Each instructor shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the State for regular operation. The number of man-days (8 hours) of instruction furnished shall be as specified in other sections. When more than 4 man-days of instruction are specified, approximately half of the time shall be used for classroom instruction.

(B) All other time shall be used for instruction with the equipment or system. When significant changes or modifications in the equipment or systems are made under the term of the contract, additional instruction shall be provided to acquaint the operating personnel with the changes or modifications.

34) Safety Requirements.

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys and other rotating parts located so that any person can come in close proximity thereto shall be fully enclosed or properly guarded. High temperature equipment and piping so located as to endanger personnel or create a fire hazard shall be properly guarded or covered with insulation of a type as specified herein. Items such as catwalks, ladders and guardrails shall be provided where required for safe operation and maintenance of equipment. Debris shall not be allowed to accumulate as a result of this work. Upon completion of this work, remove all debris and excess materials, tools, etc. resulting from this work from the jobsite and leave the location of this work broom-clean in a manner acceptable to the Engineer.

35) Final Inspection.

Final inspection shall be requested by the Mechanical Contractor only after submittal of all required certificates. No final inspection will be made until all moving parts of equipment are properly guarded, all controls and safety devices tested and operative, all painting required done and the site cleaned up.

36) Warranty.

The Mechanical Contractor shall Warranty the installation for a period of one year after 30 consecutive days of trouble-free operation after the date of acceptance of the project by the State against any defects due to faulty materials, equipment, workmanship or installation. Upon notice of defect, the Mechanical Contractor shall correct; replace defective item at no additional cost to the State.

37) One-Year Warranty and Maintenance Service Contract.

(A) In addition to the Warranty on materials and workmanship, the Installer shall submit seven (7) copies of the Maintenance Service Contract, countersigned by the Contractor, that will validate the Warranty.

(B) The Warranty and maintenance service shall extend for a period of one year after 30 consecutive days of trouble-free operation after the Project Acceptance Date, or the Air Conditioning Equipment Acceptance Date if earlier than the Project Acceptance Date, and shall include all labor, materials, equipment and parts necessary to service the complete system, in accordance with the subsection 37 F. Maintenance Schedule, 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. This maintenance period and the Warranty period shall run concurrently (same start and end dates). However, should contractor default on maintenance service contract and need to restart. The warranty period shall be extended to match the maintenance service contract. Maintenance of equipment shall start within one (1) month of equipment start-up and continue until end of one (1) year maintenance service contract period. Trouble-free operation is defined as a non-disabling condition or a non-recurring failure or disruption and the following:

(1) The system shall be free of all discrepancies, contamination and debris which requires correction in excess to those described for the monthly service which is included in the Schedule of Maintenance.

(2) The system is maintaining operational conditions and other parameter as measured during acceptance tests.

(C) The Installer shall include a listing of the following items along with the Maintenance Service Contract:

(1) Names of the servicing contractor.

(2) Air conditioning system acceptance date.

(3) Service contract expiration date.

(4) Service inspection schedule for the maintenance period.

(5) Itemized listing of the equipment covered under the service contract, including a description of the equipment identified, its model and serial number(s) and manufacturer's name(s).

(D) Maintenance service contractor shall have a local office, staffed with competent and qualified manufacturer's factory trained and certified field service personnel and stocked with full inventory of replacement repair parts, to perform specified service and maintenance tasks on all equipment in accordance with the One-Year Maintenance Service Contract and terms and conditions of all equipment manufacturer's warranties and recommendations. Field service personnel shall be fully capable of providing technical assistance instruction, routine maintenance and emergency maintenance service on all system equipment components.

(E) The Maintenance Service Contract shall be submitted along with the Operations and Maintenance Manual on/or before the Project Acceptance Date. Distribution of submittal:

1 copy: Contractor
1 copy: Inspection Branch Engineer Files
2 copies: User Church Community
2 copies: User's Facility Maintenance Agency
1 copy: Quality Control Branch

(F) Schedule of Maintenance Service: All service performed by the Contractor shall include applicable items listed but shall not be limited to the following maintenance task:

(1) Pumps (CHW)

(a) Quarterly Service (4 times per year):

(1) Lubricate and check pump and motor bearings for abnormal temperature and unusual noise or vibration and repair as needed.

(2) Check shaft seals for leaks. Adjust, tighten or replace as required.

(3) Record motor voltage and amperage.

(4) Log suction and discharge pressures

(5) Certify performance of quarterly service and correct and report all discrepancies.

(b) Semi-Annual Service (2 times per year):

(1) Pull and clean strainer for all pumps. Remove and clean strainer if excessive debris is noted.

(2) Check condition of insulation, re-insulate as necessary.

(3) Clean and remove all dust and foreign matter. Clean all rust spots and scratches and touch up paint with matching color.

(4) Check motor coupling for alignment; mounting bolts are secure.

(5) Certify performance of semi-annual service and correct and report all discrepancies.

(2) Fan Coil Units

(a) Monthly Service

(1) Clean and clear all drip pans and flush all related condensate drain lines with nitrogen. Install pan tablets if necessary to control algae growth. (Note: Contractor may be liable for water damage due to clogged drains.)

(2) Change all disposable air filters at least once a month; use Farr 30/30 or equal.

(3) Lubricate and oil all fan and motor bearings.

(4) Check all drives for wear; adjust belt tension. Replace belt as required.

(5) Operate equipment to check for proper operation, unusual noise and vibration; adjust or repair all equipment and controls as required; clean-up all equipment.

(6) Check time clock for proper operation and time settings.

(7) Certify performance of monthly services and that all discrepancies are reported and corrected.

(b) Annual Service

(1) Lubricate and oil all fan and motor bearings.

(2) Check all drives for wear; adjust belt tension. Replace all fan belts.

(3) Operate equipment to check for proper operation, unusual noise and vibration; adjust or repair all equipment and controls as required; clean-up all equipment.

(4) Check time clock for proper operation and time settings.

(5) Check and clean all unit housing (inside and outside and components), seal leaks and remove rust from exterior components and touch-up paint.

(6) Chemically clean the evaporator coil free and clear of debris, dirt and any biological growth.

(7) Certify performance of annual services and that all discrepancies are reported and corrected.

(3) Exhaust Fans

(a) Quarterly Service

(1) Check motor-controlled and back-draft damper for proper operation; lubricate linkage for free movement.

(2) Lubricate fan motors and bearings.

(3) Check belt wear and tension; adjust or replace as needed.

(4) Check sheaves for wear, replace as needed.

(5) Check fan collar, bearings and shaft for wear, repair or replace as needed.

(6) Replace air filters where installed; remove and wash intake grille.

(7) Certify performance of quarterly fan maintenance service and correct and report all discrepancies.

(b) 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) Certify performance of semi-annual fan maintenance service and correct and report all discrepancies.

(2) Temperature Controls: Quarterly Service

(a) Check control devices for proper operation, sticking stems, and calibration; repair/replace weak or broken springs and all other parts.

(b) Check automatic dampers for tightness in closing, bent blades and defective linkage; lubricate connections for free movement and repair as required.

(c) Adjust thermostat to maintain 75 degree F room temperature.

(d) Certify performance of quarterly maintenance service and that all discrepancies are reported and corrected.

(3) Cleaning of Mechanical Equipment Rooms or Enclosures: Monthly

(a) Vacuum or wipe clean all equipment surfaces and all related appurtenance.

(b) Vacuum or sweep complete floor and platform areas. DO NOT wet floor and platform area where there is no waterproofing.

(c) Wet wash complete floor area with tap water where allowed. Remove all used, deteriorated, replaced, discarded

parts and related debris. The contractor will be responsible for and will pay for any damage or problems related to water being splashed onto electrical and mechanical equipment.

(d) Notify Facility Manger of any dangerous conditions, improper storage of furniture, materials and supplies which impacts your work within rooms and enclosures, including vandalism.

(G) Work Schedule: All maintenance work shall be performed between the hours of 7:30 a.m. to 4:00 p.m., on normal working days, Monday through Friday, excluding State Holidays.

(H) Trouble Calls: Emergency service and repairs required between regular service calls shall be rendered within 24 hours after the Contractor is notified, non-work days excluded. The Contractor shall call DOE Facilities Maintenance, phone number 831-6731, the next working day after being notified of the problem and report the status of repairs.

(I) Maintenance Report/Checklist: The Contractor shall prepare and maintain a maintenance service report / checklist which shall include the following:

(1) Date maintenance service was performed.

(2) The name of the mechanic who performed said maintenance.

(3) The type and cost (labor, materials, parts and equipment) of repair work performed on the unit, if any.

(4) Documents and other data pertaining to the maintenance performed. It will be the responsibility of the Contractor to maintain the report / checklist by recording the above noted data after each scheduled maintenance and emergency repairs, 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. Reports shall be certified by a representative of the facility being served and shall be submitted to Engineer monthly at the completion of the service / trouble call.

(J) Cleanup and Work Practices: 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. The Contractor shall exercise caution during the progress of his

maintenance and repair work to prevent damage to the ceilings, roofing and other building structure. The Contractor shall restore all damages, caused by his negligence, to its original condition at his own expense.

(K) All costs for periodic maintenance services and for emergency calls shall be included in the lump sum bid price.

(L) The Maintenance Service Contract does not include repairs resulting from vandalism, negligent use or misuse of equipment.

38) Operation and Maintenance Manual.

(A) Submit four (4) hard bound copies of the Operating and Maintenance Manual on all equipment and the system as a whole. The manual shall identify project name and number, contractor, consultant, date and all equipment provided, It shall include the equipment manufacturer's name, model and serial number, tag no., capacity, quantity of units, their location and area (room) served and shall each include the manufacturer's operation and maintenance manuals including control and field wiring diagrams and source of service and replacement parts. When standard manufactures' brochures are used, adequately indicate (highlight, arrow, etc.) the project related information and delete (X or cross-out) the non-applicable information.

(B) Distribution of submittal:

2 copies: User
2 copies: User's Facility Maintenance Agency

39) Testing, Adjusting and Balancing.

(A) Test, adjust and balance each piece of equipment as required to assure proper operation.

(B) Air Systems Testing and Balancing: Upon completion of the installation and field testing, performance test and adjust the supply, return, make-up, and exhaust air systems, and chilled and hot water heat recovery systems to provide the air volume and water flow quantities indicated. Accomplish all work in accordance with the agenda and procedures specified and Associated Air Balance Council or the standards of the National Environmental Balancing Bureau. Correct air and water system performance deficiencies disclosed by the test before balancing the systems.

(C) Agency Qualifications: The Contractor, as part of this contract, shall obtain the services of a qualified testing organization to perform the testing

and balancing work as herein specified. Prior to commencing work under this section of the specifications, the testing organization shall have been approved by the Engineer. The criteria for determining qualifications shall be membership in the AABC, or certification by the NEBB.

(D) Adjust systems and components thereof that perform as required by drawings and specifications. Instruments used for measurements shall be accurate and calibrated within the last 6 months. Provide last date of calibration.

(E) Submit testing and balancing reports for all mechanical systems in accordance with section 660 – GENERAL MECHANICAL REQUIREMENTS and this Section.

(F) Balancing: Duct systems shall be balanced as follows: System (or air moving device) to not less than 90 percent of design CFM.

(G) System Test Report: The Contractor shall provide as part of the submittal typewritten schedules of readings taken during the balancing and testing operations indicating the required or specified reading, the first reading taken, and final balanced reading in the certified report. The certified report shall include for each air-handling system the data listed below:

(1) For Each Pump, Exhaust Fan and Fan Coil Unit.

(a) Manufacturer and Model

(b) Motor H.P., Voltage, Cycles, Phase, and Full Load Amps.

(c) Running Load Amps

(d) CFM and RPM

(e) Air Conditioning Temperature – Supply and Return

(H) Control Settings: On-site settings for all automatic controls including thermostats, safety controls, minimum damper settings, fire-safety thermostats, pressure controls, temperature controls, and other similar items shall be provided in the form of a type tabulated list indicating type of control, location, setting, and function. Final settings shall be permanently marked on devices.

40) Calibration and Adjustments.

After completion of the installation, perform final calibrations and adjustments of the equipment provided under this contract and supply services incidental to the proper performance of the unit control panels under warranty.

41) Acceptance Procedure.

Upon completion of the calibration, Contractor shall start-up the air conditioning system and perform all necessary testing and run diagnostic tests to ensure proper operation. Contractor shall be responsible for generating all software and entering all database necessary to perform the sequence of control and specified software routines. An acceptance test in the presence of the Engineer shall be performed. Provide operational acceptance tests. The tests shall be performed during a normal day of operation after the air conditioning system has been completely installed and made operable. Results of the tests shall be indicated on the attached Operational Performance Test form and shall be part of the submittal for the testing and balancing report.

660.04 Measurement. The Engineer will measure general mechanical requirements in Lump Sum in accordance with the contract documents.

660.43 Payment.

The Engineer will pay for the accepted pay items listed below at the contract price per pay unit, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for each of the following pay items when included in the proposal schedule:

Pay Item	Pay Unit
General Mechanical _____-	Lump Sum

END OF SECTION 660

Make the following Section a part of the Standard Specifications:

"SECTION 661 – SHEET METAL FLASHING AND TRIM

661.01 Description. This section describes the sheet metal flashing and trim work.

(A) Provide all labor, materials and equipment necessary to fabricate and install flashing, and gutters, and other related work as shown on drawings and as specified herein.

(B) Related Sections include the following:

(1) Coordinate installation of sheet metal work with Section **658 – THERMOPLASTIC POLYURETHANE ROOFING.**

(2) Sealants are specified under **Section 663 - SEALANTS.**

661.02 Materials.

(A) Flashing Associated with Metal Roofing. Provide materials which are compatible with the existing roofing.

(B) Nails and Fasteners. Use stainless steel fasteners to fasten all metals.

(C) Stainless Steel Wire Cloth Strainers. Maximum 1/2-inch mesh 0.063-inch diameter wire for downspout connector head covers at gutters, formed as shown, tight friction fit and removable.

(D) Gutters, Leader, Flashing, etc. ASTM A167, 20-gauge min., Type 304, stainless steel 2B Finish, fully annealed, dead-soft temper, configuration as shown.

(1) Gutter support strap. 2" x 1/8", configuration as shown.

(2) Fasteners. Type 316 stainless steel.

(E) Bituminous Paint. Cold-applied mastic complying with SSPC-Paint 12 but containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

(F) Other Materials. All other materials not specifically listed herein or shown on the drawings, but required for the successful installation

and completion of the work are included and are subject to approval of the Contracting Officer.

661.02 Construction Requirements.

(A) Submittals.

(1) Manufacturer's Data. Submit manufacturer's product data on all manufactured items.

(2) Shop Drawings. Submit shop drawings with reference made to detail numbers on the contract drawings to the Project Coordinator for approval. Contract drawings are general in nature. Furnish additional details for all the similar and unusual conditions necessary to fabricate the flashing and sheet metal work. Shop drawings shall show all fasteners and relationship to adjacent work. No fabrication will be permitted before approval is secured. Tracing or reproducing drawing details is unacceptable.

(3) Warranty. Submit warranty as stipulated in item entitled "WARRANTY" here in below.

(B) Quality Assurance.

(1) All sheet metal fabrications shall conform to State and local codes, SMACNA (latest edition) and industry standards.

(2) All roof penetrations shall be installed weather tight in such a manner to maintain integrity of the roofing. Fastening and cleating shall withstand all positive and negative wind pressures for 145 mph Exposure C winds; 1.25 Importance Factor.

(3) Install flashing and sheet metal work to withstand wind loads, structural movements, thermally induced movement, and exposure to weather without failing, rattling, leaking and fastener disengagement.

(C) Delivery, Storage, and Handling.

(1) All materials shall be delivered and stored in such a manner as to afford adequate protection. Damaged materials shall not be used and shall be removed from the site.

(2) Handle manufactured materials as recommended by the manufacturer

(D) Warranty.

(1) The warranty provisions and number of years for the warrantee by this article shall take precedence over the standard provisions in the GENERAL CONDITIONS.

(2) Project Warranty. Submit Contractor's warranty, signed jointly by Installer covering work of this section, including all components of flashing system such as panels, base flashing, roofing accessories, fasteners, curbs, collar flashing, and other products, for the following warranty period and conditions:

(a) Warranty Period. Two years from the date of final Acceptance.

(b) Warranty shall cover repairs or replacement of damages to the building and its finishes due to leaks.

(E) Pre-Installation.

(1) The General Contractor, the Sheet Metal Contractor, and Roofing Installer shall attend a pre-installation meeting. Include other related trades as applicable. Confirm the required participants with the Project Coordinator. Notify participants at least five days prior to meeting. Intent of the meeting is to review the preparation and installation requirements for the roofing system and associated flashing and sheet metal and to coordinate and schedule the required work.

(F) Installation and Workmanship.

(1) Surface to which sheet metal is to be applied shall be even, smooth, sound, thoroughly clean and dry, and free from defects that might affect the application. Report any unsatisfactory surfaces to the Project Coordinator. In the absence of such a report, the Contractor shall be held responsible for the finished product.

(2) All accessories or other items essential for the completeness of the sheet metal installation, though not specifically indicated on the drawings or specified, shall be

provided. All such items unless otherwise indicated on the drawings or specified, shall be of the same kind of materials as the item to be applied. Nails, screws, rivets, and bolts shall be of the type best suited for the purpose intended and shall be of a composition that is compatible with the metal to which it will contact.

(3) Except as otherwise indicated on the drawings or specified, the workmanship of sheet metal work, method of forming joints, anchoring, cleating, provisions for expansion, etc., shall conform to the standards details and recommendations of the Sheet Metal and Air Conditioning Contractors National Association's "Architectural Sheet Metal Manual", and shall be subject to the approval of the Project Coordinator. Exposed edges shall be folded back neatly to form a minimum 1/2-inch hem on the concealed side. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work.

(4) Gutters. Provide cross sectional area not less than the size of gutter indicated and complete with mitered corners, end pieces, and special pieces that may be required. Form gutters in sections not less than 12-feet in length. Join ends of each length with 1-inch flat locked, riveted, and sealed joints. Expansion-type slip joints shall be provided at the center of the runs and at intervals of not more than 40-feet. Provide hangers of an approved type, spaced not to exceed 36-inches on center. Form hangers and fastenings from a metal compatible with the gutters. Gutter to downspout transition shall be fabricated from same material as gutter.

(5) Seams. Straight and uniform in width and height with no sealants showing on the face.

(a) Flat-lock Seams: Finish not less than 3/4-inch wide.

(b) Lap Seams: Finish soldered seams not less than one-inch wide. Overlap seams not soldered, not less than 3-inches.

(c) Loose-lock Expansion Seams: Not less than 3-inches wide, and shall provide minimum one-inch movement within the joint. Joint shall be completely

filled with exterior sealant, applied at not less than 1/8-inch, thick bed.

(d) Flat Seams: Make seams in the direction of the flow.

(6) All sheet metal work shall be watertight and wind-tight in compliance with the purpose intended for the items indicated on the drawings or specified herein. Sheet metal shall be held firmly in place and shall not rattle. Finish installation to provide for a long life under hard use.

(7) Cleating. Cleats for sheet metal work shall be provided where required, continuous, unless otherwise indicated on the drawings. Cleats shall be of the same material and weight as the metal being installed. Hook cleating with 3/4-inch minimum hem on concealed side of flashing.

(8) Protection from Contact of Dissimilar Materials. Surfaces in contact with dissimilar metal shall be painted with heavy-bodied bituminous paint or shall be separated by means of moisture-proof building felts.

(G) Protection.

Protect all sheet metal work until final acceptance of the work.

(H) Clean Up.

(1) Clean all exposed sheet metal work at completion of installation. Grease and oil films, handling marks, contamination from steel wool, fittings and drilling debris shall be removed, and the work scrubbed clean. All exposed metal surfaces shall be free of dents, creases, waves, scratch marks, and solder or weld marks.

(2) At completion of the work, clean up and remove all rubbish and debris from the premises which resulted from this work.

661.04 Method of Measurement. Sheet Metal Flashing and Trim will be paid on a linear foot basis. Measurement for payment will not apply.

661.05 Basis of Payment. The Engineer will pay for the Sheet Metal Flashing and Trim listed below at the contract lump sum price, as shown in the

proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The price includes full compensation for sheet metal flashing and trim and furnishing labor, tools, materials, equipment and incidentals necessary to complete the work.

The Engineer will pay for each of the following pay item when included in the proposal schedule:

Pay Item	Pay Unit
Sheet Metal Flashing and Trim _____	Linear Foot”

END OF SECTION 661

Make the following Section a part of the Standard Specifications:

SECTION 662 - INSULATION OF MECHANICAL SYSTEMS

662.01 Description.

This section includes the insulation of plumbing and HVAC systems requirements.

662.02 General requirements.

As specified Section 660 - GENERAL MECHANICAL REQUIREMENTS, with the additions and modifications specified herein, applies to this section.

662.03 Quality Assurance.

(A) Manufacturer's Stamp or Label: Every package or standard container of insulation, jackets, cements, adhesives and coatings delivered to the project site for use must have the manufacturer's stamp or label attached giving name of manufacturer, brand and description of material. Insulation packages and containers shall be marked "asbestos-free".

(B) Fire Resistance: Insulation, adhesives, vapor-barrier materials and other accessories, except as specified herein, shall be noncombustible. The materials shall have a flame-spread rating not more than 25 and a smoke-developed rating not more than 50 in accordance with NFPA 255, ASTM E 84-80 or UL 723.

(1) Materials Tests: Test factory-applied materials assembled. Field-applied materials may be tested individually. Use no fugitive or corrosive treatments to impart flame resistance. UL label or satisfactory certified test report from an approved testing laboratory will be required to indicate that fire hazard ratings for materials proposed for use do not exceed those specified. Flame-proofing treatments subject to deterioration due to effects of moisture of high humidity are not acceptable.

(2) Materials Exempt from Fire-Resistant Rating:

(a) Nylon anchors

(b) Treated wood inserts

662.04 Submittals.

(A) The items for which the submittal requirements of Section 660 - GENERAL MECHANICAL REQUIREMENTS, apply are as follows:

(B) Manufacturer's Data:

(1) Insulation

(2) Jackets

(3) Vapor-barrier materials

(4) Accessory-materials

(C) Standards Compliance: Standards compliance labels are required on each container or package:

(1) Insulation

(2) Jackets

(3) Vapor-barrier materials

(4) Accessory materials

662.05 Definitions.

(A) Finished Spaces: Habitation or occupancy spaces where rough surfaces are plastered, paneled or otherwise treated to provide a pleasing appearance.

(B) Unfinished Spaces: Storage or work areas where appearance is not a factor, unexcavated spaces, crawl spaces, etc.

(C) Concealed Spaces: Spaces between a ceiling and floor construction above or between double walls or furred-in areas; pipe and duct shafts, etc.

(D) Exposed: Open to view inside the building. For example, pipe run through a room and not covered by other construction, is exposed.

(E) Fugitive Treatments: Treatment of materials subject to deterioration due to aging, moisture, high humidity, oxygen, ozone and heat. Fugitive means entrapped materials that can cause deterioration e.g., solvents, water vapor, etc.

(F) Outside: Open to view beyond the exterior side of walls, above the roof and unexcavated or crawl spaces, above or beneath pier floors, in tunnels or exposed on all sides in trenches connected or not connected to an exterior portion of a building.

662.06 Warranty.

As specified Section 811 - GENERAL MECHANICAL REQUIREMENTS, with the additions and modifications specified herein. Contractor shall be held responsible for all damages to any part of the premises, building or contents caused by leaks or other defects in ducts, equipment or materials provided under this specification, for the period stated in Section 660 - GENERAL MECHANICAL REQUIREMENTS.

662.07 Piping Insulation.

Insulation exterior shall be cleanable, grease resistant, non-flaking and non-peeling. Pipe insulation shall conform to the referenced publications and the specified temperature ranges and densities in pounds per cubic foot (pcf). Insulation for fittings and flanges shall be pre-molded, pre-cut or job-fabricated insulation of the same thickness and conductivity as used on adjacent piping.

(A) Above Ground Chilled Water Piping:

(1) Cellular Glass: Minimum permeability shall be 0.0 perm-inch. Absorption shall be 0.2% by volume. Insulation shall be non-combustible under ASTM E136 with flame spread of 5 and smoke developed of 0 under ASTM E84. Material shall be 100% closed cell glass. Material shall comply with ASTM C552, “Specification for Cellular Glass Thermal Insulation”, (800 degrees F. max).

(2) Flexible Unicellular Insulation: ASTM C 1427. Tubular polyolefin-polyethylene insulation. Provide adhesive as recommend by insulation manufacturer. Armacell-Tubolit, Therma-cel or approved equal.

(B) Above Ground Refrigerant Piping: Flexible Unicellular Insulation, ASTM C 1427. Tubular polyolefin-polyethylene insulation. Provide adhesive as recommend by insulation manufacturer. Imcolock, Armacell, Therma-cel or accepted equivalent.

(C) Condensate drain piping: Flexible Unicellular Insulation, ASTM C 1427. Tubular polyolefin-polyethylene insulation. Provide adhesive as recommend by insulation manufacturer. Armacell-Tubolit, Therma-cel or approved equal.

662.08 Duct Insulation.

Provide factory applied insulation manufacturer's standard reinforced fire-retardant vapor barrier jacket, with identification of installed thermal resistance (R) value and out-of-package R value.

(A) Rigid Insulation: Rigid mineral fiber in accordance with ASTM C 612, Class 2 (maximum surface temperature 400 degrees F), 3 pcf average, one inch thick. Provide exterior insulation on supply, return and plenums for ductwork located in mechanical rooms and mechanical platforms. All outside air ducts shall be exterior rigid insulated.

(B) Duct Liner Board: Internal duct insulation shall be 1.0-inch thick, 3.0 lb/cf density fiberglass duct liner board with an EPA registered biocide coating to protect from microbial growth and meets requirements of ASTM C 1338, ASTM G21 and ASTM G22. Provide insulation on supply and return air ductwork, in ceiling spaces.

662.09 Insulation Jackets.

(A) Piping Insulation Jackets

(1) Stainless Steel Jackets: Piping exposed to weather provide ASTM A 167 or ASTM A 240, Type 304, minimum thickness of 33 gage (0.010 inch), smooth surface with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide stainless steel bands, minimum width of 0.5 inch. Provide factory prefabricated stainless steel covers for insulation on fittings, valves and flanges.

(2) Piping, Fittings, Flanges, and Valves in outside locations: Finish elbows and curved piping with factory fabricated metal covers. Finish tees, flanges, and valves with metal covers. Covers shall be same thickness and material as jackets on adjacent piping.

(B) Vapor-Barrier Material: Material shall be resistant to flame and moisture penetration and not support mold growth. Provide vapor-barrier material on insulation in exposed locations with a white surface suitable for painting without sizing. Perm rating of 0.1 for piping above ground and perm rating of less than .001 for underground piping.

(C) Provide FRK jacket to all insulated piping located in the ceiling space not exposed to weather. This shall include all pipe support points.

662.10 Equipment Insulation Systems.

Insulate air water separator and accessories with rigid board insulation. In outside locations, provide insulation 1/2 inch thicker than specified. Increase the specified insulation thickness for equipment where necessary to equal the thickness of angles or other structural members to make a smooth, exterior surface.

(A) Rigid Insulation: Rigid mineral fiber in accordance with ASTM C 612, Class 2 (maximum surface temperature 400 degrees F), 3 pcf average, two inch thick on pumps and one-inch on tanks.

662.11 Adhesives, Sealants and Compounds.

(A) Shall be compatible with materials to which applied and suitable for the service.

(1) Vapor-Barrier and Jacket Adhesive: Fire resistant type. Foster Products or approved equal.

(2) Lagging Adhesive: Fire resistant type. Foster Products or approved equal.

(3) Mineral Fiber Insulation Cement: ASTM C 195, thermal conductivity 0.85 max. at 200 degrees F mean when tested per ASTM C 177.

(4) Bedding Compound and Joint Sealer: Fire resistant type. Foster Products or approved equal.

(5) Vapor-Barrier Coating: Fire resistant type. Perm rating of .05. Foster Products or approved equal.

(6) Unicellular: Adhesive, sealant and coating as recommended by the insulation manufacture.

662.12 Accessories.

(A) Staples: Corrosion-resistant outside-clinch type.

(B) Anchor Pins: Provide anchor pins and speed washers recommended by the insulation manufacturer.

(C) Glass Cloth and Tape: Textile Glass.

(D) Aluminum-Foil-Backed Pressure-Sensitive Adhesive Tape: 50 degrees F maximum and limited to use on insulation with factory-applied jacket with aluminum foil facing. Arno or approved equal.

(E) Vapor-Barrier Material Tape: Pressure-Sensitive adhesive backed. Arno or approved equal.

662.13 Installation.

(A) Preparation: Do not apply insulation until surfaces to be covered have been leak tested, have had all rust and scale removed and have been cleaned, dried and inspected.

(1) Insulation shall be clean and dry when installed and kept dry during finish application. Wet insulation will not be approved for installation. Install materials neatly with smooth and even surfaces with jackets drawing tight and smoothly cemented down on longitudinal and end laps. Scrap pieces shall not be used where a full-length section will fit. All surface finishes shall be extended to protect all surfaces, ends and raw edges of insulation. Coatings and adhesives shall be at the manufacturer's recommended coverage per gallon.

(2) Install insulation system in accordance with manufacturer's recommendations using tradesman skilled in this trade and approved by the insulation manufacturer. Provide insulation products with a composite (insulation, jacket and adhesive) fire and smoke hazard rating as tested under ASTM E84, NFPA 255 and UL 723, not exceeding a flame spread of 25 and smoke developed of 50.

(B) Insulation for Piping, Fittings and Appurtenances:

(1) Pipe Insulation:

(a) Insulate all chilled water piping including branch lines, risers and piping within pipe chases.

(b) Secure insulation with insulation tape every 3 feet.

(c) Insulation shall be continuous throughout system and shall not stop at flanges, valves, irregular or oversized components.

(2) Chilled Water Pipe Insulation:

(a) Insulate all aboveground chilled water piping and fittings, chemical feeder piping and fittings, air/water separator piping and fittings, and expansion tank piping and fittings (up to reduced pressure backflow preventer on the make-up water line). Seal off ends at flanges and fittings in accordance with manufacturer's instructions. Insulate fittings as recommended by insulation manufacturer to conform to pipe insulation and its fire and smoke hazard classification. On piping risers, every third section of insulation shall have both ends dipped in mastic to protect the risers for transfer of moisture vertically.

(b) Insulate chilled water pumps, expansion tanks, air/water separators, chemical feeders, valves, strainers and gauges with cut and fitted pieces of calcium silicate insulation finished to match pipe. Provide manufacturer recommended vapor barrier and metal jacketing intended for out-door use.

(c) Chilled water piping insulation through floor shall be continuous through the floor slab. Insulation shall be cellular glass and penetration will be sealed air tight.

(3) Flexible Unicellular Insulation: Bond cuts, butt joints, ends and longitudinal joints with adhesive. Miter all turns and elbows, tees, valves and other pipe accessories. Where pipes penetrate fire walls, provide mineral-fiber insulation inserts and sheet-metal sleeves. Insulate flanges, unions, valves, and fittings in accordance with manufacturer’s published instructions. In addition, provide 2 inch wide glass cloth tape over the insulation at 24 inches on center and along the full length of all longitudinal joints, including butt joints and mitered joints.

(C) Piping Exposed to Weather: Provide metal jackets on all aboveground chilled water piping exposed to weather.

(1) Metal Jackets: Provide over insulation, machine cut jacket to smooth edge of circumferential joints. Over jacket not less than 2 inches at longitudinal and circumferential joints and secure with metal bands at not more than 9-inch centers. Overlap longitudinal joints down to shed water. Seal circumferential joints with a coating recommended by insulation manufacturer for weatherproofing.

(2) Flanges, Unions, Valves, Fittings, and Accessories: Insulate

and finish as specified hereinbefore for applicable service. Apply two coats of emulsion type vapor barrier mastic for cold service recommended by insulation manufacturer. Embed glass tape in the first coat. Overlap tape not less than one inch and the adjoining metal jacket not less than 2 inches.

(D) Pipe Insulation Thickness: Insulation thickness shall conform to Table 1.

TABLE 1

PIPE INSULATION THICKNESS (Inches Nominal)

PIPE DIAMETERS (Inches)

SERVICE/MATERIAL	0.25-1.25	1.5	1.75-3	3.5-5	6-10
Chilled water piping (aboveground)					
Cellular Glass	N/A	1.5	1.5	1.5	2.0
Flexible Unicellular	¾	N/A	N/A	N/A	N/A
Refrigerant piping (aboveground)					
Flexible Unicellular	1	N/A	N/A	N/A	N/A
Condensation drain piping (aboveground)					
Flexible Unicellular	¾	1.0	1.0	N/A	N/A

(E) Expansion Clearances: At points where pipe will move during expansion and contraction (expansion joints, Z-bends, expansion loops and ells), clearances between the pipe and encased insulation shall be sized to permit full pipe movement without cracking or damaging insulation and jacket.

(F) Ductwork and Duct Accessories: Provide field-applied insulation to exterior outside air ducts and duct plenums. Provide insulation to interior of supply and return air ducts. Ensure full range of motion of equipment actuators. Modify insulation to avoid obstruction with valve handles, safety reliefs, and other such items. Install insulation with jackets drawn tight and cement down on longitudinal and end laps. Do not use scrap pieces where full-length section will fit.

662.14 Field Inspection.

Visually inspect to ensure that materials used conform to specifications. Inspect installation progressively for compliance with requirements.

662.15 Clean-up.

Upon completion of work, remove all rubbish and debris from the job site. See Division – 100 for additional requirements.

621.16 Measurement. The Engineer will measure various items of insulation of mechanical systems in Linear Feet, Square Feet or Lump Sum in accordance with the contract documents.

662.17 Payment.

The Engineer will pay for the accepted pay items listed below at the contract price per pay unit, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for each of the following pay items when included in the proposal schedule:

Pay Item	Pay Unit
Removal – Insulation of Mechanical Systems-Pipe Insulation	Linear Feet
Removal – Insulation of Mechanical Systems- Ductwork Insulation	Linear Feet
Pipe Insulation	Linear Feet
Ductwork Insulation	Squar Feet
Mobilization & Clean-Up	Lump Sum
Insulation of Mech Systems-New - Pipe Insulation	Linear Feet
Insulation of Mech Systems-New - Ductwork Insulation	Square Feet

END OF SECTION 662

Make the following Section a part of the Standard Specifications:

"SECTION 663 - SEALANT

663.01 Description. This section describes the sealant work.

(A) Provide all sealants to completely close all joints indicated on the drawings or specified to be sealed to a watertight condition, including the following:

(1) Exterior joints.

(2) Interior joints.

(3) Silicone sealant.

(B) Related Sections include the following:

(1) **Section 661 - SHEET METAL FLASHING AND TRIM**: Coordinate installation.

(2) **Section 681 – PAINTING**: Coordinate work.

663.02 Materials

(A) Sealant Backer Rod. Compressible rod stock of polyethylene foam, polyethylene-jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable, nonabsorptive material as recommended for compatibility with sealant by the sealant manufacturer to control the joint depth for sealant placement, to break bond of sealant at bottom of joint, to form optimum shape of sealant bead on back side, and to provide a highly compressible backer which will minimize the possibility of sealant extrusion when joint is compressed.

(B) Bond-Breaker Tape. Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure.

(C) Primer for Sealants. Non-staining, as recommended by the sealant manufacturer.

(D) Masking Tape. Non-staining, non-absorbent material compatible with joint sealants and surfaces adjacent to joints.

(E) Sealants.

(1) **Sealant No. 1, At Exterior Vertical and Overhead Joints.** One-part polyurethane-based sealant, conforming to ASTM C 920, Type S, Grade NT, Class 25 as applicable. Provide one of the following, or approved equal products of other manufacturers:

(a) Chem-Calk 900; Bostik Inc.
(b) Dymonic; Tremco.
(c) Dynatrol I; Pecora Corp.

(2) **Sealant No. 2, At Interior Vertical and Overhead Joints.** Non-Elastomeric Sealant; acrylic-emulsion type, conforming to ASTM C 834. Provide one of the following, or approved equal products of other manufacturers:

(a) AC-20 Acrylic Latex; Pecora Corp.
(b) Chem-Calk 600; Bostik Inc.
(c) Tremflex 834; Tremco.

(3) **Sealant No. 4, Silicone Sealant.** Mildew-resistant; Type S; Grade NS; Class 25; Use NT, formulated with fungicide; intended for sealing interior joints between plumbing fixtures and wall surfaces. Provide one of the following or approved equal products of other manufacturers:

(a) 786 Mildew Resistant; Dow Corning Corp.
(b) 898 Silicone Sanitary Sealant; Pecora Corp.
(c) Tremsil 600 White; Tremco.

663.03 Construction Requirements.

(A) Submittals.

(1) **Product Data**. Submit manufacturer's product data and specifications for type of sealant required for approval.

(2) **Samples.** Submit color finish samples of each sealant for approval.

(3) **Guaranty.** Submit guaranty as noted under item entitled "GUARANTY" hereinbelow.

(B) Guaranty.

The Contractor shall submit a written guaranty on the sealant for a 2-year period after the project acceptance date. The guaranty shall provide for the repair of all leaks as well as repair and replacement of sealant and damage to the building and/or its finishes at no cost to the State.

(C) Quality Assurance.

(1) Installer Qualifications. An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.

(2) Source Limitations. Obtain each type of joint sealant through one source from a single manufacturer.

(3) Preconstruction Compatibility and Adhesion Testing. Submit to joint sealant manufacturers, for testing, samples of materials that will contact or affect joint sealants. Use manufacturers standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

(4) Performance Requirements.

Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

(D) Product Handling.

(1) Delivery. Deliver sealants to the jobsite in sealed containers labeled to show the designated name, formula, or specification number, lot number, color, date of manufacture, shelf life, curing time, manufacturer's directions, and name of manufacturer.

(2) Storage. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

(E) Project Conditions.

(1) Inspection. Examine joint surfaces and backing, and their anchorage to the structure, and conditions under which joint sealer work is to be performed, and notify Contractor in writing of conditions detrimental to proper completion of the work and performance of sealers. Do not proceed with joint sealer work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

(2) Weather Conditions. Do not proceed with installation of sealants under adverse weather conditions. Proceed with the work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength.

(F) Manufacturer's Instructions.

Comply with manufacturer's printed instructions except where more stringent requirements are shown or specified, and except where manufacturer's technical representative directs otherwise.

(G) Examination.

Examine joints indicated to receive joint sealers, with Installer present, for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealer performance. Do not proceed with installation of joint sealers until unsatisfactory conditions have been corrected.

(H) Preparation.

(1) Surface Cleaning of Joints. Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:

(a) Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust; paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; oil; grease; water; and surface dirt.

(b) Clean concrete, masonry, and similar porous joint substrate surfaces, by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles

remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

(c) Remove laitance and form release agents from concrete.

(d) Clean metal, glass, glazed surfaces of hard tile; and other nonporous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers.

(2) Joint Priming. Prime joint substrates where indicated or where recommended by joint sealer manufacturer based on preconstruction joint sealer-substrate tests or prior experience. Apply primer to comply with joint sealer manufacturer's recommendations. Confine primers to areas of joint sealer bond, do not allow spillage or migration onto adjoining surfaces.

(3) Masking Tape. Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

(l) Installation of Joint Sealers.

(1) General. Comply with joint sealer manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply. Do not apply sealants on wet surfaces.

(2) Sealant Installation Standard. Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications and conditions indicated.

(3) Latex Sealant Installation Standard. Comply with requirements of ASTM C 790 for use of latex sealants.

(4) Acoustical Sealant Application Standard. Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications.

(5) Installation of Sealant Backings. Install sealant backings to comply with the following requirements:

(a) Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths which allow optimum sealant movement capability.

i. Do not leave gaps between ends of joint fillers.

ii. Do not stretch, twist, puncture, or tear joint fillers.

iii. Remove absorbent joint fillers which have become wet prior to sealant application and replace with dry material.

(b) Install bond breaker tape between sealants and joint fillers, compression seals, or back of joints where adhesion of sealant to surfaces at back of joints would result in sealant failure.

(c) Install compressible seals serving as sealant backings to comply with requirements indicated above for joint filler.

(6) Primer. Immediately prior to application of the sealant, clean out all loose particles from joints. Where recommended by sealant manufacturer, apply primer to joints in concrete, masonry units, wood, and other porous surfaces in accordance with compound manufacturer's instructions. Do not apply primer to exposed finish surfaces.

(7) Installation of Sealants. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.

(8) Tooling of Non sag Sealants. Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling

agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

(a) Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

(b) Provide flush joint configuration per Figure 5B in ASTM C 1193, where indicated.

(J) Joint Sealant Schedule.

(1) Sealant and Location. Install sealants indicated in joints fitting descriptions and locations as well as in locations where sealant is typically applied and as shown on the drawings.

(2) Sealant No. 1.

(a) Exterior joints and recesses formed where frames of windows and doors adjoin masonry, concrete, or metal frames. Use sealant at both exterior and interior surfaces of exterior wall penetrations.

(b) Metal-to-metal joints where sealant is indicated or specified.

(c) Exterior locations, not otherwise indicated or specified.

(3) Sealant No. 2.

(a) Small voids between walls or partitions and adjacent casework, shelving, door frames, built-in or surface-mounted equipment and fixtures, and similar items.

(b) Perimeter of frames at doors and windows which adjoin exposed interior concrete and masonry surfaces.

(c) Interior locations, not otherwise indicated or specified, where small voids exist between materials specified to be painted.

(4) Sealant No. 3.

(a) Seats of metal thresholds for exterior doors.

(b) Control and expansion joints in floors, slabs, ceramic tile, and walkways.

(5) Sealant No. 4.

(a) Joints between plumbing fixtures and adjoining surfaces.

(b) Joints occurring where substrates change.

(6) Sealant No. 5.

(a) Interior sealing of exposed joints.

(b) Interior sealing of concealed construction joints.

(K) Cleaning.

Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.

(L) Protection.

(1) Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of project acceptance. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealers immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work.

663.04 Method of Measurement. The Engineer will not measure sealant for payment.

663.05 Basis of Payment. The Engineer will not pay for the sealant separately. The Engineer will consider the price for the sealant included in the contract price for **Section 658– THERMOPLASTIC POLYOLEFIN ROOFING.**

The price includes full compensation for sealant and furnishing labor, tools, materials, equipment and incidentals necessary to complete the work."

END OF SECTION 663

Make the following Section a part of the Standard Specifications:

SECTION 664 - PLUMBING

664.01 Description.

The work includes plumbing systems for all new or modified plumbing fixtures according to the contract.

664.02 General Requirements.

(A) SECTION 660 - GENERAL MECHANICAL REQUIREMENTS, applies to this section with the additions and modifications specified herein.

(B) Provide complete plumbing system. "Provide" shall mean "furnish and install" when used herein. Connect to utility systems at the 5 feet building line and as shown on drawings.

664.03 Quality Assurance.

(A) Comply with all the requirements of the State of Hawaii, City and County of Honolulu and applicable utility companies.

(B) Obtain and pay for all fees, permits, licenses, assessments, connection charges and inspections required for this work.

(C) Substitution of another manufacturer's product for materials or equipment specified hereinafter and for items with "approved equal" after the brand name requires approval in accordance with the SPECIAL CONDITIONS. No substitutions will be considered after the bid opening. Equal products are acceptable in lieu of those specified hereinafter by specific manufacturer and model number.

(D) Comply with the recommendations and requirements of the Codes and Standards listed hereinafter in addition to detailed requirements of this specification. In the event of conflicting requirements, this specification shall prevail.

(1) American Society for Testing and Materials (ASTM) Publications:

A 74 Cast Iron Soil Pipe and Fittings

B 88 Seamless Copper Water Tube

B 3066 Copper Drainage Tube (DWV)

C564 Rubber Gaskets for Cast Iron Soil Pipe and Fittings

(2) American National Standards Institute Publications (ANSI):

B16.18 Cast Copper Alloy Solder-Joint Pressure Fittings

B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

B16.23 Cast Copper Alloy Solder Joint Drainage Fittings - DWV

B16.26 Cast Copper Alloy Fittings for Flared Copper Tubes

C2 National Electrical Safety Code

(3) Cast-Iron Soil Pipe Institute Publication (CISPI):

Standard No. 310 Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

Standard No. 310 Couplings Joint for Use in Connection with Hubless Cast Iron Soil Pipe and Fitting

(4) Plumbing and Drainage Institute (PDI) Standards:

PDI-WH-201 Water Hammer Arresters

664.04 Certificates.

The Engineer shall have the right to require a written certificate, dated and signed by a responsible employee of this Contractor, evidencing the performance of any portion of the work, or any testing; as a condition precedent to the acceptance of any work or the result of any test. Whenever a regulatory agency performs inspections or tests of any portion of the work, a certificate shall be furnished by the Contractor that the inspection or test was satisfactorily passed.

664.05 Submittals.

(A) Submit the following documents in conformance with the requirements for submittals from SECTION 660 - GENERAL MECHANICAL REQUIREMENTS:

(1) Shop Drawings: After review of equipment, submit for review dimensioned installation shop drawings to scale showing details

where space requirements present problems, proposed departures from the Contract Documents due to field conditions, and requirements for the concrete work, access panels, inserts in slabs and openings in structure.

(2) Product Data: Before beginning work, submit for review certified literature showing ratings and dimensions of equipment, of a list indicating manufacturer and model of fixtures and trim, and a list indicating all materials and items that are of a different manufacturer or model than those specified.

(a) Plumbing fixtures

(b) Plumbing System Specialties

(c) Accessories

(d) Pipes and Fittings

(e) Valves

(3) Certificates of Conformance or Compliance:

(a) Plumbing Inspection Completed

(b) Sterilization certificate

(4) Field Posted As-Built Drawings: Record changes from the contract drawings of all concealed piping. Indicate location of isolating valves and items requiring maintenance or inspection. Dimension underground piping from a visible point on structure. Indicate invert and slope of drainage piping at sufficient location so that the invert can be calculated for any point in the system. Submit as-built drawings for review prior to final inspection.

(5) Operations and Maintenance Manuals: Furnish operating and maintenance manuals on all equipment bound between hard covers. Include for all equipment the manufacturer's name, model and serial number, operations and maintenance bulletins including control diagrams and source of service and replacement parts. Provide tabs separating each piece of equipment. When using publications covering several model options, identify which data and instructions apply to the equipment furnished for this project. Submit one copy of the complete manual for review by the Engineer prior to final inspection.

(6) Warranty

664.06 Product Delivery, Storage and Handling.

Furnish new equipment, fixtures, materials and accessories bearing the manufacturer's identification. Coordinate deliveries to avoid interference or construction delays. Protect products during delivery, storage, installation, and the remainder of the construction period after installation.

664.07 Warranty.

All work in this section shall be guaranteed for a period of one year from date of acceptance of the work as a whole by the Engineer. Should any equipment, fixture or material fail within this period, this Contractor shall be responsible for all damage to any part of the premises caused by the failure and shall repair or replace the defects at no cost to the State.

664.08 Equipment.

Requirements of manufacturer's equipment that is a component of a system provided under this work is included with the system's specifications hereinafter. Capacities and characteristics of the equipment are indicated on the drawings.

664.09 Plumbing Fixtures.

Approved equal products are acceptable in lieu of those specified hereinafter by specific manufacturer and model number. Accessible fixtures, other than those specified herein, require pre-bid approval to ensure compliance with the Commission on Persons with Disabilities of the State of Hawaii. Provide chrome plated brass angle stops, tube risers, chrome plated brass P-traps, trap arms, adapters, escutcheons and cover plates. Provide connecting fittings, china bolt caps, wall support brackets as required. Provide floor mounted wall carriers for all wall-hung fixtures. Base plate of the wall carriers shall not exceed 3-1/2 inches front to back or the width of the wall, whichever is smaller. The bowl depths for the accessible lavatories and sinks shall be selected to meet the ADA 27 inch knee clearance with the top of the rim not higher than 34 inches. The contractor shall refer to the architectural drawings for mounting heights of all plumbing fixtures.

(A) Electric Water Cooler – Hi/Lo Accessible / Bottle Filler (ADA-EWC):

(1) Elkay VRCTLR8WSK or approved equal. Unit shall include bi-level water cooler with bottle filling station. Units shall be stainless steel construction and include vandal resistant pushbutton activation. Shall include vandal-resistant bubbler. Unit shall include bi-level reverse electric water cooler with bottle filling station, shall deliver 8 GPH of 50°F drinking water at 90°F ambient and 80°F inlet water. Units shall be stainless steel construction and include vandal-

resistant pushbutton activation. Cooler shall include vandal-resistant bubbler.

(2) Bottle filling unit shall include an auto 20-second shut-off timer and Green Ticker™ displaying count of plastic bottles saved from waste. Bottle filler shall provide 1.1-1.5 gpm flow rate with laminar flow to minimize splashing.

(3) Shall include integrated silver ion anti-microbial protection in key areas. Unit shall be lead free design which is certified to NSF/ANSI 61 and 372 and meets Federal and State low-lead requirements. Unit shall be certified to UL399.

(4) Drinking fountain unit shall meet ADA guidelines. Fountain shall be Elkay model VRCTLR8WSK with accessory apron Elkay model 98324C for use with model VRCTL stainless steel units.

(5) Install per ADA section 602 “Drinking Fountains” requirements. Spout height shall be maximum 36 inches above the finish floor, located 15 inches minimum from the vertical support and maximum 5 inches from the front edge of the unit, including bumpers. Provide an apron on the higher fountain so that the leading edge is not more than 27 inches above the finish floor to the bottom of the apron.

(B) Eye/Face Wash (Recessed) - Accessible: Haws model 7655WCC or approved equal barrier-free eye/face wash shall include an eye/face wash head shall feature inverted directional laminar flow which achieves Zero Vertical Velocity supplied by an integral 4.2 GPM flow control, a fully recessed wall mounted 18 Gauge, Type 304 stainless steel deep-drawn cabinet, wheelchair accessibility, and polished chrome-plated brass pull-down valve with easy access in-line strainer. Unit shall also include brass pipe and fittings, a front-access maintenance panel, universal sign, 1/2" NPT inlet. Operating pressure is 30 - 90 psi.

(C) Eye/Face Wash (Wall Mounted) - Accessible:

(1) Wall mounted barrier-free, Haws model 7360BTWC or approved equal barrier-free wall mounted eye/face wash shall include a stainless steel 11" (27.9 cm) round bowl, an eye/face wash head shall feature inverted directional laminar flow which achieves zero vertical velocity supplied by an integral 3.7 GPM flow control, wheelchair accessibility, chrome-plated brass stay-open ball valve equipped with stainless steel ball and stem, chrome-plated brass in-line 50 x 50 mesh water strainer, and chrome-plated brass trap and tailpiece. Unit shall also include 16-gauge stainless steel wall bracket, universal sign, 1/2" NPT inlet, and 1-1/4" NPT waste.

(2) Install per ADA section 309.1 “General” requirements.

(D) Hose Bibb

(1) Interior Hose Bibb: Chicago No. 998 with No. E27 vacuum breaker or pre-approved equal, 3/4-inch hose thread outlet, removable key handle.

(2) Exterior Hose Bibb: Arrowhead Brass 351LF, 3/4-inch lead free no kink hose bibb with PK1395 lead free self-draining vacuum breaker or approved equal, 3/4-inch hose thread outlet, removable key handle.

664.10 Pipe and Fittings.

(A) Drainage and Vent Pipes Below Grade: Service weight cast-iron soil pipe, ASTM A74, with dual tight gaskets, or no-hub cast-iron soil pipe conforming to CISPI 301 with MG couplings.

(B) Drainage and Vent Pipes 3 inches and Larger Above Grade: Service weight cast iron soil pipe, ASTM A74, no-hub cast-iron soil pipe conforming to CISPI 301 with stainless steel bands.

(C) Drainage and Vent Pipes Smaller than 3 inches Above Grade: Schedule 40 galvanized steel pipe, ASTM A129, with recessed cast-iron screwed drainage fittings or service weight soil pipe. ASTM A74, no-hub cast-iron soil pipe conforming to CISPI 301 with stainless steel bands.

(D) Polypropylene (Acid Resistant) Pipe:

(1) Waste, and Vent Pipes: All joints of the drainage system shall be mechanical joint, socket fused or approved equal. Piping shall be Orion Blueline, Harrington polypropylene flame retardant, schedule 40 pipe or approved equal.

(2) All fittings shall be Orion Blueline, Harrington polypropylene, or approved equal.

(3) All valves and appurtenances used shall be of the same size, rating and chemical resistance as the piping it is installed with.

(E) Water Pipes: Type “L” hard-drawn copper tube, ASTM B88 with soldered (95-5) joint wrought copper pressure fittings. Use Type “K” copper tube with brazing alloy on joints and pipes below grade.

(F) Gas Piping Above Grade: galvanized steel pipe with 150 pound galvanized malleable fittings. Pipe nipples, if used, shall be threaded only at their ends. Fully-threaded nipples shall not be permitted.

(G) Compressed Air Piping:

(1) Copper tubing ASTM B 88 type K, hard drawn, class 1, fitting wrought copper or bronze, with silver brazed joints.

(2) Pressure Reducing Valve: Shall have nominal pressure rating of not less than inlet system pressure indicated. Provide pressure reducing valves capable of being adjusted to specified flow and pressure, and suitable for intended service. Provide pilot valve for dome loaded type if required for proper operation.

(3) Pressure Regulators: Diaphragm type, air loaded, tight closing single seat, brass body with integral filter and bowl.

(4) Pressure Gages: ANSI/ASME B40.1 Accuracy Grade A, for air, with steel or bass case, and non-shatterable safety glass, and pressure blowout back to prevent glass from flying out in case of an explosion. Gages shall have a 3-1/2 inch minimum diameter dial and s dial range of approximately twice working pressure.

(5) Dielectric Unions: Steel female pipe thread end and copper solder-joint ends, confirming to dimensional, strength and pressure requirements of ASME/ANSI B16.39, Class 1. Steel parts shall be galvanized or 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, it shall also be able to withstand a 600-volt breakdown test.

664.11 Plumbing System Specialties.

(A) Cleanout to Grade: Provide Smith No. 4470 or approved equal installed with concrete collar, flush with grade.

(B) Floor Cleanout: Provide Smith No. 4103 or approved equal cast iron cleanout with round heavy duty scoriated nickel-bronze top and flashing flange.

(C) Wall Cleanouts (WCO): Josam, Wade or Smith Fig. 4530 Duco cast iron cleanout tee and countersunk plug. Complete with round stainless steel access cover and screw.

(D) Cleanouts To Grade (COTG): Josam, Wade or Smith Fig. 4280 cleanout bodies with countersunk plug.

(E) Floor Drains (FD): Josam, Wade or Smith Fig 2005-A. Floor drain shall be cast iron with flange, integral reversible clamping collar, seepage opening, 6-inch diameter nickel bronze strainer and trap primer connection.

(F) Trap Primer: Watts series LFTP300. Flow through trap primer. Primer shall be bronze construction with a maximum operating pressure of 125 psi.

(G) Water Hammer Arresters: Provide Smith Series 5000 or approved equal. Provide on water supplies and locate as close as practical to each faucet, control valve or flush valve except hose faucets. Commercial type arresters, tested and certified in accordance with PDI WH-201, "Water Hammer Arresters", shall be provided where indicated. Installation of these arresters shall be accessible and include access panels when concealed. Size of the arresters shall conform to the PDI symbols and shall be selected in accordance with the recommendations of PDI:

PDI Symbol	Fixture Unit Rating
A	1-11
B	12-32
C	33-60
D	61-113

(H) Access Panels: Provide Milcor or approved equal access doors with Allen wrench lock and concealed hinges; style K for plaster walls, style A for acoustical tile surfaces, style M for masonry and other surfaces. 8" x 8" minimum size in walls and partitions for single items (e.g. WHA), 12" x 12" for more than one item (e.g. two adjacent valves) and either 12" x 12" or 24" x 24" for ceiling access and as indicated. For access panels in fire rated walls and ceilings, provide fire rated access panels to match or exceed the rating of the wall or ceiling. Unless otherwise noted, provide access panels with primer painted surfaces and field painted to match the color of the adjacent surface. Provide stainless steel construction for all access panels in Building C, Milcor Style MS or approved equal.

664.12 Unions.

(A) Copper: bronze body, 200 psig. For pipes 2 inches and smaller use ground joint, for pipes 2-1/2 inches and larger use flanged face.

(B) Dielectric Unions shall separate all ferrous and nonferrous metals in all piping systems. Unions shall match those above, except that of metal-to-metal contact shall be avoided. Where flanges are used, the bolts shall be electrically insulated from the body of the flange.

664.13 Valves.

(A) Ball Valves: 600 psi W.O.G., bronze, two piece body, 316 stainless steel ball, reinforced TFE seat and seals, full port, threaded ends, 316 stainless steel stem, lever handle with integral stop. Provide NIBCO T-585-70-66 or approved equal.

(B) Cocks for Exposed Hose Bibbs: Crane 252 or approved equal.

664.14 Escutcheons.

Brass body, chrome-plated finish. Of sizes sufficient to cover pipe openings through the floor, wall, or ceiling. Escutcheons shall be secured in place by either spring clips or setscrews.

664.15 Pipe Sleeves.

Schedule 40 galvanized steel pipe sleeves in concrete, 18 gauge galvanized sheet metal sleeves in other construction. Sleeves shall be sized to provide a minimum of 1/4-inch clearance around bare or insulated piping or as otherwise required by Code.

664.16 Pipe Hangers and Supports.

(A) General: Elcen, Fee and Mason, Globe, Grinnell, Superstrut, and Unistrut are approved. Fee and Mason figure numbers indicate type and quality. Provide concrete insert at all pre-stressed planks for pipe and equipment installation and coordinate with pre-stressed plank contractor. Pipe supports shall be for seismic design category E.

(B) For Uninsulated Copper Tubing: Fee and Mason No. 307, 364, or 365.

(C) For Insulated Copper Tubing: Fee and Mason No. 800.

(D) Riser Clamps: Black steel, Fee and Mason No. 241. Copper coated, Fee and Mason No. 368.

(E) Hanger Spacing:

Pipe	Maximum Spacing
Copper tubing, 1-1/2 inches and smaller	6 feet
Copper tubing, 2 inches and larger	10 feet
Cast iron soil pipe	At each joint and at intervals not to exceed 8 feet.

(F) Hanger Rods: Continuous-threaded rod conforming to ASTM A 107. Eye rods shall be Fee and Mason Figure No. 228 and 228 WL. Sizes shall be as follows:

Pipe Size	Rod Size
1/2-inch to 2 inches	3/8-inch
2-1/2 inches to 3 inches	1/2-inch
4 inches to 6 inches	5/8-inch

664.17 Preparation.

Visit the worksite and become fully aware of all existing conditions. Investigate the Contract Documents and make proper provisions to avoid interference or construction delays. Determine the exact route of each pipe. Make offsets and changes in direction required to maintain proper headroom and pitch or to accommodate the structure and the work of other trades. Furnish other trades with information to properly locate and size openings in the structure required for this work. Furnish anchor bolts, sleeves, inserts and supports required for this work.

664.18 Installation and Requirements.

Perform work using personnel skilled in the trade involved. Provide competent supervision. Furnish new equipment, fixtures, materials and accessories bearing the manufacturer's identification and conforming to recognized commercial standards. Provide guard around high-temperature equipment and materials. When exposed to weather, provide a weather-protected enclosure around electrical equipment, controls and other items that are not satisfactorily protected. Provide all extra materials and labor for a complete operable system at no extra cost to the OWNER.

664.19 Equipment Installation.

(A) Install equipment in the space allotted with sufficient clearance for proper operation and maintenance. Where equipment differs in arrangement or connections from those shown, provide all required changes in piping, supports and appurtenances and cost of work of any other trades affected.

(B) Provide equipment accessories necessary for proper operation and support. Concrete equipment bases and supports are under CONCRETE Section. Direct trade providing concrete in the proper locations, dimensions, load carrying capacity and anchor-bolt locations. Concrete pads shall be not less than three inches above adjacent surfaces and shall extend at least three inches beyond the base of the equipment.

664.20 Fixture Installation.

Set fixtures in an approved workmanlike manner. Point up all edges against building structure with white grout. Provide supplies for all waterlines to fixtures.

664.21 Piping Installation.

(A) Conform to the requirements of the Uniform Plumbing code. Inspect all pipe inside and outside. Remove interior obstructions and ream out pipe ends. Tool markings on polished fittings are not acceptable.

(B) Cut pipe accurately so that it can be worked into place without springing or forcing. Install pipes parallel to the wall of the structure and plumb. Make changes in direction with fittings. Bushings are not permitted. Install valves with stems above horizontal. Provide proper support and adequate provisions for expansion, contraction, slope and anchorage. Provide dielectric unions where copper tubing connects to steel pipe. Wrap pipe or tubing with 1/4" thick felt, secure with tape, where it contacts other materials. Have piping tested, inspected and approved before it is furred in, buried or otherwise hidden. Provide standard weight galvanized steel pipe sleeves where water pipes pass through structure, sufficiently large to provide 1/4" clearance around pipe. Provide clamping collar to membrane flange where pipe or drains penetrate waterproof membrane. Perform all welding using qualified welders in accordance with American National Standards Institute's Code B31.1 and American Welding Society Standard B3.0.

664.22 Piping System Supports.

(A) Pipe Supports: For aboveground piping, see details on drawings. Support underground piping on firm soil along its entire length. Where rocks are encountered, have trench excavated to minimum over depth of 4-inches and backfilled with granular moist earth, thoroughly tamped. Materials used for backfilling over piping shall be granular earth, free from debris and stones. The Engineer's representative may reject any materials that he considers unsuitable for fill. Provide a minimum of one foot of cover for all pipes. Supports steel and copper pipe at maximum spacing of 6 feet for pipes 1-1/2 inch and smaller, 10 feet for pipes 2 inch through 4 inch.

(B) Pipe Hangers: Steel clevis hanger with adjustable hanger rod; 3/8 inch for pipe 2 inch and smaller, ½ inch for pipe 2-1/2 inch through 3-1/2 inch and 5/8 inch for pipe 4 inch and larger. Groups of lines shall be supported as detailed on drawings.

664.23 Drainage, Waste and Vent Pipe Systems.

Slope drain lines at ¼ inch per foot unless otherwise indicated. On roof vents and where other drains occur above the ground floor, provide clamping device with drain. Provide a four-pound lead flashing sheet extending eight inches out around drain body and secure with clamp device.

On vents through roof, extend vent flashing 8 inches out all around base of vent, extend collar up vent and turn in at top. Install hubless cast-iron and neoprene gasketed no-hub coupling below grade. MG stainless steel clamps and cast-iron no-hub couplings shall be installed in accordance with manufacturer's written instructions.

664.24 Water Piping System.

Secure each water line where it penetrates partitions to serve fixtures, hose bibbs and similar items. Wrap all lines passing through concrete with polyethylene tape. Install unions or flanges at all valves, equipment and system specialties. Set hose bibbs 18 inch above finished grade, unless otherwise indicated. Install dielectric unions at connections of copper and ferrous pipes.

664.25 Testing and Inspection

(A) Contractor shall furnish all equipment for tests and any required retests and pay for all cost of repairing any damage resulting from such tests. Contractor shall repair and adjust systems until they are approved. Tests shall be performed in presence of, and to satisfaction of, inspector of official agency involved.

(B) Defective Work: If inspection or test shows defects, such defective work or material shall be replaced and inspection and tests repeated. Repairs to piping shall be made with new material. No caulking of screwed joints or holes will be accepted.

(C) Protection to Fixtures, Materials, and Equipment: Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, and chemical or mechanical injury. Upon completion of all work, fixtures, materials, and equipment shall be thoroughly cleaned, repainted as required, adjusted, and operated.

(D) Chlorination: Domestic water lines shall be sterilized with chlorine before acceptance of work. Dosage of chlorine shall be not less than 100 ppm. After contact period of not less than 24 hours, system shall be flushed with clean water until residual chlorine content is not greater than 0.2 ppm. All valves in lines being sterilized shall be opened and closed

several times during contact period. Submit certificate to the State evidencing proper performance of sterilization.

664.26 Adjust and Clean.

(A) Clean-up work areas and fixtures. Adjust system for proper operation, ready for use. Sterilize water system for 24 hours with 100 ppm chlorine introduced into the lines in an approved manner. Operate all valves during contact period. Flush system until chlorine is less than 0.2 ppm. Touchup with matching paint all damaged factory finishes.

(B) Paint exposed work including pipe, fittings, iron body valves, pipe hangers, etc., with two coats of zinc rich paint.

664.27 Instructions.

Provide instructions to State personnel for plumbing system operation in accordance with the requirements of Section 811 - GENERAL MECHANICAL REQUIREMENTS.

664.28 Operation and Maintenance Manual.

Submit the Operating and Maintenance Manual for all plumbing system equipment and fixtures and plumbing the system as a whole in accordance with the requirements of Section 811 - GENERAL MECHANICAL REQUIREMENTS.

812.29 Payment.

The Engineer will pay for the accepted pay items listed below at the contract price per pay unit, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for each of the following pay items when included in the proposal schedule:

Pay Item	Pay Unit
Removal of Plumbing – Roof Vents	Each
Plumbing – EWC Dual Height w/ Bottle Filler	Each
Plumbing – Eye/Face Wash	Each
Plumbing – Cup Sinks Fitting, Acid Resistant	Each
Waste & Vent Piping – Polypropylene Piping	Linear Feet

Waste & Vent Piping – Cast Iron No-Hub	Linear Feet
Waste & Vent Piping – Roof Vent	Each
Waste & Vent Piping – Water Piping	Linear Feet
Waste & Vent Piping – Gas Piping	Linear Feet
Waste & Vent Piping – Mobilization & Clean-up	Lump Sum
Plumbing - Demolition - Heater Flue	Each
Plumbing - Demolition - Roof Vents	Each
Plumbing - New - Roof Vents	Each

END OF SECTION 664

Make the following Section a part of the Standard Specifications:

SECTION 665 – CHILLED WATER PIPING AND ACCESSORIES

665.01 Description.

The work includes chilled water piping systems for all new and modified air conditioning systems according to the contract.

665.02 General Requirements.

(A) As specified in Section 660 - GENERAL MECHANICAL REQUIREMENTS, applies to this section with the additions and modifications specified herein.

(B) Capacity of equipment shall not be less than that indicated. In the NFPA Standards referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears. Reference to the "authority having jurisdiction" shall be interpreted to mean the Manager.

(1) Qualification of Manufacturer and of Installation: Upon request, the Contractor shall furnish proof that he is complying with paragraphs titled "Service Record" and "Installation" below.

(a) Service Record: The Contractor shall furnish only products of a manufacturer which are of a similar material, design and workmanship as has been in satisfactory field operation in a similar application for a period of 2 years. Products having less than 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours can be shown. In either case, modifications to the equipment which have satisfied the field operation record will be permitted only when proven that the modifications will not increase maintenance or operating costs or decrease product life and provided that such modifications do not accomplish any of the following:

(1) Increase rotative speed in excess of 20 percent;

(2) Reduce metal thickness in section subject to high pressures or vacuum.

(3) Change lubricating system or bearings.

(b) Installation: The Contractor shall assure that all installation is carried out under the direct active supervision of persons who have adequate technical qualifications and experience and that a sufficient number of trained personnel and adequate facilities are available to perform the installation.

(2) Corrosion Prevention: Unless specified otherwise, equipment fabricated from ferrous metals that do not have a zinc coating conforming to ASTM A386 or a duplex coating of zinc and paint shall be treated for prevention of rust with a factory coating or paint system that will withstand 125 hours in a salt-spray fog test except that equipment located outdoors shall be tested for 500 hours. The salt-spray fog test shall be in accordance with ASTM B117 using a five parts by weight (plus or minus) of sodium chloride in 95 parts of distilled water or water containing not more than 200 parts per million of total solids sodium chloride solution. Immediately after completion of the test, the coating shall show no signs of blistering, wrinkling or cracking, no loss of adhesion and the specimen shall show no signs of rust creepage beyond 1/8-inch on either side of the scratch mark. The film thickness of the factory coating or paint system applied on the equipment shall be not less than film thickness used on test specimen.

(3) Safety Requirements: Machinery Guards: Fully guard drives mechanisms or other moving parts in accordance with ANSI B15.1. Provide guards fabricated of stainless steel and expanded stainless steel rigidly mounted, and readily removed without disassembly.

(4) Special Tools: If any part of equipment furnished under these specifications requires a special tool for assembly, adjustment, setting, or maintenance thereof and such tool is not readily available on commercial tool market, it shall be furnished with equipment as a standard accessory. Special tools are those a refrigeration mechanic would not normally own.

(5) Manufacturer's Supervision: Provide the services of competent factory representatives to supervise the installation, test, start-up and adjustment of chillers and pumps and to instruct the Facility Manager’s personnel in the proper operation and maintenance of the equipment.

665.03 Related Work Specified in Other Sections.

(A) Painting work specified in Section 681 - PAINTING.

(B) Air conditioning and ventilation work specified in Section 816 – AIR CONDITIONING AND VENTILATION.

(C) Air conditioning and ventilation system controls specified in Section 817 - CONTROLS.

(D) Electrical work specified in Section 670 - ELECTRICAL.

665.04 Submittals.

(A) Submit the following documents in conformance with the requirements for submittals from SECTION 660 - GENERAL MECHANICAL REQUIREMENTS:

(1) Manufacturer's Data:

(a) Pumps

(2) Shop Drawings:

(a) Pumps

(b) Piping Installation

(3) Testing and Start-Up Procedures:

(a) Pumps

(4) Warranty and Certificates

(B) Welding:

(1) Welding Procedure: Before any welding is performed, submit three copies of this welding procedure specification for all metals included in the work, together with proof of its qualifications as outlined in ANSI B31.1.

(2) Performance Qualification Record: Before any welder or operator performs any welding, the Contractor shall submit to the officer-in-charge three copies of the Welder's Performance Qualification Record in conformance with ANSI B31.1 showing that the welder was tested under the approved procedure specification submitted by the Contractor. In addition, the Contractor shall submit each welder's assigned number, letter or symbol which shall be used to identify the work of the welder which shall be affixed immediately upon completion of the weld. Welders making defective welds after

passing a qualification test shall be required to take a re-qualification test. Welders failing the re qualification tests will not be permitted to work under this contract.

(3) Previous Qualifications: Welding procedures, welders and welding operators previously qualified by test may be accepted for this contract without re qualification subject to approval provided that all the conditions specified in ANSI B31.1 are met before a procedure can be used.

(4) Perform all welding in accordance with ANSI Z49.1.

665.05 Product Safety Requirements.

(A) Pressure Vessels: The design, fabrication, inspection, and testing of pressure vessels including the waterside and refrigerant side of condensers and liquid coolers (evaporators) shall be in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, and ASHRAE 15. The presence of the ASME official Code U-Symbol or Code UM-Symbol stamped or marked on the vessels, and the submitting of the applicable ASME required manufacturer's data report will be accepted as evidence that the pressure vessels comply with the ASME rules for construction.

(B) Machinery Guards: Guard drives mechanisms or other moving parts in accordance with ANSI B15.1.

(C) Electrical Systems: Wiring and components shall conform to NFPA 70 and UL 465.

665.06 Warranty.

As specified Section 811 - GENERAL MECHANICAL REQUIREMENTS, with the additions and modifications specified herein. Contractor shall be held responsible for all damages to any part of the premises, building or contents caused by leaks or other defects in piping, equipment or materials provided under this specification, for the period stated in Section 811 - GENERAL MECHANICAL REQUIREMENTS.

665.07 Chilled Water Piping, Fittings and Accessories.

Materials and dimensions in accordance with ANSI B31.1 Water Piping Systems as used in this paragraph include chilled water piping systems. Piping systems shall be compatible with system fluids and capable of withstanding the operating pressures and temperatures.

(A) Chilled Water Piping (Aboveground): Provide Type "K" hard-drawn copper tube, ASTM B88, with for the pipe size 4 inches and smaller. Provide seamless Schedule 40 Black Steel, standard weight, ASTM A120, pipe size larger than 4 inch.

(B) Fittings for Chilled Water Piping: Fitting for copper piping all sizes, solder-joint wrought copper pressure fittings connected with 95-5 tin antimony solder. Fittings for Black Steel piping shall be welded or flanged with welding necks conforming to ANSI B16.9 steel or flanged type conforming to ANSI B16.5.

(C) Flanges: The raised faces shall be removed when used with flanges having a flat face.

(1) Copper Flanges: Socket solder-type joint 150 lbs, plain (flat) face, cast bronze, ASTM B 62. Dimensions shall be in accordance with ANSI B16.24. Nibco, Stockham, Walworth or approved equal.

(D) End Connections: Piping 4 inches and larger shall be flanged or groove joint.

(1) Bolting of Flanges: Material used for bolts and studs shall conform to ASTM A307, Grade B and material for nuts shall conform to ASTM A194, Grade 2. Dimensions of bolts, studs and nuts shall conform to ANSI B18.2.1 and ANSI B18.3.2 with threads conforming to ANSI B1.1 coarse type with Class 2A fit for bolts and studs and Class 2B for nuts. Bolts or studs shall extend completely through the nuts and may have reduced shanks of a diameter not less than the diameter at root of threads. Carbon steel bolts shall have American Standard regular square or heavy hexagon heads and shall have American Standard heavy semi-finished hexagonal nuts.

(2) Gaskets: ASTM D 2000, fluorinated elastomers, suitable for the pressure and temperature ranges encountered and compatible with grooves in flange faces.

(3) All connections to mechanical equipment shall be flanged or grooved connections for steel piping only.

(E) Valves: Gate, Special and Related Equipment shall conform to the following paragraphs. End connections shall conform to paragraph "End Connections". Valves shall have rising stems and shall open when turned counterclockwise. All valves installed 6 feet above the finished floor shall be provided with chain operators.

(1) Drain Valves: Shall be ball valves, bronze, 150 pound class. Shall not be smaller than 3/4 inch nominal pipe size, shall have threaded ends and shall be provided with hose nipple adapters for connecting a hose to lead to a convenient floor drain. The valves shall be manually operated. Provide extended handles for insulated valves. Stockham, Nibco, or approved equal.

(2) Air Vent Valves: Shall be Manually Operated General Service Type and Automatic Type. The automatic type air vent valves shall be of the ball float type. The valves shall be provided with cast iron bodies, 300 series corrosion resistant steel float, linkage and removable seat of hardened corrosion resistant steel. Manual vent valves shall be gate valves, bronze, 150 pound class. Valves shall be suitable for hot or cold water service and 125 psi working pressure. The valves shall be 3/4 inch pipe size for water mains and 1/2 inch pipe size, minimum, for all other applications. Air vent valves shall be provided at all high points in the water piping system and as indicated.

(3) Petes Plug: Provide petes plug in lieu of pressure and temperature gauges for AHU and FCU with chilled water piping size less than 2 inches.

(4) Plug Valves: DeZurik 400 series with neoprene facing material or approved equal.

(5) Butterfly Valves: Shall conform with MSS SP67, Type 1 tight shut off valve and valve ends shall be lug style. The valve body material shall be cast iron and shall be double tight for shut off at 150 psig. Valves shall have type 300 series corrosion resistant steel stems and discs or eccentric, ductile iron discs with molded elastomer disc seals. Flow conditions shall be for the regulation from maximum flow to complete shut off by way of throttling effect. Valves shall be used in open system. Valves shall have totally enclosed manual gear operators with adjustable balance return stops and indicators. Valves shall be suitable for water temperatures up to 180 degrees F. Valves installed 6 feet above the finished floor shall be provided with chain operators. Victaulic 300 series or approved equal.

(6) Check Valve:

(a) Check Valves 3 1/2 Inches and Larger: Valves shall be Class 150 with bronze trim. Provide non slam, eccentric disc type for centrifugal pump discharge service. Victualic, Nibco, Stockham or approved equal.

(b) Check valve 3-inches and smaller: Valves shall be of Class 125, thread or solder ends, body and caps shall be of ASTM B-62 cast iron bronze composition swing type disc. Victualic, Nibco, Stockham or approved equal.

(7) Ball Valves: 3 inches and smaller. Bronze ball valves shall be single piece body, full port 1/4" to 2-1/2 inch and conventional for 3 inches, cast bronze ball and shall be not less than 150 pound class. Stockham, Nibco, Victualic or pre-approved equal. Ball valves on chilled water piping shall be provided with extended handles to allow for insulation thickness. The extended handle shall allow valve actuation without damaging the insulation, Nib-Seal or approved equal.

(8) Manual Flow Control Valves: Flow control valve shall be y-pattern style design with ductile iron body. Valve shall perform the following functions: provide flow measurement, provide flow balancing and provide positive shut-off. Handwheel shall have a minimum of eight 3600 adjustment turns of the handwheel for maximum setting with a hidden memory feature and digital readout. The valve shall have pressure/temperature probes. Provide computer balancing instrument to measure flow differential pressure and temperature. Victaulic Y-pattern globe valve or approved equal.

(F) Miscellaneous Components for Piping System:

(1) Flexible Connector: Shall be for water service and shall be flanged neoprene type with braided stainless steel outer casing and bolted steel control rods. Materials shall be of the type recommended by the manufacturer for use with chilled water. This applies, for pipe sizes 1 inch to 4 inch. Mason Matraflex or approved equal.

(2) Y-Type Strainer: Cast iron body, 20 mesh stainless steel screen, 125 psi working pressure. Provide with blow-off valve. This applies, for pipe sizes 3/4 inch to 4 inch. Watts or approved equal.

(3) Dielectric Flange Kit: Flange kit shall be the same size as the line it is installed in. Kit shall include a full face flange phenolic gasket with the same outside diameter as the flange, insulating phenolic sleeve for each bolt and phenolic washer for each nut.

665.08 Thermometers.

Seven inch aluminum case, Well Threaded and Seal Welded or Seal Brazed, Range 40 degrees to 110 degrees F., Standard Stem, Adjustable angle. Scale

and temperature ranges shall be suitable for the intended service. Thermometers installed in close proximity to system thermostats shall be the mercury type. Thermometers that are located elsewhere in the system can be of the organic liquid type as approved. Trerice, Marshalltown or pre-approved equal.

665.09 Pressure Gauges.

Aluminum case, 4 1/2 inch dial size for water. The scale ranges, graduations, figure intervals and type of mounting shall be selected specifically for the intended service. The gauge shall be of a design that is readable from the floor. Trerice, Marshalltown or pre-approved equal. Provide HD needle valve.

665.10 Pumps.

(A) Centrifugal Pumps: The contractor shall furnish and install as shown in the plans and described in these specifications with high performance end section pumps. Pumps shall meet or exceed the efficiency shown in the pump schedule. To insure cavitation-free operation, each pump's NPSH Requirement must be low enough to permit stable, continuous operation at 120% or greater of best efficiency point. Each pump shall be capable of continuous operation without producing noise in excess of Hydraulic Institute and OSHA guidelines. Pump casing shall be close grain cast iron fitted with a replaceable bronze case wear ring. Pumps with a specific speed greater than 1600 shall have double volute casings with suction splitter to reduce radial loading and shaft deflection. All pumps shall be of the back pull out design so that the rotating element can be removed from the casing without disconnecting the suction or discharge piping. Pump impeller shall be of the enclosed type of cast bronze and shall be statically and dynamically balanced. Impeller diameter shall be trimmed for the specified design conditions. Pump shaft shall be fitted with a leak-less mechanical seal. Pump shall be mounted on a heavy duty cast iron bearing frame. Shaft shall be of carbon steel. Pump bearings shall be of the permanently sealed type requiring no external lubrication. Pump and motor shall be mounted on a rigid steel base, adequately reinforced against deflection. Pump shall be connected to the drive motor by a flexible coupling capable of withstanding all torsional, radial and axial loads. Coupling and exposed rotating components of the pump and motor shall be protected by an OSHA approved guard.

(B) Pump Motors: Motors shall conform to NEMA MG-1 and be suitable for the electrical characteristics as indicated. Provide high efficiency type motors. Provide open drip proof type for indoor and TEFC motors for outdoor application.

(C) Controls: In general, controls shall conform to Section 817, "Controls".

(D) Salt Corrosion Protection: Provide salt corrosion protection for the pumps located outdoor.

665.11 Vibration Isolators.

Provide neoprene coated spring with galvanized steel housing with minimum 1 – 1/2 inch deflection, vertically restrained, vibration isolators for all equipment specified in this section.

665.12 Installation.

(A) Install piping and piping components to insure proper and efficient operation of the equipment and controls and in accordance with manufacturer's printed instructions. Proper supports for the mounting of vibration isolators, stands, guides, anchors, clamps and brackets shall be provided. Piping connections to equipment shall be arranged so that removal of equipment or components of equipment can be accomplished with the least amount of disassembly or removal of the piping system. Piping connected to equipment with vibration isolators shall be provided with flexible connections which shall conform to vibration and sound isolation requirements for the system. Provide electric isolation between dissimilar metals.

(B) Water Piping: Air vents shall be provided at high points and drains at low points in the chilled water system.

(C) Locations: Equipment shall be located so that working space is available for all necessary servicing such as shaft removal, disassembling compressor cylinders and pistons, replacing or adjusting drives, motors, or shaft seals, access to water heads and valves of shell and tube equipment, tube cleaning or replacement, access to automatic controls, refrigerant charging, lubrication, oil draining and working clearance under overhead lines.

(D) Identification Tags and Plates: Provide equipment with tags numbered and stamped for their use. Plates and tags shall be brass or non-ferrous material. Minimum letter and numeral sizes shall be 1/8-inch high.

(E) All new exposed metal surfaces in the mechanical room shall be painted in accordance with section 681 – Painting.

665.13 Piping Systems.

Cut to the measurements established at the site and work into place without springing or forcing. Install piping with line flexibility included to absorb the expansion and contraction due to temperature changes of the piping systems. Piping line flexibility shall be achieved by the use of pipe bends or loops or bellows type expansion joints. The piping shall not be run concealed in or between walls or partitions or under floor slabs or under floors. Where piping shall pass through the structure of the building the pipe joints shall not be concealed but shall be located where they are accessible for inspection.

(A) Reducing Fittings: Shall be used to connect changes of sizes in piping lines. Branch connections shall be made with tees.

(B) Dielectric Unions or Flanges: Provide between ferrous and non ferrous piping, equipment and fittings; except that bronze valves and fittings may be used without dielectric couplings for ferrous to ferrous or nonferrous connections. Flanges and unions shall conform to the requirements of ANSI B16.10 Standard.

(C) Piping System Supports: Factory-fabricated by Elcen, Fee and Mason, Grinnell, or Unistrut; no chains or straps permitted. Provide concrete inserts, beam clamps, channel framing hanger rods and accessories required for proper pipe support. Concrete inserts must be used at all pre-stressed planks. Ramset or explosive type anchors are not permitted. All outdoor supports shall be hot dipped galvanized.

(1) Support pipe at maximum spacing of 6 feet for pipes 1-1/2 inches and smaller, 10 feet for pipes 2 inches through 4 inches and 15 feet for pipes larger than 4 inches. Support vertical piping with hanger at base of riser and with pipe clamp at each floor. On vertical chilled water risers, clamps shall be mounted 2" above finished slab with steel rod supports.

(2) At each support point on insulated piping, provide Owens-Corning Kaylo Pipe Insulation around pipe with 18-gage galvanized sheet metal jacket each two pipe diameters in length. Pipe hangers shall be steel clevis hanger with adjustable hanger rod; 3/8-inch for pipe 2 inches and smaller, 1/2-inch for pipe 2-1/2 inches through 3-1/2 inches and 5/8-inch for pipe 4 inches and larger. Groups of lines may be supported from steel channel with pipe clamp.

(D) Flexible Connections: Install flexible pipe connectors or couplings on piping connected to equipment. The material used and the configuration shall be suitable for pressure, temperature and circulating medium. The flexible section shall have flanged ends and shall be suitable for the

service intended. The flexible section may be reinforced with metal retaining rings, with built in braided wire reinforcement and restriction bolts or with wire braid cover suitable for the service intended.

(E) Condensate Drain Piping Systems: Slope lines at 1/4-inch per foot unless otherwise directed. Provide a water seal with water column 1-inch greater than the total static pressure of the fan in inches of water. Terminate condensate drain over nearest plumbing drain when not otherwise indicated.

665.14 Aboveground Chilled Water Piping.

(A) Fabrication and Assembly of Piping and Components: Provide drain valves at low points of piping system and automatic air vent valves at high points where air pockets would occur. All piping shall follow the general arrangement shown, cut accurately to measurements established for the work by the Contractor and worked into place without springing or forcing, except where cold springing is indicated. Provide adequate clearance from walls and roofs to permit the welding of joints and re-roofing work; at least 6 inches. Provision for expansion and contraction of pipe lines shall be made. Changes in size of water lines shall be made with reducing fittings. Protect materials and equipment from the weather. Use flanged joints only where necessary for normal maintenance and where required to match valves and equipment. Install joints so that flange faces bear uniformly on gaskets. All gaskets, packing and thread compounds shall be suitable for the service. Long radius ells shall be used wherever possible to reduce pressure drops. Do not miter pipe to form elbows or notch straight runs to form full sized tees or any similar construction. All branch connections shall be made with welding tees except factory made forged welding branch outlets or nozzles having integral reinforcements conforming to ANSI B31.1 may be used, provided the nominal diameter of the branch is at least one pipe size less than the nominal diameter of the run. All piping shall be run essentially as indicated, avoid interference with other piping, conduit or equipment. Except, where specifically shown otherwise, run vertical piping plumb and straight and parallel to walls. Trapping of lines shall not be permitted except as otherwise indicated. Provide sleeves of suitable size for all lines passing through building structure. Piping connected to equipment shall be installed to provide flexibility for thermal stresses and for vibration, and shall be adequately supported and anchored so that strain from weight and thermal movement of piping is not imposed on the equipment. Each section of pipe, fittings and valves shall be thoroughly cleaned and positively free of all foreign matter before erection. Prior to erection, each piece of pipe shall be held in an inclined position and thoroughly tapped to loose sand, mill scale and foreign matter. Before all final connections are made to apparatus, wash the interior of all piping thoroughly with water. Blow out piping with

compressed air to remove rust chips, oil and debris. Plug or cap open ends of mains during all shut down periods. Lines shall not be left open at any place where foreign matter might accidentally enter pipe.

(1) Valves: Install at equipment to allow maintenance or isolation, and to establish proper and sequential operation of the complete system.

(2) Air Vent Valves: Provide at high points in water piping. Isolate valves and pipe to run off into the nearest floor drain.

665.15 Cleaning of Systems.

When installations of the various components of the piping systems are completed, they shall be cleaned with water before final closing. All piping and components shall be cleaned free of scale and thoroughly flushed of all foreign matter. All strainers and valves shall be thoroughly cleaned. Equipment shall be wiped clean, with all traces of oil, dust, dirt or paint spots removed. The Contractor shall maintain the system in this clean condition until final approval. Piping and equipment shall be cleaned and painted.

(A) Safety Procedure: Ventilate work area and avoid skin contact. Solvent resistant gloves shall be used. Observe precautions and warnings on the manufacturer's product labels.

665.16 Field Tests.

(A) After completion of the piping installation and prior to initial operation, tests shall be conducted on the piping system. Furnish materials and equipment required for tests. Defects disclosed by the test shall be corrected by the Contractor. After installation and prior to acceptance, tests shall be performed in the presence of the officer-in-charge and shall be subject to his approval.

(B) Chilled Water Piping: Test piping system at one and one half times system pressure but at least 100 PSIG with water not exceeding 100 degrees F. Before tests, remove or isolate gauges, traps and other apparatus in the piping system which may be damaged. Repair all leaks by re-brazing joints or replacing pipe or fittings. Caulking of joints will not be permitted. Install a calibrated test pressure gauge in the system to observe loss in pressure. The required test pressure shall be maintained for a sufficient amount of time to enable an inspection to be made of joints and connections. Defects disclosed by the test shall be corrected by the Contractor.

665.17 Start-up and Operational Tests.

The chilled water systems shall be started up and initially operated. During this time, the various new and existing strainers shall be periodically cleaned until no further accumulation of foreign material occurs. Adjust safety and automatic control instruments as necessary to place them in required operation and sequence. Repair insulation after final adjustments have been made.

665.18 Field Painting.

(A) Conform to Section 09901 – PAINTING. Provide labels/signs for all piping including chilled water, condenser water lines.

(B) The following items furnished under this section are to be painted and identified under Section 09901 – PAINTING. Do not paint over name plates or other identifying labels.

(1) Paint exposed black iron work including pipe, fittings, iron body valves, pipe hangers, etc., with two coats of zinc rich paint. Included in this work shall be bare metal resisters, louvers access panel for mechanical equipment, control covers, thermostat covers, sheetmetal ductwork, jackets, piping, hangers, etc. Prepare surface as required in paint schedule. Provide two final coats to match adjoining surfaces except as noted.

(2) Stencil all exposed piping with painted black letters indicating the service and with an arrow indicating the direction of flow. Piping shall be stenciled where it enters and leaves each area and not in intervals over 30 ft. within an area. Width of color band, size of legend letters, and position of legend shall conform to the requirements of ANSI A13.1, Scheme for the Identification of Piping Systems.

665.19 Payment.

The Engineer will pay for the accepted pay items listed below at the contract price per pay unit, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for each of the following pay items when included in the proposal schedule:

Pay Item	Pay Unit
Removal – CHW Piping	Linear Feet
CHW Piping	Linear Feet
Mobilization & Clean-Up	Lump Sum
Chilled Water Piping & Accessories - Demolition - CHW Pump	Each
Chilled Water Piping & Accessories - Demolition - CHW Pipe	Each
Chilled Water Piping & Accessories - New - CHW Pump	Each
Chilled Water Piping & Accessories - New - CHW Piping	Linear Feet

END OF SECTION 665

Make the following Section a part of the Standard Specifications:

SECTION 666 – AIR CONDITIONING AND VENTILATION

666.01 Description.

The work includes providing new and modified air conditioning and ventilation systems complete according to the contract. Provide all temperature and indicating controls for this work. Furnish motor starters for equipment under this section. Coordinate with work of other trades and/or being performed under sections.

666.02 General Requirements.

(A) As specified in Section 660 - GENERAL MECHANICAL REQUIREMENTS, applies to this section with the additions and modifications specified herein.

(B) This section covers the furnishing, fabrication, delivery and installation of the air conditioning and ventilation system complete, including but not limited to the following:

(1) Chilled Water Air handling units / Fan Coil Units.

(2) Dehumidifiers.

(3) Ductless DX split systems.

(4) Supply air and exhaust fans.

(5) Fume Hoods and exhaust fans.

(6) Sheetmetal duct and duct insulation.

(7) Diffusers, registers and grilles.

(8) Piping, fittings, valves and pipe insulation.

(9) Testing, adjusting and balancing of air and water systems.

(10) Operation and maintenance instructions and manuals.

(11) Manufacturer’s literature, shop drawings and record drawings.

(12) Inspection, test and guarantee.

666.03 Related Work Specified in Other Sections.

(A) Painting work specified in Section 681 - PAINTING.

(B) Electrical work specified in Section 820 - ELECTRICAL.

(C) Air conditioning and ventilation system controls specified in Section 666 - CONTROLS.

814.04 Submittals.

(A) The items for which the submittal requirements of Section 660 - GENERAL MECHANICAL REQUIREMENTS, apply are as follows:

(B) Shop Drawings: Submit shop drawings of plans, performance data and details showing locations and installation including but not limited to the following:

(1) Air handling / Fan coil units and associated ductwork.

(2) Fume hood units and associated ductwork

(3) Exhaust fans and associated ductwork

(4) Dehumidifier and associated ductwork

(5) Ductless DX split systems and associated piping

(6) Electrical and electronic control wiring diagrams

(7) Ductwork and air devices

(C) Product Data: Submit product data for the following:

(1) Air handling / Fan coil units

(2) Fume Hood

(3) Dehumidifier

(4) Ductless DX Split System

(5) Flow control valves

(6) Motorized control valves

(7) Electrical controls including starters

(8) Exhaust fans

(9) Vibration isolators

(10) Valves

(11) Flow devices and portable meters

(12) Pipe Insulation

(D) Schedules:

(1) Schedule of equipment listing name and addresses of manufacturers, catalog numbers and trade names.

(2) Maintenance service contract and schedule.

(E) Reports: All testing and balancing reports.

(F) Certificates of Conformance or Compliance:

(1) Submit certificates of conformance for performance and characteristics specified, the listed standards and in accordance with Section 811 - GENERAL MECHANICAL REQUIREMENTS for the following:

(a) Air handling / Fan coil units per ARI Standards 430 and 410

(b) Exhaust fans per AMCA

(2) Submit certificates of qualifications for manufacturers' representatives: Test and Balance contractor.

(G) As-Built Drawings: Submit drawings in accordance with Section 811 - GENERAL MECHANICAL REQUIREMENT.

(H) Operations and Maintenance Manuals: Submit manuals in accordance with Section 660 - GENERAL MECHANICAL REQUIREMENTS.

(I) Guarantee and Certificate: Submit one year guarantee and certificate in accordance with Section 660 - GENERAL MECHANICAL REQUIREMENT.

814.05 Materials and Equipment.

Air conditioning and ventilation equipment to be considered for bid purposes shall be from a manufacturer that has locally stocked spare parts, representation, and support of a factory authorized service organization within 500 miles of the site of installation and has serviced manufacturer's units of comparable type, size and capacity as those specified herein. The manufacturer must have other units of comparable type, size and capacity installed and operating satisfactorily in the State of Hawaii for a minimum of two (2) years prior to bid opening.

814.06 Fan Coil Units (FCU) – Chilled Water.

(A) General: Factory-assembled, horizontal and vertical, draw-thru type fan coil unit for ducted installation above the ceiling or floor mounting. Unit shall be complete with water coils, fan(s), motor, belt drive, drain pan, and filter.

(B) Casing: Construction shall be heavy-gage galvanized steel, lined with one-in. thick epoxy coated edge sealed fiberglass thermal/acoustical insulation. Knockouts shall be provided for hanging the horizontal unit, that will accept 3/8-in. threaded rod at the top, and bottom of all unit corners. Supply and return duct connection shall be one in. long. Removable side panels shall be provided for access to the fan/motor assembly. A double-sloped drain pan shall be constructed of stainless steel, extending under the full length and width of the coil(s) with a 3/4-in. male nominal pipe thread stainless steel drain connection and 1/2-in. male MPT stainless secondary drain connection (capped when not required). The outside surface of the drain pan shall be insulated with 1/8-in. closed cell insulation.

(C) Fans: Belt-driven, double-width fan wheels shall have forward-curved blades and be statically and dynamically balanced. Fan drive shall consist of variable-pitch motor pulley, fixed-pitch fan pulley and V-belt. Fans and scrolls shall be of galvanized steel.

(D) Coils: Coils shall have 1/2 inch. copper tubes, copper headers, aluminum fins bonded to the tubes by mechanical expansion and have a working pressure of 250 PSIG at 200 F. Each coil shall have a manual air vent and sweat connections for copper tubes.

(E) Motor(s): Fan motors shall be 3 phase TEFC invertor motor, 60 Hz, 1750 rpm, suitable for continuous duty at 104 F. Motors shall be resilient base mounted. Motors 1 HP and higher will premium efficiency, qualify for the HECO motor efficiency rebate program.

(F) Special Features:

(1) Coils: Unit coil(s) shall be equipped with automatic air vent(s).

(2) Filters: 2-in. pleated filter shall be installed in the unit.

(3) Insulation: Units shall be equipped with one-in. thick Tuf-Skin II insulation.

814.07 Exhaust Fan (EF).

(A) Fume Hood Exhaust Fan: Base fan performance at standard conditions. (density 0.075 lbs/ft3). Fans selected shall be capable of accommodating static pressure and flow variations of +/- 15% of scheduled values. Each fan shall be belt driven. Fans submitted that are not in arrangement 10 with the motor accessible at roof level, shall have a jib crane (complete with removable hoist), provided by the fan manufacturer, to perform motor maintenance and replacement. Fans to be equipped with lifting lugs. Fan stand to be coated steel with a minimum of 4 mils of Plastifer epoxy #ES90-AS81 epoxy. Fasteners to be 316 stainless steel. Fan shall be M.K. Plastics Corporation, Axijet or pre-approved equal

(1) Fan Housing and Outlet

(a) Fan housing to be aerodynamically designed with high-efficiency inlet, engineered to reduce incoming air turbulence.

(b) Fan housing shall be manufactured in specifically formulated resins, for maximum corrosion resistance, UV inhibited and reinforced with fiberglass for structural strength. Fastening bolts holding the casing to the support plate are to be encapsulated in FRP. No uncoated metal fan parts in the corrosive air stream will be tolerated. Fans shall be supplied with a internal graphite liner and grounding strap to remove static electricity, as well as a flame retardancy of 25 of less, if scheduled.

(c) A bifurcated fiberglass reinforced plastic (FRP) discharge nozzle shall be supplied by the fan manufacturer and be designed to efficiently handle an outlet velocity of up to 7200 FPM. The discharge shall include a venturi and wind band to induce ambient air up to 270% of fan capacity.

(d) Provide housing drain attached at the lowest point for condensation removal.

(e) An access door shall be supplied for impeller inspection and service.

(f) Standard finish color to be light gray.

(2) Fan Impeller

(a) Fan impeller shall be centrifugal, backward inclined, or airfoil design with non-stall characteristics. The impeller shall be electronically balanced both statically and dynamically Grade G6.3 per AMCA Standard.

(b) For 1225 and 1500 sizes, the impellers to be molded FRP, backward inclined. A metal back plate integral to the FRP impeller and encapsulated in resin shall have the hub extending to the outside of the fan housing. The shaft end in the housing to be covered by a tight fitting FRP cap.

(c) Fan impeller on 1825 and larger shall be manufactured of steel and coated with a minimum of 4-6 mils of Plastifer epoxy # ES90-AS81.

(3) Fan Inlet Elbow / Plenum

(a) For constant volume systems, the fan shall be connected directly to duct without the need of bypass damper.

(b) For variable volume systems, an inlet elbow/plenum shall be provided as shown on drawings. The elbow/plenum shall be equipped with a bypass air damper and drainable inlet air louver for introducing outside air at roof level upstream of the fan. The plenum shall be constructed of galvanized steel and coated with 4-6 mils of Plastifer epoxy TC-B62Z-B60VZ70, and mounted on roof curb or rails as shown on the project drawings. Inlet elbow/plenum to be attached to the fan inlet by a flexible PVC connector, provided by the fan manufacturer.

(c) Bypass air damper shall be opposed-blade design, and the damper and inlet louver for each inlet elbow/plenum shall be fabricated of aluminum.

(d) A fan isolation damper fabricated of epoxy coated aluminum shall be provided as shown on the project documents.

(4) Fan Motors and Drive

(a) Motors to be premium efficiency, standard NEMA frame, 1800 RPM, premium efficiency TEFC with a 1.15 service factor. A factory mounted NEMA 3R disconnect switch shall be provided for each fan. Motor maintenance shall be accomplished without fan impeller removal or requiring maintenance personnel to access the contaminated exhaust components. Motors shall be readily accessible for maintenance. Provide premium efficiency TEFC type motors. Motors 1 HP and higher will qualify for the HECO motor efficiency rebate program.

(b) Fan submitted that use 900 RPM, 1200 RPM or are C-Face motors, shall include one spare motor per fan system, in accordance with ANSI Z9.5, section 4.14.7.4, CRITICAL SERVICE SPARES.

(c) Drives belts and sheaves shall be sized for 200% of the fan operating brake horsepower, and shall be readily and easily accessible for service, if required.

(d) Shaft to be ANSI C-1045 steel, and be protected with TECTYL 822B protective coating.

(e) Fan shaft bearings to be selected according to bearing manufacturers recommendations and be sized for an L-10 life of 200,000 hours. Bearings shall be ball or spherical pillow block type, sealed retain lubricant and exclude dust and air.

814.08 Fume Hood.

Fume hoods shall function as ventilated, enclosed workspaces, designed to capture, contain and exhaust fumes, vapors and particulate matter produced or generated within the enclosure. Fume hood shall be factory designed to function as a by-pass fume hood.

(A) Manufacturer: Labconco, Protector Premier Laboratory Fume Hoods model 100400002 or approved equal.

(1) Cabinet: 48 inch wide x 31.7 inch deep x 59 inch high. Hood shall be double-wall construction, powder-coated, cold rolled steel exterior, galvanized steel support members with a one piece monolithic molded polyester resin liner.

(a) Side panels and access panels 20-gauge sheet steel. Hood corner posts are 18-gauge sheet steel. Ceiling enclosure panels

are 18 gauge sheet steel. Sheet steel shall be cold-rolled, commercial steel (CS) sheet, complying with ASTM A 1008/A 1008M.

(b) Chemical Resistant Finish shall be prepare, treat, and finish welded assemblies after welding. Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8. Third party validation required.

(c) Fume Hood Finish shall be Glacier White.

(2) Baffle: Shall be one-piece monolithic molded polyester resin. Moving or adjustable baffles are not acceptable.

(3) Sash: Shall have a maximum opening is 28 inches. An unobstructed viewing height of 37.5 inch. Hood shall incorporate a perforated sash handle to bleed air into the hood chamber directing fume concentrations away from the user's breathing zone.

(a) Glass: Fully tempered safety glass with unobstructed, side-to-side view of fume hood interior and service fixture connections.

(b) Sash Tracks: Steel with Chemical Resistant Finish. Shall include bump stops for opening and closing.

(c) Sash guides: Corrosion resistant extruded poly-vinyl chloride.

(d) Sash System: Vertical Sash (Cable and Pulley), hoods have a single vertical sash counterbalanced by a single weight. Sash and weight to be connected via aircraft cable meeting MIL-W-83420 Military Specification. Rear pulleys shall be connected via timing shaft to prevent sash tilting and permit one finger operation at any point along full width sash handle. Maximum 7 pounds pull required to raise or lower sash throughout its full length of travel. Design system to hold sash at any position without creep and to prevent sash drop in the event of cable failure. Include a defeatable, and automatically resetting sash stop positioned for an 18” sash height.

(4) By-Pass Opening: The size of the by-pass opening is controlled by sash position for use with a constant volume mechanical system. The hood shall not have a change in static pressure or exhaust volume across all sash positions.

(5) Exhaust Connection: Fiberglass reinforced polyester resin, and a continuous component of the fume hood liner. Duct collars attached with fasteners, adhesive, or varying in material of construction from the liner are not acceptable. Collar shall have a 12.81 inch ID to accommodate any 12 inch nominal duct without the need for a transition adapter. 4-foot hoods have one exhaust connection. Ducting shall go inside the duct collar to ensure condensate travels into the hood and evaporates.

(6) Service: The hood manufacturer shall furnish and deliver all service outlets, accessory fittings, electrical receptacles and switches, as listed in these specifications, equipment schedules or as shown on drawings.

(a) Plumbing fittings mounted on the fume hood superstructures shall be pre-plumbed per section 2.03.

(b) Final plumbing and electrical connections are the responsibility of those Contractors fulfilling requirements of the mechanical and electrical Divisions.

(c) All electrical services are pre-wired to a single point internal junction box at the top right of the hood.

(7) Wiring: Pre-wire fluorescent lighting, light switch, blower switch, and electrical outlet for 115 volt, 60 Hz, 15 amp operation.

(8) Fume Hood Accessories: Service Fixtures: Color-coded hose nozzle outlets and valves mounted inside the fume hood and controlled from the exterior with color-coded index handles

(a) Provide a gas, air and cold water service fixtures. Hose connectors located inside the fume hood cavity are chemically-resistant, glass-filled polypropylene with 6 serrations.

(b) Service lines shall be factory installed from valve to outlet. Copper tubing unless otherwise noted. Brass service lines for gas

(c) Valves: Extruded brass valve and rotating seat, TFE-coated silicone bronze stem and TFE packing. Fixture handles are plastic and color coded as well as labeled for the designated type of service. Valves are front loaded, located on the fume hood corner post for remote use, and include Cold tap water, LP Gas and Air.

(d) Ceiling Enclosure Panels: Provide filler panels matching fume hood exterior to enclose space above fume hoods at front and sides of fume hoods and extending from tops of fume hoods to ceiling.

(e) Face Velocity Monitor/Alarm (Audio/Visual Air Flow Monitor): Provide audible and visual alarm in the event of an unsafe face velocity. Alarm shall sit flush with the fume hood corner post. Based on a thermally compensated thermistor in the alarm module, and air passing through a separate airstream into the hood interior. LED lights display red for alarm and green for normal operation. Include external alarm and night setback functions. Alarm mute shall be accessible from the front of the monitor; visual alarm must remain activated until alarm condition is corrected. Calibration shall be through a front located potentiometer. Calibration is the responsibility of the mechanical contractor following a complete balancing of the mechanical system, and concurrently with As-Installed testing.

(B) Fume Hood Work Surface: 1.25 inch thick, molded from solid modified epoxy resin, with smooth, non-specular, black finish. One inch radius front edge for optimal fume hood performance. 3/8 inch dished area to match the fume hood interior work space and form a water tight pan for spill containment.

(1) Include a 2.5 inch diameter hole on each side for service pass-through and piping. Hole to be covered by hood superstructure upon installation. Include two 1.5 inch diameter penetrations to accommodate base cabinet venting. Holes to be located outside of dished area and under the fume hood baffles. Include plugs.

(2) Cupsink: provide a 3 x 6” dimension, polypropylene construction with strainers and tailpieces, NPS 1-1/2. Shall sit flush with dished area of work surface Cupsink to be located Left rear.

(C) Fume Hood Base Cabinet: Shall be in depths of 22", widths, quantities, and types called out in the equipment schedule or drawings, and meet the requirements of this specification. Exterior construction minimum 18 gauge cold rolled sheet steel with Chemical Resistant Finish. Hinges minimum 10 gauge plate with self-clinching pilot pin. The rear panel will feature a 12" x 8" removable plumbing access panel. Each cabinet includes four leveling feet. Capable of supporting up to 800 pounds. An 8 inch filler panel shall be provided to increases the cabinet depth to 30 inches.

(1) Standard Storage with an overall exterior dimension of 48 inch wide x 22 inch deep x 35.5-36.75 inch. Flush pull handles are ABS, low gloss black.

814.09 Ductless DX Split System.

(A) Fan Coil Unit (FCU) – Cassette

(1) Cassette Ceiling Mounted: Indoor, direct-expansion, low profile (10.1 in.) in-ceiling fan coil. Unit shall be complete with a coil, fan driven by DC inverter-motor, PMV (pulse modulating valve), piping connectors, electrical controls, microprocessor control system, integral temperature sensing, condensate pump with a lift capability of 26 inch W.G. and hanging brackets.

(2) Unit Cabinet: Cabinet shall be constructed of zinc-coated steel. Fully insulated discharge and inlet grilles shall be attractively styled, high-impact non- metallic material. The inlet grille shall have hinges and can be opened to obtain access to the cleanable filters, indoor fan motor and control box.

(3) Fans: Fan shall be centrifugal direct-drive blower type with air intake in the center of the unit and discharge at the perimeter. Automatic, motor-driven vertical air sweep shall be provided standard. Automatic motor-driven louvers shall be provided standard and shall be adjustable for 2, 3 or 4-way discharge. Air sweep operation shall provide 3 user selectable modes.

(4) Coils: Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion and specially coated for enhanced wettability. A drip pan under the coil shall have a factory-installed condensate pump and drain connection for hose attachment to remove condensate. A replaceable element in the condensate disposal system provides antibacterial protection.

(5) Motors: Motors shall be totally enclosed, permanently lubricated ball bearing with inherent overload protection. Fan motors shall be inverter controlled variable speed.

(6) Controls: Wired remote controller shall communicate over 2-core shielded wire up to 1640 feet. It shall be capable of controlling groups of up to 8 indoor units. It shall be able to operate as a primary or secondary controller when 2 remote controllers are connected to a single indoor unit or group. The system shall be able to be configured so that the return air (TA) can be sensed at the unit, at the remote controller or through a remote sensor. The local controller shall minimally be able to control On-OFF, set point, mode, and be able to display system generated error codes. User interface with the unit shall be accomplished via a wired thermostat that shall have the following functions as a minimum:

(i) Automatic restart after power failure at the same operating conditions as at failure.

(ii) Thermostat control to enter set points and operating conditions.

(iii) Programmable fan speed control shall be user-selectable: high, medium, low, or automatic operation during all operating modes.

(7) Internal Condensate Pump: The condensate pump shall remove condensate from the drain pan when gravity drainage cannot be used. The lift capability of the condensate pump shall be direct vertical 20 inches. Float control shall be in the condensate sump to shut the unit down in case of a pump malfunction.

(8) Ventilation Air Intake: The multi-function casement ventilation air intake plenum shall include duct connection to provide increased outdoor ventilation air volume.

(9) Thermostat: The flat stat thermostat shall incorporate 3-speed control, programmability, auto changeover, backlight, locking keypad and a large LCD display that is mounted flush to the wall.

(B) Air Cooled Condensing Unit (ACCU, 5-TON AND LESS)

(1) General: Factory assembled, single piece, air-cooled outdoor unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and the compressor.

(2) Unit Cabinet: Unit cabinet is constructed of galvanized steel, bonderized and coated with a baked-enamel finish on inside and outside. Unit access panels are removable with minimal screws that provide full access to the compressor, fan, and control components. Outdoor compartment is isolated and have an acoustic lining to assure quiet operation.

(3) Fans: Outdoor fans are direct-drive propeller type, and discharge air horizontally. Fans draw air through the outdoor coil. Outdoor fan motors are totally-enclosed, single phase motors with class B insulation and permanently-lubricated ball bearings. Motor is protected by internal thermal overload protection. Shaft has inherent corrosion resistance. Fan blades shall be nonmetallic and shall be statically and dynamically balanced. Outdoor fan openings shall be equipped with PVC metal/mesh coated protection grille over fan.

(4) Compressor: Compressor shall be fully hermetic rotary type. Compressor shall be equipped with oil system, operating oil charge, and motor. Internal overloads shall protect the compressor from over-

temperature and over-current. Motor shall be NEMA rated class F, suitable for operation in a refrigerant atmosphere. Compressor assembly shall be installed on rubber vibration isolators. Compressors shall be single phase.

(5) Outdoor Coil: Coil shall be constructed of aluminum fins mechanically bonded to seamless copper tubes, which are cleaned, dehydrated, and sealed.

(6) Refrigeration Components: Refrigerant circuit components shall include brass external liquid line service valve with service gage port connections, suction line service valve with service gage connection port, service gage port connections on compressor suction and discharge lines with Schrader type fittings with brass caps, accumulator, reversing valve.

(7) Controls and Safeties: Operating controls and safeties shall be factory selected, assembled, and tested. The minimum control functions shall include the following:

(a) Controls:

(i) A time delay control sequence is provided standard through the fan coil board.

(ii) Automatic outdoor-fan motor protection.

(b) Safeties:

(i) System diagnostics.

(ii) Compressor motor current and temperature overload protection.

(iii) Outdoor fan failure protection.

814.10 Dehumidifier (DH)

Dehumidifier shall be of a type proven in satisfactory operation for a minimum of 10 years. Dehumidifier shall be of the non-cycling sorption type with a single desiccant rotary structure.

(A) The casing will be fabricated as a unitized body with welded aluminum construction for maximum strength and durability. Suitable access panel shall allow access for inspection or servicing without disconnecting ducting or electrical wiring. Airflow balancing dampers to be furnished.

(B) The rotary structure shall be a monolithic fabricated extended surface consisting of inert silicates reinforced with uniform diameter glass fibers for maximum strength. The fabricated structure shall be smooth and continuous in the direction of airflow without interruptions or sandwich layers which restrict

airflow or create a leakage path at joining surfaces. Desiccant shall not channel, cake or fracture due to repeated temperature and moisture cycling. The materials of construction shall be water washable, non-toxic and NFPA 255-ASTM E84 compliant. Full face contact pressure seals shall be provided to separate the process and reactivation air streams and eliminate detrimental leakage of air or moisture with static pressure differentials of up to 3" of water gauge.

(C) Dehumidifier shall be factory assembled; fully automatic, complete with honey comb desiccant wheel, reactivation heaters, reactivation energy control system, roughing filters, motors, fans, non-ratcheting desiccant drive unit, automatic controller and all components' auxiliaries. Reactivation energy modulation shall be stepless solid state proportioning type. Dehumidifier shall be functionally tested at the manufacturer's factory and shipped complete with all components necessary to maintain normal operation.

(D) Controls: Wall mounted humidistat for on/off controls

(E) Desiccant Dehumidifier shall be Munters model HC or pre-approved equal

814.11 Motor Starter.

(A) Single-Phase Starter: Starters for 115VAC single phase motors less than 1 HP shall have a quick-make / quick break toggle mechanism, trip free manual reset thermal overload relay, position indicator showing ON and OFF positions.

(B) Multi-Phase Starter: Furnish magnetic across-the-line starter with three overload protection relays with pilot light and with three auxiliary contacts and circuit breaker with hand-off-automatic switch, for each multi-phase motor unit. Starter shall be clearly marked to indicate the motor for which it is being furnished. Enclosure shall be NEMA 4X stainless steel. Provide integral control transformer and voltage protection.

814.12 Air Devices.

(A) Supply Air Diffuser: Provide Titus Model TDCA series, type 3, or approved equal. Diffuser shall be square neck, louvered face, aluminum, surface mounted with adjustable pattern in sizes and patterns as indicated.

(B) Return Air Register: Provide Titus Model TDCA series, type 3, or approved equal. Diffuser shall be square neck, louvered face, aluminum, adjustable volume damper surface mounted with adjustable pattern, in sizes and patterns as indicated.

(C) Exhaust and Transfer Air Grille - EAG: Provide Titus Model 350RL-SS series or approved equal. Grille shall be louvered, stainless steel for exterior location and aluminum for interior locations, surface mounted, 3/4 inch louver spacing, 35 degree fixed deflection angle with blades parallel to

long dimension and in sizes and capacities as indicated. Provide standard finish or as indicated.

(D) Color shall be white unless otherwise noted.

814.13 A/C and Ventilation Ductwork, Pressure Class 0 to 2 inch W.G.

(A) All ductwork shall be galvanized steel with gages and construction in accordance with Chapter 1, Air Duct Design, 1988 Equipment Volume ASHRAE Handbook. Duct system shall be constructed for a commercial system with a minimum of 3 inch W.G. pressure.

(B) Sheet Metal for Ducts: Standard hot dipped galvanized steel sheets of weights as specified hereinafter, except where another material is specifically indicated. See PART 3 - EXECUTION - DUCTWORK, AND RELATED SHEETMETAL WORK.

(C) All ductwork and plenum chambers shall be galvanized metal installed of gauges and with bracing and joints all in accordance with latest edition of ASHRAE Guide and SMACNA Duct Construction Standards.

(D) Flexible Duct: Owens-Corning Fiberglass INL-25, Flexible duct, Class 1 or equal. Length of flexible duct connecting rigid duct and devices shall not exceed 5 feet. Flexible only allowed for connecting rigid duct to air devices or for plenums of the air devices.

814.14 Fume Hood Exhaust Duct.

(A) All ductwork and plenum chambers shall be 304 stainless steel installed of gauges and with bracing and joints all in accordance with latest edition of ASHRAE Guide and SMACNA Round Industrial Duct Construction Standards for duct supports and reinforcement using stainless steel materials. All seams shall be welded.

(B) For air conditioning and general ventilation systems, the thickness of the sheetmetal and size and spacing of the stiffeners used shall be in accordance with the requirements of the latest edition of the ASHRAE Guide and Data Book and SMACNA HVAC Metal Duct Standard, +6 inch W.G. static pressure class. Ducts shall also be capable of withstanding -3 inch W.G. negative pressure. Connections to plenum shall be airtight. All ducts shall be sealed to Seal Class C requirements. No polysulfide sealant shall be used. Polyurethane sealant is acceptable. Return and outside air ducts may be constructed of properly sealed punch seam duct. Ducts may be welded to meet the high static pressure requirements.

814.15 Volume, Dampers, Balancing Dampers, Fire Dampers.

(A) Volume Dampers: Volume dampers shall be installed where shown and as required for air balancing. Dampers shall be two gages heavier than the duct in which they are installed and shall be reinforced to prevent vibration and noise. Unless otherwise indicated, all volume dampers in ductwork 10 inches or greater, in either width or height, shall be opposed blade type. Branch dampers as indicated are required regardless if the air devices are provided with volume dampers. Provide Ruskin or approved equal.

(B) Balancing Dampers: Balancing dampers for branches and mains shall be equipped with Young Regulator No. 1 or approved equal.

(C) Concealed Operators: Where damper operators must be placed in remote or concealed locations, provide Young Regulator No. 914 or approved equal miter gear operator with Young Regulator No. 315 or approved equal, concealed regulator with flush mount, chrome plated and adjustable access cover.

(D) Backdraft Dampers: Backdraft dampers shall be adjustable, counterbalanced type, heavy duty extruded aluminum, minimum 0.125 inch wall thickness frame, minimum 0.070 inch wall thickness blades with vinyl edge seals and maximum allowed spot velocity of 3500 fpm and maximum air temperature of 200 degree F. Provide front flange. Provide Ruskin CBD6 or approved equal.

814.16 Flexible Connections for Ductwork.

All duct connections to air handling units shall be 9 inches full length.

814.17 Vibration Isolation.

(A) Unless otherwise noted on Equipment Schedule, all mechanical equipment shall be mounted on vibration isolators to prevent transmission of vibration and mechanically transmitted sound to building structure. Vibration isolator shall be selected in accordance with weight distribution so as to produce reasonably uniform deflection. Deflections shall be minimum of one inch for all equipment.

(1) For Ceiling Mounted Fan Coil Units and Exhaust Fans: Provide minimum 1 inch deflection spring vibration hangers containing a spring and a double deflection neoprene element in series. Neoprene elements shall have a minimum deflection of 0.35 inches. Spring diameters shall be no less than 0.8 of compressed height of spring at rated load. Springs shall have minimum additional travel to solid equal

to 50 percent of rated deflection. Hangers shall be as manufactured by Mason Industries, Amber booth or approved equal.

(2) Pipe Isolation: Piping connected to mechanical equipment shall be isolated from building structure throughout its turns by hangers or supports. In order to be certain that piping weight is properly distributed and not distorting equipment connections support first three hangers at equipment with vibration isolation. All pipe hangers shall be the same type as for the ceiling mounted air handling unit and fan coil unit previously described.

(B) Flexible Connectors: Flexible neoprene connectors with Hypalon cover shall be provided in all water piping connections to air handler / fan coil units where pipe is greater than 2 inches nominal diameter. Connectors shall be of neoprene, single sphere, with ductile iron Class 150 flanged connections. Flanged assemblies shall be equipped with limit bolt to restrict maximum travel and resist pressure thrusts. Connectors shall have a minimum rating of 225 psi at 170 degrees F operating temperature. All materials shall be suitable for use in chilled water systems and outdoor environments. Connectors shall be Mason Industries, Inc., Type MFNC or approved equal.

(C) Flexible Hoses: Metallic braided bronze hoses shall be provided in all chilled water piping to the air handling units where pipe is 2 inches or less nominal diameter. Hoses shall be Mercer BBF or equal. Provide soldered or threaded ends. Lengths shall be 6 times the nominal diameter with a maximum of 36 inches. Hoses shall be installed on equipment side of shut-off valves and horizontally wherever possible.

814.18 Cooperation with Other Trades and Conflict in Work.

(A) Contractor shall examine all drawings of proposed work and coordinate his work with other trades. Work conflicts shall be brought to attention of Engineer and work rearranged or modified in accordance with his decision.

(B) If changes in indicated locations or arrangements of work are required, they shall be made by Contractor without additional charge to the State provided that these changes were ordered before work is installed and no extra material or labor are required.

(C) Should Contractor determine that extra material and labor will be required to accommodate any rearrangement, he shall first submit detailed estimate of cost for required changes and proceed with work only upon written authority of the Engineer.

814.19 Equipment Installation.

(A) Equipment shall be installed as indicated and in accordance with manufacturer's recommendations and instructions.

(B) All necessary supports shall be provided for equipment, appurtenances and duct as required. This shall include any additional steel purlins, brackets or supports.

(C) Provide controls as indicated for proper operation of the equipment. Provide all necessary relays, contactors, enclosures and transformers to ensure proper system operation.

814.20 Workmanship and Fabrication.

(A) Ductwork:

(1) Fabricate all ductwork and related work to highest industry standards and recommendations of ASHRAE and SMACNA. Provide all necessary supplementary steel structure supports, purlins or brackets to support duct properly from structure.

(2) Sides of ductwork shall be cross broken. Long seams shall be Pittsburgh lock groove, hammered flat or double seamed. Ducts shall also have supplemental stiffening as required to prevent drumming and to provide structurally sound assembly.

(3) Center line radius of curves, bends, offsets for branch and connections shall be equal to 1-1/4 times duct width or larger. Duct turns in all square elbows shall be accomplished by using prefabricated turning vanes such as Tuttle & Bailey "Ducturn" or other approved equal. Double thickness turning vanes in ducts deeper than 16 inches may be used.

(4) Volume and splitter dampers shall be installed where required and shall be provided with extension rods for adjusting and locking. Dampers shall be made of not lighter than 18 gauge steel for dimensions up to 10 inches, and multi-louvered, opposed blade type on ducts over 10 inches high. All dampers shall have Young Regulator No. 401 locking quadrants.

(5) Paint inside of all supply, return, exhaust and transfer air ducts with one (1) coat of flat black paint wherever duct is visible through register or grille opening.

(6) Ducts passing through outside walls shall be suitably and properly flashed and counter flashed to prevent leaks. Fresh air intake or ventilation opening shall be provided with screened intakes.

(B) Pipe Installation:

(1) Pipe shall be cut accurately to measurements established at the job site and worked into place without springing or forcing, properly clearing all windows, doors and other openings. Cutting or weakening of the building structure to facilitate piping installation will not be permitted.

(2) Pipes shall be cut square, shall have burrs removed by reaming, and shall be so installed as to permit free expansion and contraction without damage to joints or hangers. Install special swing and expansion joints in pipe lines where required. Filings, dust, or dirt shall be wiped from interior of the pipe before connections are made.

(3) Changes in direction shall be made with fittings, except the bending of pipe will be permitted, provided a hydraulic or mechanical pipe bender is used and wide sweep bends are formed. Bent pipe showing kinks, wrinkles, or other malformations will not be accepted. All piping shall be installed with sufficient pitch to insure adequate drainage.

(4) Screw joints shall be made with tapered threads properly cut conforming to requirements of NBS handbook H28. Joints shall be made perfectly tight with a stiff mixture of litharge and glycerin or other approved threaded joint compound applied with a brush to the male threads only. Not more than three threads shall show after the joint is made up.

(5) Welded joints shall conform as to workmanship, testing, qualification of welders and general requirements, with welding section of ANSI B31.1 "Codes of Pressure Piping". The University reserves the right to require qualifying demonstration of any welder assigned to job by Contractor at no additional cost.

(6) Flanges shall be suitable for the required operating pressures and temperature conditions. Gaskets shall be fiber plastic or other synthetic material suitable for water service. All nuts, bolts and washers used shall be galvanized for ferrous flanges and brass for copper or bronze flanges.

(7) Pipes passing through walls or concrete floors shall be provided with pipe sleeves fitted into place at time of construction. Sleeves shall

not be installed in structural members. Each sleeve shall extend through its respective wall or floor and shall be cut flush with each surface. Unless otherwise indicated, sleeves shall be of such size as to provide a minimum of 1/4 inch all around clearance between jacket over insulation and sleeves. Space between sleeve and piping shall be packed with twisted jute packing and then sealed with waterproof sealant. Where pipes pass through fire walls or floors, seal both ends of sleeve with Underwriter's Laboratories listed thermal barrier material to maintain fire rating.

(8) All piping systems shall be thoroughly tested for leaks prior to insulating the pipe and closing up ceilings, walls and floors. Piping system shall be pressure tested to maximum allowable working pressure. Correct all leaks.

814.21 Equipment Support.

Refer to drawings for type of construction from which equipment is to be supported. Shall be provided as indicated:

(A) Provide adjustable hangers, clamps, supplementary steel, etc., as required for proper support of all piping.

(B) Supports shall secure pipes or conduits in place, shall prevent pipe vibration, maintain required grading by proper adjustment, provide for expansion and contraction, and shall make neat appearance.

(C) Design supports of strength and rigidity to suit loading, service, and in a manner which will not stress unduly the building construction.

(D) Where support is from concrete construction, take care not to weaken concrete or penetrate waterproofing.

814.22 Adjusting and Cleaning.

Pipes shall be cleaned free of scale and thoroughly flushed of all foreign matter. Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided for all fans that are operated during construction and after all construction dirt has been removed, new filters shall be installed. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. All valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

814.23 Testing, Adjusting and Balancing.

(A) Test, adjust and balance each piece of equipment as required to assure proper operation.

(B) Air and Water Systems Testing and Balancing: Upon completion of the installation and field testing, performance test and adjust the supply, return, make-up, and exhaust air systems, and chilled and hot water heat recovery systems to provide the air volume and water flow quantities indicated. Accomplish all work in accordance with the agenda and procedures specified and Associated Air Balance Council 71679 or the standards of the National Environmental Balancing Bureau. Correct air and water system performance deficiencies disclosed by the test before balancing the systems.

(C) Agency Qualifications: The Contractor, as part of this contract, shall obtain the services of a qualified testing organization to perform the testing and balancing work as herein specified. Prior to commencing work under this section of the specifications, the testing organization shall have been approved by the Engineer. The criteria for determining qualifications shall be membership in the AABC, or certification by the NEBB.

(D) Adjust systems and components thereof that perform as required by drawings and specifications. Instruments used for measurements shall be accurate and calibrated within the last 6 months. Provide last date of calibration.

(E) Submit testing and balancing reports for all air and water systems in accordance with Section 811 - GENERAL MECHANICAL REQUIREMENTS.

(F) Balancing:

(1) Water piping systems shall be balanced to produce water quantities as indicated with all manual and automatic control valves open.

(2) Duct systems shall be balanced as follows: System (or air moving device) to not less than 95 percent of design CFM.

(G) System Test Report: The Contractor shall provide as part of the submittal typewritten schedules of readings taken during the balancing and testing operations indicating the required or specified reading, the first reading taken, and final balanced reading in the certified report. The

certified report shall include for each air-handling system the data listed below:

(1) For Each Air Handling / Fan Coil Unit:

(a) Manufacturer and Model

(b) Size

(c) Arrangement, Discharge, and Class

(d) Motor HP, Voltage, Phase, Cycles, and Full Load Amps.

(e) Location and Local Identification Data

(f) CFM

(g) Static Pressure

(h) RPM

(i) Motor Operating Amps

(j) Duct Static Pressure Controller Setpoint (for VAV systems)

(2) Duct Systems:

(a) Duct Size(s)

(d) Average Velocity

(c) Recorded (Actual) CFM

(d) Design CFM

(3) For Each Individual Air Terminal:

(a) Terminal Identification (Supply or Exhaust, Location and Number Designation)

(b) Type, Size, Manufacturer, and Catalog Identification

(c) CFM

(d) Applicable Factor for Velocity, Area, etc.

(e) Velocities - FPM (State "core," "inlet," etc., as applicable)

(4) Cooling Coils for Each Air Handing / Fan Coil Unit:

(a) GPM

(b) Entering and Leaving Water Temperatures

(c) Entering and Leaving Air Conditions (D.B. and W.B.)

(d) Air Side Pressure Drop

(e) Water Pressure Drop

(5) For Each Exhaust Fan:

(a) Manufacturer and Model

(b) Motor H.P., Voltage, Cycles, Phase, and Full Load Amps

(c) Running Load Amps

(d) CFM and RPM. if belt drive

(6) For Each Pump:

(a) Manufacturer and Model

(b) Motor HP, Voltage, Cycles, Phase, and Full Load Amps

(c) Running Load Amps

(d) GPM

(e) Inlet / Outlet Pressure

(H) Control Settings: On-site settings for all automatic controls including thermostats, safety controls, minimum damper settings, fire-safety thermostats, pressure controls, temperature controls, and other similar items shall be provided in the form of a type tabulated list indicating type of control, location, setting, and function. Final settings shall be permanently marked on devices. Coordinate all control settings with requirements of Section 817 - CONTROLS.

814.24 Calibration and Adjustments.

After completion of the installation, perform final calibrations and adjustments of the equipment provided under this contract and supply services incidental to the proper performance of the unit control panels under warranty.

814.25 Acceptance Procedure.

Upon completion of the calibration, Contractor shall start-up the air conditioning system and perform all necessary testing and run diagnostic tests to ensure proper operation. Contractor shall be responsible for generating all software and entering all database necessary to perform the sequence of control and specified software routines. An acceptance test in the presence of the Engineer shall be performed. Provide operational acceptance tests. The tests shall be performed during a normal day of operation after the air conditioning system has been completely installed and made operable. Results of the tests shall be indicated on an Official Operational Performance Test form by NEBB or AABC and shall be part of the test and balance submittal.

814.26 Field Instruction.

Upon completion of the work and at a time designated, the services of one or more qualified personnel shall be provided by the Contractor for a period of not less than 4 hours to train and provide technical assistance to the representatives of the State in the operation and maintenance of the air conditioning and ventilation system. These field instructions shall cover all the items contained in the bound instructions. Submit course outline, instructor's name and an on-site training schedule.

814.27 One Year Maintenance Service Contract.
Shall be provided as specified in Section 660 - MECHANICAL GENERAL REQUIREMENTS.

814.28 Operation and Maintenance Manual.

Provide hard bound copies of the Operating and Maintenance Manual on all equipment and the system as a whole. Provide manuals in accordance with the requirements of Section 8110 - MECHANICAL GENERAL REQUIREMENTS.

666.29 Schedule of Maintenance Service.

Shall be provided as specified in Section 660 - MECHANICAL GENERAL REQUIREMENTS.

666.30 Payment.

The Engineer will pay for the accepted pay items listed below at the contract price per pay unit, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for each of the following pay items when included in the proposal schedule:

Pay Item	Pay Unit
General Mechanical requirements	Each
CHW Piping	Each
Mobilization & Clean-Up	Each
Removal Air Conditioning and Ventilation – FCU	Each
Removal Air Conditioning and Ventilation - Air Device Removal	Each
Removal Air Conditioning and Ventilation - Roof Caps	Each
Removal Air Conditioning and Ventilation – Fume Hood Exhaust Fan	Each
Removal Air Conditioning and Ventilation - Exhaust Fan	Each
Air Conditioning and Ventilation - Air Device Reinstall	Each
Air Conditioning and Ventilation - Roof Caps (OA)	Each
Air Conditioning and Ventilation - 4-foot Fume Hood & Cabinet	Each
Air Conditioning and Ventilation - FRP Fume Hood Exhaust Fan	Each
Air Conditioning and Ventilation - Exhaust Fan Reinstall	Each
Air Conditioning and Ventilation - FCU-CHW	Each
Air Conditioning and Ventilation - Condensate Drain Piping	Linear Feet
Air Conditioning and Ventilation - Ductwork S.S. Fume	LB
Air Conditioning and Ventilation - Ductwork Galvanized	LB
Air Conditioning and Ventilation - Duct Insulation	Square Feet
Mobilization and Clean-Up	Lump Sum

Air Conditioning and Ventilation-Demolition-FCU	Each
Air Conditioning and Ventilation-Demolition-Air Device Reinstall	Each
Air Conditioning and Ventilation-New-Desiccant Dehumdifier	Each
Air Conditioning and Ventilation-New Dehumidifier Support DH	Each
Air Conditioning and Ventilation-New-FCU (DX Split System) Cassette (1.0 Ton) - IT Room	Each
Air Conditioning and Ventilation-New-FCU (DX Split System) High Wall (1.0 Ton) - Office Room	Each
ACCU (DX Split System) - 1.0 ton systems - IT ROOM	Each
ACCU (DX Split System) - 1.0 ton systems - Office Room	Each
ACCU (DX Split System) - Refrigerant Piping	Linear Feet
ACCU (DX Split System) - Refrigerant Pipe Insulation	Linear Feet
ACCU (DX Split System) - Wall Support ACCU	Each
ACCU (DX Split System) - Condensate Drain Piping	Linear Feet
ACCU (DX Split System) - Air Device Reinstall	Each
ACCU (DX Split System) - FCU-CHW	Each
ACCU (DX Split System) - Ductwork S.S. Fume	LB
ACCU (DX Split System) - Ductwork Galvanized	LB
ACCU (DX Split System) - Duct Insulation	Lump sum

END OF SECTION 666

Make the following Section a part of the Standard Specifications:

SECTION 667 - CONTROLS

667.01 Description.

This section includes the requirements for HVAC control systems.

667.02 General Requirements.

(A) As specified in Section 660 - GENERAL MECHANICAL REQUIREMENTS, applies to this section, with the additions and modification specified herein.

(B) The work includes providing new and modifying existing control systems including associated equipment and appurtenances. Provide each system complete and ready for operation. Equipment, materials, installation and workmanship shall be in accordance with NFPA 70, NFPA 90A, except as specified or indicated otherwise. In the publications referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; reference to the "authority having jurisdiction" shall be interpreted to mean the State.

(C) Provide control systems to maintain the conditions indicated, to perform the functions indicated, and to operate in the sequence indicated. Provide control systems of the electronic or electric type or any combination of these types. Control diagrams showing one type of control system on the drawings are not intended to show a preference for that type system. Installation shall be made by or under the direct supervision of competent technicians regularly employed in the installation and calibration of controls. Control equipment and panels shall bear the manufacturer's nameplate.

(D) New controls shall be BACnet at component level. The system shall be one complete operating system able to be controlled and monitored from workstations. The contract shall provide the require programming and equipment to make the connection to the campus system.

(E) Direct Digital Control (DDC) technology shall be used to provide the functions necessary for control of mechanical systems on this project.

(F) The control system shall accommodate simultaneous multiple user operation. Access to the control system data should be limited only by operator password. Multiple users shall have access to all valid system data. An operator shall be able to log onto any workstation on the control system and have access to all appropriate data.

(G) The control system shall be designed such that each mechanical system will be able to operate under stand-alone control. As such, in the event of a network communication failure, or the loss of any other controller, the control system shall continue to independently operate under control.

(H) The documentation is schematic in nature. The Contractor shall provide hardware and software necessary to implement the functions and sequences shown.

667.03 Related Work Specified in Other Sections.

(A) Air conditioning and ventilation work specified in Section 865 – CHILLED WATER PIPING AND ACCESSORIES.

(B) Air conditioning and ventilation work specified in Section 666 – AIR CONDITIONING AND VENTILATION.

(C) Electrical work specified in Section 670 - ELECTRICAL.

667.04 Submittals.

(A) The items for which the submittal requirements of Section 811 - GENERAL MECHANICAL REQUIREMENTS, apply are as follows:

(B) Manufacturer's Data: Provide manufacturers cut sheets for major system components. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is being submitted to cover. Include:

(1) Building Controllers

(2) Custom Application Controllers

(3) Application Specific Controllers

(4) Operator Interface Computer

(5) Temperature sensors, including complete wiring and connection diagrams.

(3) Switches, relays, including complete wiring and connection diagrams.

(4) Timing controls, including wiring and connection diagrams.

(5) Control Cabinets.

(6) Control valves and dampers.

(C) Shop Drawings:

(1) Operator and controllers, including complete wiring and connection diagrams. Proposed control system riser diagram showing system configuration, device locations, addresses, and cabling.

(2) Points list showing all system objects and the proposed English language object names.

(3) Sequence of operations for each system under control. This sequence shall be specific for the use of the Control System being provided for this project.

(3) Control Panels.

(4) Equipment interlocks.

(D) Operation and Maintenance Manuals: Furnish an operation and maintenance manual for each item of equipment listed under "Manufacturer's Data". The manuals shall contain full hardware support documentation, which shall include, without being limited to, the following:

(1) General description and specifications.

(2) Installation and initial checkout procedures.

(3) Principles and theory of operation.

(4) Detailed Electrical and logical description.

(5) Complete trouble-shooting procedures, diagrams, and guidelines.

(6) Complete alignment and calibration procedures for all components.

(7) Preventive maintenance requirements

(8) Detailed schematics and assembly drawings.

(9) Complete spare parts lists.

(10) Interface requirements and capabilities.

(E) Posted Operating Instructions:

(1) Complete temperature control schematic and wiring diagram.

(2) Sequence of operation for each system and function.

(3) Equipment interlocks.

(F) Warranty: Submit warranty as noted under item entitled "WARRANTY" herein below.

667.05 Quality Assurance.

System Installer Qualifications:

(A) The Installer shall have an established working relationship with the Control System Manufacturer of not less than 3 years.

(B) The Installer shall have successfully completed Control System Manufacturer's classes on the control system. The Installer shall present for review the certification of completed training, including the hours of instruction and course outlines upon request.

(C) The installer shall have an office within 50 miles of the project site and provide 24 hour response in the event of a customer call.

667.06 Warranty.

Contractor's Warranty: The warranty shall extend for a period of one year commencing after 30 consecutive days of trouble-free operation from the project acceptance date or as authorized by the University, if earlier than the project acceptance date. The warranty 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. Control System periodic maintenance, failures and emergency calls during the warranty period shall be adjusted, repaired, or replaced

at no charge or reduction in service to the University. This warranty period shall run concurrently (same start and end dates). The Contractor shall respond to the University's request for warranty service within 2 hours during customary business hours.

667.07 Applicable Publications.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Comply with the latest applicable codes of regulatory bodies having jurisdiction, including but not necessarily limited to the following:

(A) American National Standards Institute (ANSI)

ANSI B31.1 Power Piping

(B) National Fire Protection Association (NFPA)

NFPA 70 National Electrical Code

NFPA 90A Installation of Air Conditioning and Ventilating Systems

(C) National Electrical Manufacturers Association (NEMA)

NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)

667.08 System Components.

Sensors, industrial or commercial grade, shall be compatible with the control equipment provided and shall have accuracies as stated herein. Instrument characteristics such as hysteresis, relaxation time, span including maximum and minimum limits shall be coordinated for all applications of sensors and controls, so that the control system shall operate smoothly and accurately throughout the design range. Temperature sensor wells shall be of bronze, stainless steel, copper or Monel materials; thermal transmission material shall be compatible with the sensor.

(A) Control Panels: Provide controllers relays, time clocks in or on the face of control cabinets for each system. Construct cabinets shall be of galvanized steel or aluminum with hinged door and lock. Provide pilot lights flush on the cabinet door. Provide controllers, switches and relays in the interior of the cabinet on a steel or aluminum subpanel which may also act as the back of the cabinet. Electrical controls shall be wired to numbered screw type terminal strips. Cabinets shall be floor mounted free

standing type; or surface mounted type. Panels at outdoor locations shall be NEMA 3R stainless steel type.

(B) Control Damper: Opposed-blade factory-fabricated dampers with felt or neoprene edges suitable for 2 percent maximum leakage when closed under the system operating conditions. Provide equal percentage linkage.

(C) Actuator: Actuator shall be direct coupled (over shaft), enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The actuator-to-shaft clamp shall be attached to the damper shaft for maximum holding strength. Single bolt or set screw type fasteners are not acceptable.

(1) Actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator. End switches to deactivate the actuator at the end of rotation or magnetic clutch are not acceptable. Actuators shall be non-over loading type.

(2) For power-failure/safety return mechanism shall be capable of either clockwise or counterclockwise spring return operation by simply changing the mounting orientation.

(3) Proportional actuators shall accept a 2-10VDC, 4-20mA signal, or be of the 2-point floating type and provide a 2-10VDC actuator position feedback signal.

(4) All actuators shall have an external manual gear release (clutch) or manual crank to aid in installation and for allowing manual positioning when the actuator is not powered.

(5) All actuators shall have an external direction of rotation switch to aid in installation and to allow proper control response.

(6) Actuators shall be provided with factory-mounted 3-foot electrical cable and conduit fitting to provide easy hook-up to an electrical junction box.

(7) Actuators shall be listed under Underwriters Laboratories Standard 873 and Canadian Standards Association.

(8) Provide internal transformer as required. Actuator shall be Johnson Controls, Honeywell or approved equal.

(C) Thermostat: Air conditioning equipment manufacturer programmable wall mounted thermostat with by-pass timer.

(D) Carbon Dioxide Sensor: Duct mounted carbon dioxide sensor, Johnson Controls Model CDS4000, Honeywell or approved equal.

(E) Smoke Detector: Furnish and install where indicated on the plans, duct housing with photoelectric smoke detector and remote alarm and power indicator, Honeywell, Johnson Controls or approved equal. The detector shall be UL listed for compatibility with the fire alarm control panel and shall obtain its operating power from the alarm initiating circuit.

(1) Detectors shall operate on the light-scattering, photo diode principle. To minimize nuisance alarms, detectors shall have an insect screen and be designed to ignore invisible airborne particles or smoke densities that are below the factory-set alarm point. No radioactive materials shall be used.

(2) Removal of the detector head shall interrupt the supervisory circuit and activate a trouble signal at the control panel. It shall be possible to alarm the duct detector by using remote stations.

(3) Auxiliary SPDT relays and/or remote LED alarm indicators and key-operated test stations shall be installed where indicated on plans.

667.09 Electrical and Electronic Power Supply and Wiring.

120 volts or less, 60 Hertz, 2 pole, 3 wire with ground. The devices shall be UL listed or FM approved.

(A) Transformers: Provide step-down transformers where control equipment operates at lower than the line circuit voltage. Transformers serving individual air conditioning units shall be fed from the fan motor leads or fed from the nearest distribution panel board or motor control center, utilizing circuits provided for the purpose. Transformers, other than transformers in bridge circuits, shall have primaries wound for the voltage available and secondaries wound for the correct control circuit voltage. Transformer shall have capacity to operate simultaneously all apparatus connected to it and shall be capable of carrying 125 percent of the load for one hour in an ambient air temperature of 100 degrees F. Transformers shall be enclosed in a galvanized steel cabinet with conduit connections and shall have a disconnect switch on the primary side and a fuse cut-out on the secondary side.

(B) Relays: Provide open contact, mercury tube or electronic type with dust proof enclosures.

(C) Manual Transfer Switches: Provide with operating levers and index plates showing switch positions and names of apparatus controlled or other appropriate designations.

(D) Wiring: Provide complete electric wiring for control apparatus, including wiring to transformer primaries. Control circuit conductors run in same conduit conductors shall have same insulation level as power circuit conductors. Circuits operating at more than 120 volts shall be in accordance with Section 820 - ELECTRICAL WORK. Circuits operating at 120 volts or less shall be defined as low voltage and shall be in rigid or flexible conduit, metallic tubing, metal raceways or wireways, armored cable or multi-conductor cable. Provide switches and fuses for the protection and convenient operation of the system. Protect exposed wiring from abuse and damage in an approved manner. Wire for low voltage AC shall be insulated copper No. 20 AWG or larger and shall conform to NFPA 70, Type MTW, THHN, TFFN, or BN. For low voltage DC and electronic circuit carrying less than 0.5 amperes, cables of two or more conductor, not smaller than No. 22 AWG solid copper if shielded or No. 20 AWG solid copper if not shielded, may be used in lieu of individual wires. Cable shall terminate in solder or screw type terminal strips. Cables shall not be tapped intermediate points. Wires, whether individual or in cables, shall be color coded or numbered for identification. Cables terminating in screw type terminal strips shall have pressure type connectors. Wire in physical contact with compression screw will not be acceptable.

(E) Control Panels: Interconnections between internal and face-mounted devices pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600-volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings. Provide on/off power switch with over-current protection for control power sources to each local panel.

667.10 DDC System

(A) Provide a new BACnet controller. The system shall have stand-alone digital controller, a communication network to the existing building control system.

(B) Provide a digital controller that will perform required climate control and alarm functions. All material used shall be currently in production.

667.11 Operator Interface

System must be accessible via Internet through Microsoft Internet Explorer. The use of proprietary software to access the system through the Internet is not acceptable.

(A) Workstation information access shall use the BACnet Protocol. Communication shall use the ISO 8802-3 (Ethernet) or ARCNET (ASTM 878.1) Physical/Data Link layer protocol. Remote communications shall use the BACnet Point to Point Physical/Data Link Layer Protocol.

(1) Hardware: Workstation web server hardware equipment and peripherals shall be recommended by the DDC system manufacturer.

(B) Web server shall be dedicated and not a dual use as a workstation. Hardware equipment at a minimum the web server hardware shall be a server class computer consists of:

(1) Web server – Core I7 or Xeon server class computer

(2) 19-inch Digital/Analog flat panel monitor

(3) 8 GB ram

(4) 512 GB SSD internal hard drive

(5) Windows Pro, OS with recovery disks, back-up software. Server software shall be provided with adequate clients.

(6) Keyboard, mouse.

667.12 System Software

(A) Furnish the following applications software for the HVAC building management. All software applications shall reside and run in the system controllers. Editing of applications shall occur at the operator workstation. All software needed for trending, reports and programming shall be provided.

(B) System Security

(1) User access shall be secured using individual security passwords and user names. Individual password shall correspond to certain levels of security.

(2) Passwords shall restrict the user to only the objects, applications, and system functions as assigned by the system administrator. Secure levels shall be made to be adjustable by the Administrator. Four levels of security shall be set up

(a) General - View only access

(b) Advanced - Access to FCU temperature set points only.

(c) Premium - Full access to all set points and settings.

(d) Administrative - Full access to programs.

(3) Before setting final security, contractor shall meet with HDOT to coordinate.

(4) User logon/logoff attempts and changes users make shall be tracked and recorded.

(5) The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user definable.

(6) User defined security; user shall have the ability to secure by password for all points individually. Allow user to be copied.

(C) Alarm Reporting: The operator shall be able to determine the action to be taken in the event of an alarm. Alarms shall be routed to the appropriate work-stations based on time and other conditions. An alarm shall be able to start programs, be logged in the event log, printed, generate custom messages graphics.

(D) Remote Communications: The alarm message shall include the name of the calling location, the device that generated the alarm, and the alarm message itself. The operator shall be able to remotely access and operate the system using dial up communications in the same format and method used on site under Operator Interface section above.

(E) Maintenance Management: The system shall monitor equipment status and generate maintenance messages based upon user designated run time, starts, and/or calendar date limits.

(F) PID Control: A PID (proportional-integral-derivative) algorithm with direct or reverse action and anti-wind-up shall be supplied. The algorithm shall calculate a time-varying analog value used to position an output or stage a series of outputs. The controlled variable, set-point, and PID gains

shall be user-selectable. The set-point shall optionally be chosen to be a reset schedule.

(G) Staggered Start: This application shall prevent all controlled equipment from simultaneously restarting after a power outage. The order in which equipment (or groups of equipment) is started, along with the time delay between starts shall be user-selectable.

(H) System Calculations: Provide software to allow instantaneous power (e.g. KW), flow rates (e.g. GPM) to be accumulated and converted to energy usage data. Provide an algorithm that calculates a sliding-window KW demand value. Provide an algorithm that calculates energy usage and weather data (heating and cooling degree days). These items shall all be available for daily, previous day, monthly and the previous month.

(I) Anti-Short Cycling: All binary output points shall be protected from short cycling. This feature shall allow minimum on-time and off-time to be selected.

(J) Provide necessary software to program controllers via internet for one workstation.

(K) Graphics: Shall include standard equipment graphics and overrides for valves, on/off, set points, etc. Graphics shall include drawing of project rooms and rooftop with equipment locations and room numbers and the following:

(1) Data shall be neatly arranged with all related data together.

(2) All relevant status points shall be displayed and with proper nomenclature; Air temps, CHW temps, Smoke Detector, etc.

(3) Shall have the ability to override any sensor, setpoint or devise (valve, damper, on/off…etc.) depending on the password.

(4) Single button to override all FCU valve positions to allow equally distributed water after an outage or during system problems.

(5) Contractor should meet with HDOT Mechanical Division to coordinate graphics screen prior to completion.

(6) Overall plant/floor plan shall show status of all equipment - inlet/outlet temperatures setpoints, % current, SA temp, %RH, Space temp, etc.

(7) Component graphic screens should have predefined trend graphs as part of graphics.

(L) Trending: Trends of all points (analog and digital) should reside at the controller automatically for 24 hours at 20 minute intervals. Trends from any point should have the ability to be grouped and graphical capabilities.

(M) Schedules: Shall have the ability to copy schedules by day. Schedule several one-time holidays by specific dates, Schedules shall be organized and controlled in a hierarchal manner.

667.13 Building Controllers

(A) General:

(1) The Building Automation System shall be composed of one or more independent, stand-alone, microprocessor based Building Controllers to manage the global strategies described in System software section.

(2) The Building Controller shall have sufficient memory to support its operating system, database, and programming requirements.

(3) The controller shall provide a communications port for connection of the Portable Operators Terminal using Point to Point BACnet physical/data link layer protocol or a connection to the inter-network.

(4) The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.

(5) Controllers that perform scheduling shall have a real time clock.

(6) Data shall be shared between networked Building Controllers.

(7) The Building Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall:

(a) Assume a predetermined failure mode.

(b) Generate an alarm notification.

(8) BACnet: The Building Controller shall use the Read (Initiate) and Write (Execute) Services as defined in Clauses 15.5 and 15.8, respectively, of ASHRAE Standard 135-95, to communicate with BACnet objects in the internetwork. Objects supported shall include: Analog input, analog output, binary input, binary output, and device.

(B) Communications: Each Building Controller shall reside on a BACnet inter-network using the ISO 8802-3 (Ethernet) or ARCNET (ASTM 878.1) Physical/Data Link layer protocol. Each Building Controller shall also perform routing to a network of Custom Application and Application Specific Controllers.

(C) Environment: Controller hardware shall be suitable for the anticipated ambient conditions. Controller used in conditioned ambient shall be mounted in an NEMA 1 enclosure and shall be rated for operation at 32 F to 120 F. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4X Stainless Steel Type enclosures, and shall be rated for operation at -40 F to 150 F.

(D) Serviceability: Provide diagnostic LEDs for power, communications, and processor. All wiring connections shall be made to field removable, modular terminal strips or to a termination card connected by a ribbon cable. Cabinet shall be large enough to fit all components inside - controller, wiring, relays, transformer, surge protection, accessory outlet, modem, etc.

(E) Memory: The Building Controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.

(F) Immunity to power and noise: Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shut-down below 80% nominal voltage. Provide power conditioner to regulate power with surge protection. Controller cabinet should have and available accessory power outlet for laptop or light.

667.14 Custom Application Controllers

(A) General: Provide Custom Application Controllers to provide the performance specified in section 1 of this division. Each of these panels shall meet the following requirements.

(1) The Building Automation System shall be composed of one or more independent, stand-alone, microprocessor based Building Controllers to manage the local strategies described in System software section.

(2) The Controller shall have sufficient memory to support its operating system, database, and programming requirements.

(3) Controllers that perform scheduling shall have a real time clock.

(4) The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.

(5) Data shall be shared between networked Controllers.

(6) The Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall:

(a) Assume a predetermined failure mode.

(b) Generate an alarm notification.

(7) Controllers for equipment (pumps, shutoff valves, AHUs…etc.) shall be provided with a manual override switch to allow manual control of the equipment.

(B) Environment: Controller hardware shall be suitable for the anticipated ambient conditions.

(1) Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4X Stainless Steel Type enclosures, and shall be rated for operation at -40 F to 150 F.

(2) Controller used in conditioned ambient shall be mounted in NEMA 1 Type rated enclosures, and shall be rated for operation at 32 F to 120 F.

(C) Serviceability: Provide diagnostic LEDs for power, communications, and processor. All wiring connections shall be made to field removable, modular terminal strips or to a termination card connected by a ribbon cable.

(D) Memory: The Controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.

(E) Immunity to power and noise: Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shut-down below 80% nominal voltage. Provide surge protection with

automatic voltage regulator.

667.15 Application Specific Controller

(A) General: Application specific controllers (ASC) are microprocessor-based DDC controllers which through hardware or firmware design are dedicated to control a specific piece of equipment. They are not fully user programmable, but are customized for operation within the confines of the equipment they are designed to serve.

(1) Each ASC shall be capable of stand-alone operation and shall continue to provide control functions without being connected to the network.

(2) Each ASC will contain sufficient I/O capacity to control the target system.

(3) Each ASC shall function as programmed with setpoints intact if communication is lost. Failing to a factory preset default is unacceptable.

(4) Programs shall reside in the controller. Controller can standalone and function as programmed regardless of the status of the rest of the system.

(5) Auxiliary binary outputs can be used to control exhaust fans (EF) and supply fans (SF) of other equipment nearby.

(B) Environment: The hardware shall be suitable for the anticipated ambient conditions.

(1) Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4X Stainless Steel type enclosures, and shall be rated for operation at -40 F to 150 F.

(2) Controller used in conditioned ambient shall be mounted in NEMA 1 Type rated enclosures, and shall be rated for operation at 32 F to 120 F.

(C) Serviceability: Provide diagnostic LEDs for power, and communications. All wiring connections shall be made to field removable, modular terminal strips or to a termination card connected by a ribbon cable.

(D) Memory: The Application Specific Controller shall maintain all BIOS and programming information in the event of a power loss for at least 90

days.

(E) Immunity to Power and Noise: Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shut-down below 80%. Provide surge protection with automatic voltage regulator.

(F) Transformer: Power supply for the ASC must be rated at minimum of 125% of ASC power consumption, and shall be fused or current limiting type.

(G) FCU: Each unit shall have its own controller.

667.16 Communications

(A) This project shall comprise a BACnet inter-network. All PC Workstations and Building Controller components shall meet ASHRAE / ANSI Standard 135-1995, BACnet.

(B) Each BACnet device shall operate on the BACnet physical/data link protocols specified for that device as defined earlier in this section.

(C) The controls Contractor shall provide all communication media, connectors, repeaters, hubs, and routers necessary for the inter-network.

(D) All Building Controllers shall have a communications port for connections with the operator interfaces. This may be either an RS-232 port for Point to Point connection or a network interface node for connection to the Ethernet or ARCNET network.

(E) Remote operator interface via internet using Internet Explorer shall allow for communication with any and all controllers on this network as described in F below. Remote control software not allowed, except for remote control of web server, for administrative purpose only. External communication shall be through Ethernet TCP/IP. The DOE will provide a single LAN jack. Contractor shall provide Ethernet switches and wiring as required to provide additional connections.

(F) Communications services over the internetwork shall result in operator interface and value passing that is transparent to the internetwork architecture as follows:

(1) Connection of an operator interface device to any one controller on the internetwork will allow the operator to interface with all other controllers as if that interface were directly connected to the other controllers. Data, status information, reports, system software,

custom programs, etc., for all controllers shall be available for viewing and editing from any one controller on the internetwork.

(2) All database values (i.e., points, software variable, custom program variables) of any one controller shall be readable by any other controller on the internetwork. This value passing shall be automatically performed by a controller when a reference to a point name not located in that controller is entered into the controller's database. An operator/installer shall not be required to set up any communications services to perform internetwork value passing.

(G) The time clocks in all controllers shall be automatically synchronized daily.

667.17 Input / Output Interface

(A) Hard-wired inputs and outputs may tie into the system through Building, Custom, or Application Specific Controllers.

(B) All input points and output points shall be protected such that shorting of the point to itself, another point, or ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24V of any duration, such that contact with this voltage will cause no damage to the controller.

(C) Binary inputs shall allow the monitoring of on/off signals from remote devices. The binary inputs shall provide a wetting current of at least 12 ma to be compatible with commonly available control devices.

(D) Pulse accumulation input points: This type of point shall conform to all the requirements of Binary Input points, and also accept up to 2 pulses per second for pulse accumulation, and shall be protected against effects of contact bounce and noise.

(E) Analog inputs shall allow the monitoring of low voltage (0-10 Vdc), current (4-20 ma), or resistance signals (thermistor, RTD). Analog inputs shall be compatible with, and field configurable to commonly available sensing devices.

(F) Binary outputs shall provide for on/off operation, or a pulsed low voltage signal for pulse width modulation control. Binary outputs on custom and building controllers shall have 3-position (on/off/auto) override switches and status lights. Outputs shall be selectable for either normally open or normally closed operation.

(G) Analog outputs shall provide a modulating signal for the control of

end devices. Outputs shall provide either a 0-10 Vdc or a 4-20 ma signal as required to provide proper control of the output device. Analog outputs on building or custom programmable controllers shall have status lights and a 2-position (auto/manual) switch and manually adjustable potentiometer for manual override.

667.18 Auxiliary Control Devices

(A) Electronic valve actuators:

(1) The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.

(2) Where shown, for power-failure/safety applications, an internal mechanical, spring return mechanism shall be built into the actuator housing.

(3) All rotary spring return actuators shall be capable of both clockwise and counter clockwise spring return operation. Linear actuators shall spring return to the retracted position.

(4) Proportional actuators shall accept a 0-10 VDC or 0-20 ma control signal and provide a 2-10 VDC or 4-20 ma operating range.

(5) All 24 VAC/DC actuators shall operate on Class 2 wiring and shall not require more than 10 VA for AC or more than 8 W for DC applications. Actuators operating on 120 VAC or 230 VAC shall not require more than 11 VA.

(6) All non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring return actuators with more than 60 in-lb. torque capacity shall have a manual crank for this purpose.

(7) All modulating actuators shall have an external, built-in switch to allow the reversing of direction of rotation.

(8) Actuators shall be provided with a conduit fitting and a minimum 1m electrical cable and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections.

(9) Actuators shall be Underwriters Laboratories Standard 873 listed.

(10) Actuators shall be designed for a minimum of 60,000 full stroke

cycles at the actuator's rated torque.

(B) Control Valves

(1) Control valves shall be three-way type for modulating service as scheduled or shown.

(2) Water Valves: Body and trim style and materials shall be per manufacturer's recommendations for design conditions and service shown, with equal percentage ports for modulating service.

(3) Water Valve Sizing: Valves 1/2-inch through 2-inch shall be bronze body or cast brass ANSI Class 250, spring loaded,

(4) Water valves shall fail normally open or closed as scheduled on plans or as follows. Cooling coils - normally open.

(5) Other applications - as scheduled or as required by sequence of operation. Zone valves shall be sized to meet the control application and they shall maintain their last position in the event of a power failure.

(C) Temperature Sensors

(1) Temperature sensors shall be Resistance Temperature Device (RTD) or Thermistor.

(2) Duct sensors shall be rigid or averaging as shown. Averaging sensors shall be a minimum of 5 feet in length.

(3) Immersion sensors shall be provided with a separable stainless steel well. Pressure rating of well is to be consistent with the system pressure in which it is to be installed. Wells for pipes with insulation shall have extended necks. Strap on type not acceptable.

(4) Space sensors shall be equipped with set-point adjustment, override switch, display, and/or communication port as shown on the drawings.

(5) Provide matched temperature sensors for differential temperature measurement. Differential accuracy shall be within 0.2 F.

(D) Humidity Sensors

(1) Duct and room sensors shall have a sensing range of 20% to

80% with accuracy of +/-5% R.H.

(2) Duct sensors shall be provided with a sampling chamber.

(3) Humidity sensor's drift shall not exceed 1% of full scale per year.

(E) Static Pressure Sensor

(1) Sensor shall have linear output signal. Zero and span shall be field-adjustable.

(2) Sensor sensing elements shall withstand continuous operating conditions plus or minus 50% greater than calibrated span without damage.

(3) Water pressure sensor shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Sensor shall be complete with 4-20 ma output, required mounting brackets, and block and bleed valves. Mount in location accessible for service.

(4) Water differential pressure sensor shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Over-range limit (DP) and maximum static pressure shall be 3,000 psi. Transmitter shall be complete with 4-20 ma output, required mounting brackets, and five-valve manifold. Mount in a location accessible for service.

(F) Flow Switches

(1) Flow-proving switches shall be differential pressure type. Use 1/2-inch diameter piping all the way to the switch. Use thread-o-let, brass nipple and full port ball valve if from black pipe.

(2) Paddle type switches (water service only) shall be UL listed, SPDT snap-acting with pilot duty rating (125 VA minimum). Adjustable sensitivity with NEMA 1 Type enclosure unless otherwise specified:

(3) Differential pressure type switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 Type enclosure, with scale range and differential suitable for intended application, or as specified.

(4) Current sensing relays may be used for flow sensing or terminal devices.

(G) Relays

(1) Control relays shall be UL listed plug-in type with dust cover. Contact rating, configuration, and coil voltage suitable for application.

(2) Time delay relays shall be UL listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable plus or minus 200% (minimum) from set-point shown on plans. Contact rating, configuration, and coil voltage suitable for application. Provide NEMA 1 Type enclosure when not installed in local control panel.

(H) Transformers and Power Supplies

(1) Control transformers shall be UL listed, Class 2 current-limiting type, or shall be furnished with over-current protection in both primary and secondary circuits for Class 2 service.

(2) Unit output shall match the required output current and voltage requirements. Current output shall allow for a 50% safety factor. Output ripple shall be 3.0 mV maximum Peak-to-Peak. Regulation shall be 0.10% line and load combined, with 50 microsecond response time for 50% load changes. Unit shall have built-in over-voltage protection.

(3) Unit shall operate between 0 C and 50 C.

(4) Unit shall be UL recognized.

(I) Current Switches

(1) Current-operated switches shall be self-powered, solid state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system.

(J) Local Control Panels

(1) Indoor control cabinets shall be fully enclosed NEMA 1 Type construction, key-lock latch, and removable sub-panels. A single key shall be common to all field panels and sub-panels.

(2) Control cabinets used outdoors and/or in wet ambient shall be fully enclosed NEMA 4X Stainless Steel Type construction, key-lock latch, removable sub-panels. A single key shall be common to all field panels and sub-panels.

(3) Interconnections between internal and face-mounted devices pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped.

(4) Terminals for field connections shall be UL listed for 600-volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.

(5) Provide on/off power switch with over-current protection for control power sources to each local panel.

(K) Motor status: Motor running confirmation must be done via CT sensor (not switch) on an analog input. Analog input shall have ability to be overridden should sensor fail.

667.19 Installation.

Provide all necessary wiring and conduit to connect the control components to secure an operational control system. Provide conduit and wiring from control and such other sensors and controls as may be specified or indicated, including, but not limited to pumps, air-conditioning units, electric driven dampers, and fans.

(A) Install equipment, piping, wiring/conduit parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.

(B) Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

(C) Install all equipment in readily accessible location as defined by chapter one article 100 part A of the NEC. Control panels shall be attached to structural walls unless mounted in equipment enclosure specifically designed for that purpose. Panels shall be mounted to allow for unobstructed access for service.

(D) Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.

(E) All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

667.20 Wiring.

(A) All control and interlock wiring shall comply with the national and local electrical codes and DIVISION 16 - ELECTRICAL of these specifications. Where the requirements of this section differ with those in DIVISION 16 - ELECTRICAL, the requirements of this section shall take precedence. All wiring shall be installed in conduit. Control Contractor is responsible for installing and coordinating the installation of all control wiring.

(B) Do not install Class 2 wiring in conduit containing Class one wiring. Boxes and panels containing high voltage may not be used for low voltage wiring except for the purpose of interfacing the 2 (e.g. relays and transformers). All control wiring will be installed in conduit.

(C) All wire-to-device connections shall be made at a terminal blocks or terminal strip. All wire-to-wire connections shall be at a terminal block, or with a crimped connector. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

(D) Maximum allowable voltage for control wiring shall be 120V. If only higher voltages are available, the Control System Contractor shall provide step down transformers.

(E) All wiring shall be installed as continuous lengths, where possible. Any required splices shall be made only within an approved junction box or other approved protective device.

(F) Size of conduit and size and type of wire shall be the design responsibility of the Control System Contractor, in keeping with the manufacturer's recommendation and NEC.

(G) Control and status relays are to be located in designated enclosures only. These relays may also be located within packaged equipment control panel enclosures. These relays shall not be located within Class starter enclosures.

(H) Follow manufacturer's installation recommendations for all communication and network cabling. Network or communication cabling shall be run separately from other wiring.

(I) Adhere to Section 820 - ELECTRICAL requirements for installation of raceway.

(J) This Contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.

(K) Flexible metal conduits and liquid-tight, flexible metal conduits shall not exceed 3 feet in length and shall be supported at each end. Flexible metal conduit less than 1/2 inch electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal conduits shall be used.

(L) Conduits entering cold devices shall be plugged with putty before it enters the junction box.

667.21 Installation of Sensors.

(A) Install sensors in accordance with the manufacturer's recommendations.

(B) Mount sensors rigidly and adequate for the environment within which the sensor operates.

(C) Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.

(D) All wires attached to sensors shall be air sealed in their conduits or in the wall to stop air transmitted from other areas affecting sensor readings.

(E) Install duct static pressure tap with tube end facing directly down-stream of air flow.

(F) Sensors used in mixing plenums, and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip.

(G) All pipe mounted temperature sensors shall be installed in wells. Install all liquid temperature sensors with heat conducting fluid in thermal wells.

(H) Wiring for space sensors shall be concealed in building walls. EMT conduit is acceptable within mechanical and service rooms.

667.22 Controllers

(A) Provide a separate Controller for each major piece of HVAC equipment. Points used for control loop reset such as outside air or space temperature are exempt from this requirement.

(B) Building Controllers and Custom Application Controllers shall be selected to provide a minimum of 15% spare I/O point capacity for each point type found at each location. If input points are not universal, 15% of each type is required. If outputs are not universal, 15% of each type is required. A minimum of one spare is required for each type of point used.

(C) Future use of spare capacity shall require providing the field device, field wiring, point database definition, and custom software. No additional Controller boards or point modules shall be required to implement use of these spare points.

667.23 Programing

(A) Provide sufficient internal memory for the specified control sequences and trend logging. There shall be a minimum of 25% of available memory free for future use.

(B) Point Naming: System point names shall be modular in design, allowing easy operator interface without the use of a written point index.

(C) Software Programming

(1) Provide programming for the system as per specifications and adhere to the strategy algorithms provided. All other system programming necessary for the operation of the system but not specified in this document shall also be provided by the Control System Contractor. Imbed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequence of operations.

(2) FCU: DDC programming also monitors room air temperature. If air temperature is outside of an adjustable range, supply air temperature is adjusted up or down within an adjustable range to maintain air temperature within the range.

(3) Chilled and Chilled Water Pump: DDC programming also monitors chilled water temperature and pump pressure.

(D) Operators' Interface

(1) The controls contractor shall provide all the labor necessary to install, initialize, start-up, and trouble-shoot all operator interface software and their functions as described in this section. This includes any operating system software, the operator interface data base, and any

third party software installation and integration required for successful operation of the operator interface.

(2) As part of this execution phase, the controls contractor will perform a complete test of the operator interface. Test duration shall be a minimum of 16 hours on-site. Tests shall be made in the presence of the State's representative.

(E) Demonstration: A complete demonstration and readout of the capabilities of the monitoring and control system shall be performed. The contractor shall dedicate a minimum of 16 hours on-site with the HDOT and the State's representatives for a complete functional demonstration of all the system requirements. This demonstration constitutes a joint acceptance inspection, and permits acceptance of the delivered system for on-line operation.

(F) Work with the HDOT on the final programming and graphics after system is running.

667.24 Adjustments.

Adjust controls and equipment to maintain the conditions indicated, to perform the functions indicated and to operate in the sequence indicated.

667.25 Instructing Operating Personnel.

Upon completion of the work and at a time designated by the State, provide the services of a competent technician regularly employed by the manufacturer of the temperature controls for the instruction of the State personnel in the proper operation and maintenance of each control system. The period of instructions shall not be less than a 4-hour working day and 8-hours of follow up training. Training shall consist of the following:

(A) Basic training to familiarize technician with system.

(1) Layout of controllers.

(2) Component locations in the field.

(3) How to determine a controller has failed and how to manually operate equipment safely.

(B) Premium Training:

(1) Review actual logic sequences.

(2) How to make state changes in logic sequences.

(3) Schedules.

(4) Overrides (timed, continuous, etc.).

(5) Programming of controllers.

667.26 Nameplates.

Provide laminated plastic nameplates for all control items listed or shown in the submittal and approved control diagrams. Each inscription shall identify its function; such as "mixed air controller", "cold deck sensor" and when applicable, its position. Laminated plastic shall be 0.125-inch thick Melamine plastic, black with white center core. Surface shall be a matte finish. All corners shall be square. The lettering shall be accurately aligned and engraved into the white core. Size of nameplates shall be one by 2.5 inches minimum. Lettering shall be a minimum of 0.25-inch high normal block lettering. Key nameplates to a chart and schedule for each system. Mount charts and schedules under glass, in a frame and place where directed near each system. Furnish two copies of each chart and schedule to State prior to final acceptance.

667.27 Testing.

Contractor shall submit two copies of the operation and maintenance manual and two copies of a test plan to the Engineer not less than 14 days prior to acceptance testing. Test plan shall, as a minimum, indicate how control system is to be tested, what variables will be monitored during test and what criteria for acceptance should be used. Indicate how operation of air conditioning system and control system in all seasonal conditions shall be simulated. If the Engineer witnesses any tests, such tests shall be subject to his approval. If the Engineer elects not to witness the test, Contractor shall provide performance certification.

(A) Field Testing: Upon completion of 72 hours of continuous air conditioning and control systems operation and before final acceptance of the work, Contractor shall test the control systems in service with the air conditioning systems to demonstrate conformance with the contract requirements. Test controls through every cycle of operation, including simulation of each season in so far as possible.

(B) Test safety controls to demonstrate performance of their required function. Contractor shall furnish instruments, connecting devices and personnel for the tests. If any of the control equipment is proved to be defective in workmanship or material, adjust, repair or replace the system. Repeat the tests to demonstrate conformance with the contract requirements.

667.28 Identification of Hardware and Wiring.

(A) All wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 2 inch of termination with a cable identifier and other descriptive information.

(B) Permanently label or code each point of field terminal strips to show the instrument or item served.

(C) Identify control panels with minimum one cm letters on laminated plastic nameplates.

(D) Identify all other control components with permanent labels. Identifiers shall match record documents all plug-in components shall be labeled such that removal of the component does not remove the label.

667.29 Payment.

The Engineer will pay for the accepted pay items listed below at the contract price per pay unit, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for each of the following pay items when included in the proposal schedule:

Pay Item	Pay Unit
Removal - Controls -FCU-CHW	Each
Removal - Controls - Disconnect - Exhaust Fan	Each
Removal - Controls - Fume Hood Exhaust Fan	Each
Removal - Controls – Chiller	Each
Removal - Controls - CHW Pump	Each
Controls – FCU-CHW	Each
Controls - Reconnect Exhaust Fan	Each
Controls - Fume Hood Exhaust Fan	Each
Mobilization & Clean-Up	Lump Sum
Controls - Demolition - FCU-CHW	Each

Controls - Demolition - Disconnect Exhaust Fan	Each
Controls - Demolition - Fume Hood Exhaust Fan	Each
Controls - Demolition – Chiller	Each
Controls - Demolition - CHW Pump	Each
Controls - New - FCU-CHW	Each
Reconnect Exhaust Fan	Each
Controls - New - Fume Hood Exhaust Fan	Each
Controls - New – Chiller	Each
Controls - New - CHW Pump	Each
Controls - New - Building AC Controller	Lump Sum

END OF SECTION 667

Make the following Section a part of the Standard Specifications:

SECTION 668 - AUTOMATIC WET PIPE SPRINKLER SYSTEM

668.01 Description.

This section includes the requirements for the automatic wet pipe fire sprinkler system for the entire building herein.

668.02 General Requirements.

(A) As specified in Section 660 - MECHANICAL GENERAL REQUIREMENTS applies to this section, with the additions and modifications specified herein.

(B) The work includes designing and providing new automatic wet pipe fire extinguishing sprinkler for uniform distribution of water by hydraulic design to afford complete fire protection coverage throughout the building. Sprinkler protection shall provide 100% coverage for the entire building including elevator and stair shafts (where required by NFPA 13). The design, equipment, materials, installation, and workmanship shall be in strict accordance with the required and advisory provisions of NFPA 13 and UBC STD 38-2, except as modified herein.

(C) Each system shall be provided with earthquake protection and shall include all materials, accessories, and equipment necessary to provide each system complete and ready for use. Design and install each system to give full consideration to blind spaces, piping, electrical equipment, ductwork, and all other construction and equipment to afford complete coverage in accordance with detailed drawings to be submitted for approval. Devices and equipment for fire protection service shall be listed by the Underwriters' Laboratories, Inc. or approved by Factory Mutual System. In the NFPA publications referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; reference to the "authority having jurisdiction" shall be interpreted to mean the City and County of Honolulu Building Department and Fire Departments. The work shall begin at the point indicated.

668.03 Applicable Publications.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Comply with the latest applicable codes of regulatory bodies having jurisdiction, including but not necessarily limited to the following:

(A) American Society for Testing and Materials (ASTM) Publications

A 53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

A 795 Black and Hot-Dipped Zinc Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use

(B) American Water Works (AWWA) Publications:

C104 Cement-Mortar Lining for Cast-Iron and Ductile-Iron Pipe and Fitting for Water

C151 Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water and Other Liquids

C601 Disinfecting Water Mains

(C) Factory Mutual (FM) Publication: Approval Guide, Latest edition

(D) National Fire Protection Association (NFPA) Publications:

13 Sprinkler Systems

24 Outside Protection

70 National Electrical Code

(E) Underwriters' Laboratories, Inc. (UL) Publications: Fire Protection Equipment Directory

668.04 Qualifications of Installer.

Prior to installation, submit data for approval by the Engineer, showing that the Contractor has successfully installed automatic fire extinguishing sprinkler systems of the same type and design as specified herein, or that he has a firm contractual agreement with a subcontractor having such required experience. The data shall include the names and locations of at least two installations where the Contractor, or the subcontractor referred to above, has installed such systems. The Contractor shall indicate the type and design of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 18 months.

668.05 Electrical Work.

Provide fire alarm system under Division 16, Electrical. Provide fire alarm wiring under this section in accordance with NFPA 70. Provide wiring in rigid metal conduit or intermediate metal conduit, except electrical metallic tubing conduit may be used in dry locations not enclosed in concrete or where not subject to mechanical damage.

668.06 Submittals.

(A) Submit the following documents in conformance with the requirements for submittals from SECTION 660 - GENERAL MECHANICAL REQUIREMENTS:

(B) Partial submittals will not be acceptable. Annotate descriptive data to show the specific model, type, and size of each item the Contractor proposes to furnish. Prepare working drawings on sheets not smaller than 24 by 36 inches, in accordance with the requirements for "Working Drawings (Plans) as specified in NFPA 13, and include data essential to the proper installation of each system. Do not commence work until the design of each system and the various components have been approved. The Engineer and the Building and Fire Departments will review and approve all submittals. Before work is commenced, submit for approval complete sets of working drawings and calculations for each sprinkler system. Working drawings and calculations must be stamped by a registered professional engineer.

(1) Manufacturer's Data:

Pipe, fittings, and mechanical couplings
Valves including gate, check, relief
Sprinklers
Pipe hangers and supports
Earthquake sway bracing
Flow control valve
Alarm pressure and water flow switches
Valve tamper switches
Gages
Sprinkler stoppers

(2) Shop (Working) Drawings:

Sprinkler system layout
Hydraulic calculations

(3) Samples: One of each type of sprinkler head and escutcheon

plates to be used.

(4) Certificates of Compliance: Contractor's material and test certificate per NFPA 13. Pipe and fittings

(5) Operation and Maintenance Manuals:

Flow control valve
Alarm pressure and water flow switches
Valve tamper switch

668.07 As-Built (Record) Working Drawings.

After completion, but before final acceptance of the work, furnish a complete set of drawings of each sprinkler system for record purposes. The drawings shall be not smaller than 24 inches by 36 inches reproducible drawings with title block (8 inches by 4 inches) similar to full size contract drawings. Furnish the as-built (record) working drawings in addition to the as-built contract drawings required by SECTION 811 – GENERAL MECHANICAL REQUIREMENTS.

668.08 Design of Sprinkler System.

(A) Sprinkler System: Design of wet pipe fire extinguishing sprinkler system shall be by hydraulic calculations for uniform distribution of water over the design area and shall conform to NFPA 13 and to the requirements as specified herein.

(B) Distribution of Water: Distribution shall be essentially uniform throughout the area in which it is assumed the sprinkler heads will open. Variation in discharge from individual heads in the hydraulically most remote area shall be between 100 and 120 percent of the specified density.

(C) Density of Application of Water: Size pipe to provide the specified density when the system is discharging the specified total maximum required flow. Application to horizontal surfaces below the sprinklers shall be as indicated on the drawings.

(D) Sprinkler Discharge Area: Area shall be the hydraulically most remote area as defined by NFPA 13. The design area shall be as indicated on the drawings.

(E) Outside Hose Allowances: Hydraulic calculations shall include the allowance as indicated on the drawings.

(F) Friction Losses: Calculate losses in pipe in accordance with the

Hazen-Williams formula with 'C' value of 120 for steel pipe, and 140 for buried cement-lined ductile-iron pipe and asbestos cement pipe.

(G) Location of Sprinkler Heads: Heads in relation to the ceiling and walls and the spacing of sprinklers shall not exceed that permitted by NFPA 13.

(H) Water Supply: Base hydraulic calculations on the water supply as indicated on the drawings.

668.09 Equipment.

(A) Sprinkler Heads: Release element of each head shall be as indicated on the drawings or higher as suitable for the individual location where it is installed. Provide recessed chromium-plated quick response pendent sprinklers, and chromium-plated ceiling plates below suspended ceilings. Provide standard response sprinklers in the mechanical rooms and the elevator shaft and machine room.

(D) Sprinkler Supervisory Devices: Provide as indicated. Connection of the sprinkler supervisory devices to the building fire alarm system shall be provided under Section 821 – FIRE ALARM SYSTEM.

(1) Alarm Pressure and Water Flow Switches: UL listed or FM approved.

(2) Valve Tamper Switch: Provide each control valve with a listed or approved tamper switch for the automatic transmittal of a trouble signal. Valve tamper switches which are integral to the control valve will be acceptable.

(E) Flow Control Valves: Provide flow control valves which are electrically operated via a 24 VDC supervised circuit for control of sprinkler water supplies to the pre-action systems. Flow control valves shall be similar in design to a listed pre-action or deluge valve.

668.10 Aboveground Piping Systems.

(A) Inspect, test and approve piping before burying, covering, or concealing. Provide fittings for changes in direction of piping and for all connections. Make changes in piping sizes through reducing pipe fittings; the use of bushings will not be permitted. Welding shall be performed in the shop; field welding will not be permitted.

(B) Pipe and Fittings: Provide in accordance with NFPA 13, and UBC STD 38-2, except that all piping shall be steel. Pipe sizes less than 2-1/2 inches shall be Schedule 40, all piping and fittings exposed to the weather

shall be hot dipped coated (galvanized.) Fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded shall be welded, threaded, or grooved-end type. Use of plain-end fittings with mechanical couplings (which utilize steel gripping devices to bite into pipe when pressure is applied) will not be permitted. Rubber gasketed grooved-end pipe and fittings with mechanical couplings shall be permitted in pipe sizes 1.25 inches and larger; fittings shall be UL listed or FM approved for use in sprinkler systems. Provide an earthquake sway brace within 24 inches of each flexible coupling which is installed in horizontal piping for purposes other than earthquake protection

(C) Pipe Hangers, Supports, and Earthquake Sway Bracing: Provide in accordance NFPA 13, seismic zone 4. Provide retaining straps on beam clamps.

(D) Valves: Provide valves as required by NFPA 13 and UBC STD 38-2 and of types approved for fire service. Gate valves shall open by counterclockwise rotation. Check valves shall be flanged clear opening swing check type with flanged inspection and access cover plate for sizes 4 inches and larger. Provide OS&Y valves as indicated.

(E) Relief Valve: Provide an approved relief valve on gridded systems in accordance with NFPA 13.

(F) Identification Signs: Attach properly lettered approved metal signs conforming to NFPA 13 to each valve and alarm device. Permanently affix hydraulic design data nameplates to the riser of each system.

(G) Inspector's Test Connection: Provide test connections about 6 feet above the floor for each sprinkler system or portion of each sprinkler system equipped with an alarm device and locate at the hydraulically most part of each system.

(H) Main and Auxiliary Drains: Provide drain piping to discharge at safe points outside each building or to sight cones attached to drains of adequate size to readily receive the full flow from each drain under maximum pressure. Provide auxiliary drains required by NFPA 13.

(I) Pipe Sleeves: Provide where piping passes through walls, floors, roofs, and partitions. Secure sleeves in proper position and location. 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 piping or pipe insulation and interior of sleeve. Firmly pack space with an approved fire stopping material.

(1) Sleeves in Masonry and Concrete Walls, Floors and Roofs:

Provide ASTM A 53, Schedule 40 or Standard Weight, zinc-coated steel pipe sleeves. Extend sleeves in floor slabs 3 inches above the finished floor.

(2) Sleeves in Partitions and Other Than Masonry and Concrete Walls, Floors, and Roofs: Provide zinc-coated steel having weight of not less than 0.90 pounds per square foot.

(J) Escutcheon Plates: Provide one piece or split hinge type metal plates for piping passing through floors, walls, and ceilings in exposed areas. Provide chromium-plated finish on plates in finished areas. Provide paint finish on plates in unfinished areas. Securely anchor plates in place with setscrews or other approved positive means.

668.11 Underground Water Piping Systems.

(A) Pipe and Fittings: Provide outside-coated, cement mortar lined, ductile-iron pipe and fittings conforming to NFPA 24 for piping under the building and less than 5 feet outside of the building walls.

(B) Anchor the joints in accordance with NFPA 24; provide concrete thrust block at the elbow where the pipe turns up toward the floor, and restrain the pipe riser with steel rods from the elbow to the flange above the floor.

(C) Minimum pipe size shall be 6 inches. Minimum depth of cover shall be 3 feet. Piping more than 5 feet outside of the building walls shall be provided under Division 2 "Site Work".

668.12 Installation.

(A) Equipment, material, installation, and workmanship shall be in accordance with NFPA 13 and UBC STD 38-2, except as modified herein. Install piping straight and true to bear evenly on hangers. Keep the interior and of new piping and existing piping affected by the Contractor's operations thoroughly cleaned of water and foreign matter. Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping and fittings so that water and foreign matter will not enter the pipes or fittings. Inspect piping before placing into position. Inspect, test, and approve piping before burying, covering, or concealing. Provide fittings for changes in direction of piping and for all connections. Make changes in piping sizes through tapered reducing pipe fittings; do not use bushings.

(B) Pipe Hangers (Supports): Provide additional hangers to support the concentrated loads in piping between hangers, such as for flanged valves.

668.13 Disinfection.

Disinfect the new water piping and existing water piping affected by Contractor's operations in accordance with AWWA C601. Fill the piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Flush the solution from the systems with clean water until maximum residual chlorine content is not greater than 0.2 parts per million.

668.14 Field Painting.

(A) Clean, pretreat, prime, and paint new sprinkler systems including valves, piping, conduit, hangers, miscellaneous metalwork, and accessories. Apply coatings to clean dry surfaces using clean brushes. Clean the surfaces to remove dust, dirt, rust and loose mill scale. Immediately after cleaning, provide the metal surfaces with one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, and one coat of primer applied to a minimum dry film thickness of one mil. Exercise care to avoid painting of sprinkler heads or protective devices. Remove materials which are used to protect sprinkler heads, while painting is in process, upon the completion of painting. Remove sprinkler heads which are painted and provide new clean sprinkler heads of the proper type. Provide primed surfaces with the following:

(B) Sprinkler Systems in Unfinished Areas: Unfinished areas are defined as attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, and spaces where walls or ceiling are not painted or not constructed of prefinished material. Provide primed surfaces with one coat of red enamel applied to a minimum dry film thickness of one mil.

(C) Sprinkler Systems in All Other Areas: Provide primed surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red enamel.

668.15 Field Testing and Flushing.

(A) Preliminary Tests: Preform an air pressure leakage test per NFPA 13, Paragraph 8-2.3, prior to hydrostatic testing. Hydrostatically test each system at 200 psig for a period of two hours. Piping above suspended ceilings shall be tested, inspected and approved before installation of ceilings. Flush sprinkler and standpipe piping in accordance with NFPA 13. Continue flushing operations until water is clear, but for not less than 10 minutes. Test the alarms and other devices. Test the water flow alarms by flowing water through the inspector's test connection. When tests have been made completed and corrections made, submit a signed and dated

certificate, similar to that specified in NFPA 13, with a request for a formal inspection and tests.

(B) Formal Inspection and Tests: The County of Hawaii Building and Fire Departments will witness formal tests and approve all systems before they are accepted. Submit the request for formal inspection at least 15 days prior to the date for formal inspection is to take place. An experienced technician regularly employed by the sprinkler installer shall be present during the inspection. At this inspection, repeat any or all of the required tests as directed. Correct defects in the work provided by the Contractor, and make additional tests until it has been demonstrated that the systems comply with all contract requirements. Furnish appliances, equipment, electricity, instruments, connecting devices, and personnel for the tests.

668.16 Instructing Operating Personnel.

Upon completion of the work and at a time designated by the Owner, provide for a period of not less than a 4-hour the services of experienced technicians regularly employed by the manufacturer of the sprinkler system to instruct the fire department and building personnel in the proper operation and maintenance of the equipment.

668.17 Payment.

The Engineer will pay for the accepted pay items listed below at the contract price per pay unit, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for each of the following pay items when included in the proposal schedule:

Pay Item	Pay Unit
Removal Automatic Wet Pipe Sprinkler – Head	Each
Removal Automatic Wet Pipe Sprinkler – Piping	Linear Feet
Automatic Wet Pipe Sprinkler – Heads	Each
Automatic Wet Pipe Sprinkler – Pre-Action Systems	Each
Piping	Linear Feet

END OF SECTION 668

Make the following Section a part of the Standard Specifications:

"SECTION 669 – FIBERGLASS REINFORCED POLYURETHANE (FRP) DOORS

669.01 Description. This section describes the all fiberglass reinforced Polyurethane (FRP) Doors.

669.02 Materials.

(A) Furnish all labor, materials, and equipment required to complete all fiberglass reinforced polyester doors and frames as shown on drawings and specified herein, design to exacting tolerances and specifications eliminating the need for field cutting or trimming. Doors and frames shall be manufactured to plus or minus 1/32-inch.

(B) Related Sections include the following:

(1) **Section 672 - FINISH HARDWARE**. Door hardware and weather stripping.

(2) **Section 676 – GYPSUM BOARD**. Anchoring frames to metal studs.

(3) **Section 681– PAINTING**. Field painting factory-primed doors and frames.

(4) **Section 627 – ROUGH CARPENTRY**

669.03 Construction.

(A) Submittals.

(1) Product Data. Submit manufacturer's specifications, details, and installation recommendations for components of fiberglass reinforced polyester doors and frames required for the project.

(2) Shop Drawings. Submit drawings showing the following:

(a) Elevations of each door design.

(b) Details of doors including vertical and horizontal edge details.

(c) Frame details for each frame type including dimensioned profiles.

(d) Details and locations of reinforcement and preparations for hardware.

(e) Details of each different wall opening condition.

(f) Details of anchorages, accessories, joints, and connections.

(g) Coordination of glazing frames and stops with glass and glazing requirements.

(3) Door Schedule. Submit door schedule using the same reference designations indicated on drawings in preparing schedule for doors and frames.

(B) Quality Assurance.

Manufacturer shall have produced fiberglass reinforced polyester doors as standard products, featuring solid balsa wood core construction for a minimum of five (5) years. Manufacturer shall have completed projects of similar building type and size. Manufacturers failing to meet the above requirements will not be accepted.

(C) Delivery, Storage, and Handling.

(1) Delivery. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

(2) Inspection. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work. Remove and replace damaged items that cannot be repaired as directed.

(3) Storage. Store doors and frames at building site under cover. Place units on minimum 4-inch high wood blocking. Avoid use of non-vented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove carton immediately. Provide minimum 1/4-inch spaces between stacked doors to permit air circulation.

(D) Manufacturers.

(1) Available Manufacturers.

(a) Subject to compliance with requirements, provide products of the following:

(b) Fib-R-Dor as manufactured by Advance Fiberglass, Inc., North Little Rock, Arkansas, or approved equal.

(c) Furnish door and frame components from the same manufacturer. Splitting of door and frame components is not permitted.

(E) FRP Doors (Exterior).

(1) Provide flush type fiberglass reinforced polyester doors, 1-3/4" inch thick, and constructed using end-grain balsa wood core material. Balsa wood cores shall provide the high compressive and flexural strength to weight ratio.

(2) Door plates shall be molded in one continuous piece.

(a) Materials shall consist of premium grade resin reinforced with hand-laid fiberglass mat.

(b) Construction of plates shall be nominal 1/8-inch thick with a gel coated surface of no less than 25 mils to obtain a mirror-like finish of 88 or better per ASTM D 523.

(c) A ratio of glass to resin shall be 30% to 70% to maintain strength and obtain an R-value of no less than 11.

(F) Resins: Provide vinyl ester resins.

(G) Door Frames:

(1) Door frame shall conform with Steel Door Institute specifications and shall be comparable in strength to 16-gauge hollow metal frame.

(2) Door frames shall be assembled using one piece, FRP pultruded construction with no less than 3-inch in thickness. Frames shall be standard 5-3/4-inch and 2-inch face. Header-to-jamb joints shall be miter cut and assembled by use of FRP clips and Type 316 stainless steel fasteners. Frames shall also

be pigmented to promote true and constant color throughout entire frame thickness. Frame, upon assembly, shall be one piece in nature and rigid in construction.

(3) Door and frame finish shall be classified as self-extinguishing.

(4) Fasteners: Stainless steel. Provide type 316 stainless steel throughout.

(H) Accessories

(1) Hardware: All doors and frames shall be machined using templates available from the manufacturer of specified hardware. Doors shall be internally reinforced for specified surface hardware. All doors to be properly reinforced for hardware during fabrication.

(2) Hardware Preparation: Secure templates from the finish hardware supplier. Reinforce all hardware locations as required for long life under hard service.

(I) Fabrication. Perform fabrication operations, including cutting, fitting, forming, drilling, and grinding material in manner which prevents damage to exposed surfaces.

(J) Examination. Examine areas to receive doors. Identify Conditions that would adversely affect installation or subsequent Use and notify State DOT. Do not proceed with installation until Unsatisfactory conditions are corrected.

(K) Preparation

(1) General. Ensure openings to receive frames are plumb, level, square, and in tolerance

(2) Placing Frames. Adjust opening to receive frames and doors.

(L) Door Installation.

(1) Install doors in accordance with manufacturer's instructions.

(2) Install doors plumb, level, square, true to line, and without warp or rack.

(3) Anchor frames securely in place.

(4) Separate aluminum from other metal surfaces with bituminous coatings or other means approved by Contracting Officer.

(a) Set thresholds in bed of mastic and back seal.

(b) Install exterior doors to be weathertight in closed position.

(c) Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.

(d) Remove and replace damaged components that cannot be successfully repaired as determined by the Engineer.

(K) Adjusting and Cleaning.

(1) Prime Coat Touch-up. Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

(2) Protection Removal. Immediately before final inspection, remove protective wrappings from doors and frames.

669.04 Measurement. The Engineer will measure fiberglass reinforced doors per each in accordance with the contract documents.

669.03 Payment. The Engineer will pay for the accepted pay items listed below at the contract pay unit price, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for each of the following pay items when included in the proposal schedule:

Pay Item	**Pay Unit**
FRP Doors - Double	Each
FRP Doors - Single	Each"

END OF SECTION 669

SECTION 670 - ELECTRICAL WORK

Amend Section 670 – Electrical Work to read as follows:

670.01 General

(A) This Section includes the following for electrical work:

(1) Provide (furnish and install) a complete and operable electrical wiring and lighting systems for all equipment and appliances as shown on the drawings or specified herein including wires, raceways, boxes, devices, apparatus, lighting fixtures, accessories, time switch, dimmers, controls, etc., and tests, adjustments, instructions, and documentation.

(2) Electrical wiring system shall have sufficient capacity to accommodate all equipment, appliances and other electrical loads as specified herein and shown on the drawings and as required per National Electrical Code and other applicable codes, standards and requirements plus spare capacity to accommodate any planned future facilities and additions and minimum 25 percent spare capacity for future growth.

(3) Lighting system shall meet footcandle levels and other lighting criteria per Illuminating Engineering Society recommendations, State Model Energy Code and other applicable codes, standards and requirements.

670.02 Related Work

(A) Electric utilization equipment.

(B) Underground electrical work.

(C) Non-power wiring, such as control and ancillary electrical lights and signals for heating, ventilation, pump, and air-conditioning systems unless shown on drawings or specified herein.

(D) Signal and communications equipment and wires, less raceways.

670.03 Work Related to Serving Utility Agencies

(A) Electric: Metering apparatus.

(B) Telephone and Cable TV: By Contractor - Raceways with pull wire, for cables specified elsewhere or shown on the drawings, pullboxes, terminal cabinets and backboards, outlets with plates and

grounding system.

670.04 Rules, Regulations and Standards

(A) Comply with local ordinances and building department directives including IBC and N.E.C.; statutes and official requirements of the State of Hawaii including General Order Nos. 6 and 10 of the P.U.C. and Occupational Safety and Health Standards. Apply and pay for electrical permit.

(B) Applicable Documents: Current issues of the standards of ANSI, UL, Inc., NEMA, EEI, IEEE, NFPA, I.E.S., TIA/EIA, ADA Standards for Accessible Design. Relevant definitions and requirements from these documents shall be applicable.

670.05 Submittals

(A) Submittals shall comply with the following requirements:

(1) Submit shop drawings showing proposed equipment and distribution raceway layouts on plan in not less than 1/8" = 1'-0" scale. Raceway routing shall be coordinated with architectural, structural and mechanical systems and other trades. Submit shop drawings showing plans and elevations of electrical equipment, rooms and closets.

(a) Mounting details where not shown on drawings or alternate methods are proposed or required.

(b) Terminal-to-terminal wiring diagrams showing all relays, dimmers, switches and other control devices and conductors for all lighting circuits.

(2) Manufacturer's product data is required for the following:

(a) Safety switches

(b) Individual breakers

(c) Panelboards with breaker-to-bus connection data

(d) Lighting fixtures

(e) Fixture accessories

(f) Emergency lighting equipment

(g) Time switch

(h) Dimmers

(i) Low-voltage control relays and other related equipment.

(j) Occupancy sensor switches

Submit additional product data upon request; i.e., raceway accessories, boxes and enclosures for exterior and wet locations, wiring devices, etc.

(3) Submit control diagrams for motors, lights and other equipment upon request.

(4) Equipment specified by manufacturer's definitive brands or catalog numbers without modifications need not be submitted, unless clarification is required due to obsolescence, supersedure, or error in identification.

(5) Standard features of equipment specified by manufacturer's definitive brands or catalog numbers, whether specifically described or not on the drawings or in the specifications, will mandate the inclusion of optimal features of listed equivalent manufacturers and can be also used to evaluate competitive brands proposed by the Contractor.

(6) Any deviation from drawings and specifications shall be clearly identified on the submittal. Unless deviations are clearly identified, then all requirements indicated on the drawings and specifications shall be assumed to be complied with.

(7) Shop drawing and product data shall be checked by Contractor to insure equipment are adequately sized and can be properly installed and with Code clearances maintained for a complete and operable system within intent indicated on plans and specifications. Review and acceptance of shop drawings by Contracting Officer shall not relieve the Contractor of responsibility to provide a proper and complete installation.

(8) Submit computerized footcandle level printouts for rooms upon request.

(9) Obtain utility company approval for all metering equipment.

(10) Submit samples of lighting fixtures, materials and equipment upon request.

(11) Warranty: Submit warranty as noted under item entitled "WARRANTIES" hereinbelow.

(B) Certificates: Certificates of electrical inspection.

(C) As-Built Drawings:

(1) Contractor shall provide drawings of complete electrical system on 24" x 36" mylars showing as-installed locations of equipment and wiring on plans, including circuiting, details, etc., or mylar reproductions of contract drawings with all changes neatly drafted thereon. In addition, Contractor shall update Autocad Release 2010 files of as-built construction drawings on CD recordable disks along with as-built mylars. Incomplete or unsatisfactory as-built drawings or CAD files shall be grounds for rejection by the Contracting Officer. Contractor shall revise and resubmit as-built drawings and CAD files at no additional cost to State of Hawaii until accepted by the Contracting Officer.

(2) Deliver to the Contracting Officer not later than two (2) weeks before final inspection.

(D) Utility Company Energy Efficiency Rebate Program:

(1) Lighting system shall be provided to take advantage of energy rebates offered by the electrical utility company where practicable.

(2) Upon completion of project, Contractor shall fill out energy rebate application forms for customer submission to utility company.

(E) Operation and Maintenance Manuals:

(1) Provide six (6) operation and maintenance manuals for emergency lighting equipment, dimmers, time switch, lighting control equipment, list of all lamps and ballasts (drivers) required for each light fixture type, and metering and control equipment including technical information for all components, wiring diagrams and instructions for installation, operation, maintenance and repair.

(2) Deliver to the Contracting Officer not later than two (2) weeks before final inspection.

670.06 Drawing and Specifications

(A) Electrical system drawings are diagrammatic and symbolic.

Locations of fixtures, outlets, devices, raceways, apparatus, etc., shown are approximate and shall be installed with the required heights, spacing, maintenance and code clearances and to avoid conflict with existing conditions and other systems and trades. Visit site and verify lineal footages required and check scales and dimensions shown on civil and architectural drawings prior to bidding to verify locations, routing and lineal footages of electrical work required for inclusion into bid. Study adjacent civil, architectural, structural and mechanical details and make installation in most logical manner for eye appeal and coordination with other systems and trades. Unless dimensioned or noted otherwise, orderly configuration and visual composition are fully intended.

(B) Include mounting accessories, additional components and wiring which are not shown or specified herein but are required for proper control and operation to provide for a complete and operable system within intent indicated on the drawings and specifications.

(C) Study architectural, mechanical and civil drawings and specifications prior to bidding and provide additional wiring including lighting fixtures, apparatus and devices for equipment furnished by State of Hawaii or other trades without additional cost to State of Hawaii.

(D) Relocate fixtures, outlets, devices, apparatus and associated wiring including raceways, from locations shown, without additional cost to State of Hawaii, for code compliance and to avoid conflict with existing conditions, other systems or trades, structures, utilities and when directed before installation.

(E) Equipment ratings or wire sizes that are missing or shown in error shall have adequate capacity to serve the required and future loads plus minimum 25 percent spare capacity, and be in compliance with N.E.C.

(F) Verify voltages and other ratings of energy conversion, transformation and electrical utilization equipment prior to placing order with factory. Input voltages of equipment shall match system voltage available.

(G) In the event of conflicts within the drawings, specifications or any referenced code, standards or requirements, the more rigorous requirements shall govern.

670.07 Warranties

Entire installation shall be warranted to be free from defects for a one

(1) year period commencing from date of final acceptance. Any portion of the installation developing defects within the one year period shall be replaced by identical or better equipment, materials or parts including labor to make such defective portion of the installation complete and operable within the intent indicated on drawings and specifications, at no additional cost to State of Hawaii.

670.08 General Materials

(A) All equipment and material shall bear U/L label or be listed by a nationally recognized testing organization in accordance with the National Electrical Code.

(B) Equipment and material specified by manufacturers' catalog numbers and names: In case of obsolescence, supersedure, or error in identification, the intent implied by the description, application, required performance and the features of competitive brands also listed shall govern.

(C) Features of equipment for specified manufacturers can be used to establish the quality of the product.

(D) All equipment and materials shall be suitable for intended location and use and include all accessories for proper installation and operation.

670.09 Wiring Materials

(A) Raceways:

(1) EMT and rigid steel conduit, galvanized inside and out, 3/4" minimum diameter for power and signal systems. N.E.C. minimum for lighting systems.

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

(3) Non-Metallic Conduit: PVC Schedule 40, 3/4" minimum diameter.

(4) Metal Surface Raceways: Low profile surface mount raceway, .040-inch thick, painted finish, sized for number of wires indicated plus 25 percent spare capacity with matching fittings and accessories. Wiremold No. V500, V700, V2000 or V2400, or approved equal for power and Wiremold No. V2000 or V2400 or approved equal for telecommunications.

(a) Two-piece type, .050-inch thick, with divider for power

and communication. Wiremold No. G4000.

(b) Telecommunication raceway fittings for 90 degree bends shall be TIA-EIA compliant.

(5) Tele Power Poles: Extruded aluminum channel, 2 1/4-inch square cross section, height as required to span from floor to ceiling with adjustable stanchion base, separate compartments for power and communication, power compartment prewired with four duplex NEMA 5-15R specification grade receptacles (isolated ground as indicated) and ceiling junction box, communication compartment with capacity based on 30% fill for minimum 16-4 twisted pair #24 gauge type CMP Level 5 cables and device plates with provision for four dual modular jack inserts and blank covers, anodized aluminum finish, color as selected by Contracting Officer, with mounting hardware, trims and accessories, Wiremold AMDP-4D(IG).

(B) Boxes, Enclosures:

(1) Enclosures and Cabinets: Enclosures and cabinets for panelboards, breakers, switches and communication shall be NEMA type, fabricated from sheet steel and galvanized after fabrication, or as otherwise indicated, exterior surfaces prime painted and enamel-finished according to NEMA specifications, complete with hinged door, trim, locking device and lugs. For exterior and wet locations, enclosures and cabinets shall be epoxy painted galvanized cast ferrous alloy or type 316 stainless steel with matching neoprene gasketed trim and doors, threaded hubs for conduit connections, stainless steel screws and hardware and external means for mounting.

(2) Outlet and Small Junction Boxes: Pressed, zinc-coated steel, minimum nominal size 4" square, minimum depth 1-1/2", with raised covers where concealed or flush mounted. Exposed boxes and weather exposed boxes shall be cast iron, or ferrous alloy, prime painted and enamel finished, with neoprene gasketed covers, threaded hubs for conduit connections and stainless steel screws. Boxes for metal surface raceways shall match raceways. Wiremold #V5700 or V2400 series or approved equal.

(3) Large Junction Boxes and Wireways: For dry interior location, boxes and wireways shall be fabricated from N.E.C. gauge galvanized steel with matching screw-on type cover, field punched knockouts. For exterior and wet locations, boxes and wireways shall be epoxy painted galvanized cast ferrous alloy or stainless steel with matching neoprene gasketed covers, threaded hubs for conduit connections and stainless steel screws.

(4) Telephone and Communication Cabinets:

(a) Cabinet to be NEMA 1 enclosure, constructed of sheet steel with boxes and trim and door being zinc-plated after fabrication, mounting as indicated. (NEMA 4X type 316 stainless steel enclosure with neoprene gasket for outdoor applications or as indicated). Box and door trim shall be factory painted with gray to match panelboard enclosure. Provide locking device and keys.

(b) Cabinet to be provided with 3/4-inch pentachlorophenol pressure treated plywood backing.

(C) Devices:

(1) General: Ratings and NEMA arrangement types as indicated. Drawings show minimum application ratings, specification describes nominal ratings. Comparable devices by Pass & Seymour, Bryant, and Hubbell shall be acceptable.

(2) Receptacles: Duplex, 15 or 20-ampere as indicated, 125 volts, side and back wired, 3-wire grounding type, automatic one-piece self-grounding strap, ivory composition body, (brown at woodwork, yellow for emergency power, other colors to match wall finish), premium specification grade. Hubbell #5262, 5362. Ground fault circuit interrupter type for bathrooms, exterior, near sinks and wet areas, Hubbell #GF5262 and GF5362. Isolated ground surge protection type, hospital grade, blue color, with LED indicator and switched or no audible alarm, for computer equipment, Hubbell #IG5262S and IG5362S. Safety type for classrooms and student work areas, Hubbell #SG-62.

(3) Special Use Receptacles: Single, black, straight blade or twist lock grounding type, rating to match equipment or as shown on drawings, with matching plug. Verify requirements with equipment supplier.

(4) Floor Outlet: Flush, brass flip-open covers and plate with appropriate hole for device, carpet flange as required, cast iron box with bituminous compound coating for slab on grade or below floor, pressed steel junction box with U.L. listed fire rated poke through assembly for slabs above grade and device as specified herein. Hubbell #PT7FBRS or approved equal.

(5) Service Fittings: Brushed aluminum finish, with matching device plates for devices as indicated, suitable for mounting on laboratory counter top.

(6) Ceiling Outlet: Flush in ceiling where applicable, single, black, twist lock grounding type, rating as shown on drawings. Provide matching connector type "SO" cord and plug with strain relief cable grips for each ceiling outlet. Connector height shall be 2'-0" above finish floor. Verify requirements with equipment supplier.

(7) Photo Switch: Cadmium sulfide photocell with relay, lightning arrester and weatherproof receptacle.

(8) Manual Dimmers: Solid state, 120-volt or 277-volt, for switch outlet box mounting, slider operation, with on off integral switch, 1,500-watt minimum with heat sink or as indicated. Provide filters to eliminate AM/FM radio and public address system interference. Manual dimmers shall be Lutron "Nova T" series or approved equal.

(9) Occupancy Sensor Switch:

(a) Occupancy sensor wall switch shall consist of ultrasonic motion detector to provide minimum 20-ft. by-25 ft. motion at desk coverage with integral two switched outputs, 120 to 277 VAC, manual and automatic mode and on off control switches and adjustable sensitivity and off delay time. Novitas 01-153 or Wattstopper, Mytech equal.

(b) Occupancy sensor ceiling mounted switch shall consist of ultrasonic motion detector to provide minimum 27-ft. by 33-ft. minor motion coverage in partitioned area with separate 120 to 277 VAC switch pack and adjustable sensitivity and off delay time. Each switchpack contains Class 2 transformer with Form C relay. One switchpack can be controlled from up to five sensors or 10 switchpacks can be connected to one sensor. Novitas 01-110/13-031 or Wattstopper, Mytech equal.

(c) Occupancy sensor switches for lighting in corridors, lobbies, stairs, and other paths of egress shall be fail safe type per NFPA 101.

(10) Light Switch: Flush, tumbler, quiet, non-mercury, Type AC, 277-volt minimum, 20-ampere, one-pole, two-pole or 3-way as indicated, individual yoke, automatic self-grounding clip, ivory (brown at woodwork, yellow for emergency circuits, other colors to match wall finish), premium specification grade. Hubbell #1221, 1222, 1223.

(11) Clock Outlet: Single, 15-ampere, 125 volts, 3-wire recessed grounding type, brown. Enclose in outlet box and 0.040-inch brass (or stainless steel as required) device plate with clock hanger, Hubbell #5233 (5235).

(12) Device Plates: Single and multi-gang, clean, simple design with appropriate hole for device. Provide appropriate device plate for each outlet shown or as required by the specifications.

(a) Metal, .032-inch minimum thickness, type 430 stainless steel, painted ivory, brown or other colors to match wall finish (Type 302 stainless steel for kitchen areas). Pass & Seymour- Legrand SS-series, or approved equal.

(b) Weatherproof, polycarbonate flip-open hinged cover with cable opening and neoprene gaskets for plug-in equipment in outdoor or wet applications when receptacle is in use per N.E.C. 410-57. Taymac "Safety Outlet Enclosures".

(c) Telephone/data outlets shall have provisions for four modular jack inserts and be provided with blank covers.

(d) Cable TV outlets shall be duplex receptacle type with single “F” connector wall tap.

(D) Wires and Cables: Copper conductors; aluminum not allowed.

(1) Low-Voltage Wires: 600-volt, No. 12 AWG minimum; No. 10 and smaller, solid and round; No. 8 and larger, 7 or 19 strands concentric. Conductors No. 8 and smaller, types TW, THW, THWN, THHN or XHHW; conductors No. 6 and larger, types THW, THWN or XHHW. For exterior and below grade use type XHHW-USE. Fixture wires per N.E.C.

(a) Provide color coding for service, feeder, branch, control, and signaling circuit conductors. Color shall be green for grounding conductors and white for neutrals, except where neutrals of more than one system are installed in same raceway or box, other neutral shall be white with colored (not green) stripe. Color of ungrounded conductors in different voltage systems shall be as follows:

(1) 120/208-volt, 3-phase

(a) Phase A – black

(b) Phase B – red

(c) Phase C – blue

(2) 277/480-volt, 3-phase

(a) Phase A – brown

(b) Phase B – orange

(c) Phase C – yellow

(3) 120/240-volt, single-phase: Red and black.

(3) Cables shall not be manufactured more than one year prior to use.

670.10 Apparatus

(A) Control Apparatus and Devices

(1) Manufacturers: Eaton, General Electric Company, Square D, and Allen-Bradley shall be acceptable, unless a separate listing is given for a particular equipment; per NEMA ICS-1970, Industrial Control Systems; all in enclosures.

(2) Manual Motor Starters: HP rated toggle operated mechanism with appropriate overload heater elements, NEMA 1 enclosure. (NEMA 4 cast iron or ferrous alloy with neoprene gaskets for outdoor applications or where exposed to damp atmosphere or as indicated.) Toggle positions "ON", "OFF" and "TRIPPED" engraved or embossed on body and visible without removing enclosure cover.

(3) Contactors: Enclosed, number of poles and rating as required or indicated. Replace noisy units without attempting to make adjustments on the field.

(4) Pushbutton Station: Heavy duty, industrial oil-tight, 30mm pushbuttons in NEMA 1 enclosure (NEMA 4 cast metal for outdoor applications or where exposed to damp atmosphere or as indicated) with contacts, selector switches and indicating lights as required.

(5) Lighting Control Panel shall consist of up to 24 single pole contactors, rated at 30 amperes, 120/277 volts, A.C., with a microprocessor based controller with 24 digital outputs to provide for 365-day scheduling, multiple on/off operations per day for

each contactor or inputs from an external source or local pushbutton controls, digital LED readouts, minimum 90 day battery backup, in a recessed or surface mounted enclosure with hinged door. A control diagram shall be mounted on the cabinet door.

(B) Disconnecting and Protective Devices:

(1) Manufacturers: Square-D, Eaton, Siemens-I.T.E., and General Electric Company shall be acceptable.

(2) Safety Switch: Surface mounting, Federal Specification W-S-865, heavy-duty, hp-rated, NEMA 1 enclosure. (NEMA 4X type 316 stainless steel enclosure with neoprene gaskets for outdoor applications or wet locations or as indicated.) Fusible type to have fuseholders to reject N.E.C. standard type fuses when current-limiting fuses specified. Provide auxiliary contact for control circuit.

(3) Individual Circuit Breaker: Industrial/commercial molded plastic case circuit breaker with toggle operated mechanism, thermal-magnetic overload trips, input and output lugs minimum 65,000 AIC or as required, NEMA 1 enclosure. (NEMA 4X type 316 stainless steel enclosure with neoprene gaskets for outdoor applications or wet locations or as indicated.) Plug-in breakers with loadcenter enclosure shall not be allowed. Interchangeable trip shall be provided when available for ampere rating indicated and single toggle handle provided for multiple-pole devices. Toggle positions "ON", "OFF" and "TRIPPED" and breaker rating engraved or embossed on body and visible without removing enclosure cover.

(4) Panels: Branch circuit, industrial/commercial use, bolted molded case thermal-magnetic circuit breakers, rated at minimum 10,000 AIC for 208-volt systems and 14,000 AIC for 480-volt systems or as required and series rated with upstream protective device, copper busses and harnesses, device position or bus connections as indicated, Federal Specification W-P-115a and Am. 2 and NEMA PB-1, NEMA 1 enclosure, minimum 20 inches wide, complete with hinged door, trim, locking device and keys, and directory. (NEMA 4X type 316 stainless steel enclosure with neoprene gaskets for outdoor applications or wet locations or as indicated.) Distribution panel similar except busses with minimum 50,000 amperes symmetrical short circuit current, interchangeable trip circuit breakers rated at minimum 22,000 AIC or as required, and with 30" wide enclosure. Toggle positions "ON" and "OFF" and breaker rating engraved or embossed on body and visible without removing enclosure cover. Provide

ground lugs.

(a) Loadcenters shall have one-inch per pole plug-in circuit breakers with tin-plated aluminum busses, twin neutral bars, positive door latch.

(b) Transient Voltage Surge Suppressor (TVSS) devices shall conform to ANSI/IEEE C62.41 and C62.45 and NEMA LS1. The TVSS shall include an electrical noise filter and utilize hybrid Silicon Avalanche Diodes (SAD) as the primary means of protection and Metal Oxide Varistors (MOV's) as secondary protection for surge suppression. Each protection circuit shall be independent of each other. The minimum surge current per phase that the device can withstand shall be 200 KA for main service and distribution panels and switchboard and 100 KA for branch panels. The unit shall be provided with overcurrent protection and monitoring and mounted in a NEMA 12 enclosure.

(5) Protective Device Coordination: All protective devices, including circuit breakers, fuses, overload and protective relays shall have short circuit withstand ratings and time-current characteristics to protect equipment and conductors against fault currents and sustained overload conditions and coordinated for fault isolation with minimum impact to system operation. Protective device requirements shall be coordinated with the utility company's system. Protective devices shall be set, adjusted, tested and calibrated as required and per manufacturer's recommendations for proper coordination prior to energization of the electrical system.

(C) Transformers:

(1) Dry-type: Conform to NEMA ST20 and to ANSI C89.2, general purpose, ventilated enclosure for indoor use, non-ventilated NEMA 4X type 316 stainless steel enclosure for outdoor applications or wet locations or as indicated, not less than one coil per phase, 150 degrees C temperature rise (115 degrees C rise for less than 45 KVA) with corresponding NEMA standard insulation class, full capacity NEMA standard taps or as indicated, sound levels less than NEMA standard and with vibration isolation resilient mount accessories. Provide wall brackets as required. Eaton EP/EPT and DS-3/DT-3 or Square-D, Hevi-Duty, General Electric-ABB, and Siemens-I.T.E. equal.

(D) Metering Equipment:

(1) Utility Service Metering Equipment: Metering equipment for utility company service including meter sockets, current transformer enclosures and pullboxes shall comply with EUSERC and requirements of the utility company. All equipment enclosures on line side of utility meter and for utility metering equipment shall be sealable.

(2) Checkmeter system shall measure kilo-watthours and utilize the powerline as the signal carrier. The system shall consist of meter/communications modules (intellimeters), central data collection unit (central stations), KWH display units (Lobby Displays), current transformers, and couplers. Provide all components and wiring for a complete system. Neta Corp. "Intellimeter" or approved equal.

****OR****

(2) Checkmeter system shall conform to ANSI C12.10 and measure kilo-watthours and 15 minute maximum kilowatt demand. The system shall consist of meters, sockets, and current transformers. Provide all fuses, accessories and wiring for a complete system. Sangamo or approved equal.

(E) Automatic Transfer switch and Bypass-Isolation Switches: UL 1008, NEMA ICS 2-447.

(1) Automatic Transfer Switch and Bypass-Isolation Switches: Provide automatic transfer switch with the number of poles, amperage, voltage, and withstand ratings as shown. Transfer switch shall be listed per UL 1008 as a recognized component for emergency systems and rated for all classes of loads when installed in an unventilated enclosure. Electrical operation shall be accomplished by a nonfused momentarily energized solenoid direct operating mechanism or stored energy operator. Mechanical locking in each direction shall be provided. Operation shall be automatic synchronized transfer and retransfer between utility and emergency power. Main pole structures shall be designed so that fault currents result in increased main contact pressure. An overload or short circuit shall not cause the switch to go to a neutral position. Main contacts shall be designed for automatic transfer switch service. Inspection and replacement of all main and separate arcing contacts, moving and stationary, shall be possible from the front of the switch without any disassembly of operating linkages or power conductors. Drawout mechanism and mechanical interlocks shall be provided to allow for removal of the transfer switch after the load has been bypassed.

(2) Accessories: An integrally mounted unitized control module

shall include:

(a) Nonadjustable (one-second, nominal) time delay to override momentary dips in normal power source.

(b) Phase voltage relay supervision of three phases of the normal source 65 to 70 percent dropout (D.O.) and 92 to 95 percent pickup (P.U.) to detect "brown-out" conditions.

(c) Voltage/frequency lockout relay (90 percent P.U., nominal) to prevent premature transfer.

(d) System test switch (momentary type).

(e) Engine starting control contacts (one-N.C. and one-N.O.).

(f) Auxiliary pilot contacts rated 10 amperes at 480 VAC (one closed on "N" (normal) and one closed on "E" (emergency)).

(g) Adjustable 0-25 minutes time delay on retransfer to normal power source.

(h) Provide adjustable time delay, 0 to 15 minutes, on shutdown of engine-generator after retransfer of the load to "normal".

(i) Pilot lights for transfer and bypass-isolation switches to indicate source to which the load is connected.

(j) A device to allow manual transfer to either switch position in the event of an electrical failure in the control circuits.

(k) Provide in-phase monitor for automatic synchronized transfer and retransfer operation between utility and emergency power.

(3) Provide a manual bypass/isolation switch for the automatic transfer switch, arranged to bypass the emergency or the normal source of power directly to the load in one operation. The switch shall isolate the automatic transfer switch from the load and both normal and emergency power sources. The bypass/ isolation switch shall be lockable in the "isolated" position. The arrangement shall permit electrical testing of the transfer switch before the load is reconnected. Interlocks shall prevent operation

of the transfer switch, except for testing purposes, when the switch is in the "isolated" position. The enclosure shall be designed so that the automatic transfer switch and the bypass isolation switch shall be accessible through individual door openings and installed in separate compartments to eliminate any exposure to the operator when servicing the automatic transfer switch while the bypass/isolation switch is in the "isolation" position. Bypassing the automatic transfer switch shall not cause any interruption of power to the load. The current, voltage, phase, and short circuit ratings shall be at least equal to the transfer switch ratings. The bypass/isolation switch shall also have the same number of switched poles as the transfer switch. The bypass/isolation switch may be a non-loadbreak device, but the short circuit withstand and closing rating of the bypass/isolation switch shall be equal or greater than that of the transfer switch. When the switch is installed in an unventilated enclosure and is carrying rated current, its contact temperature shall not exceed the limitations designed for the transfer switch.

(4) Manufacturers: Russelectric, ASCO, Lake Shore or approved equal.

(F) Uninterruptible Power System (UPS):

(1) The UPS shall provide on-line, continuous supply, clean, closely regulated AC power and shall completely isolate the protected equipment from the AC line, providing total protection against noise transients, voltage sags, surges, brown-outs and blackouts. The UPS shall be front access, double conversion type and be provided with transient voltage suppression on the input, internal batteries, battery charger, automatic system by-pass and computerized system status monitoring. Single conversion, off-line type UPS shall not be allowed.

(2) Modes of Operation: The UPS system shall operate in the following modes:

(a) Normal: The critical AC load is continuously powered by the UPS inverters. The rectifier/charger derives power from the utility AC source and supplies DC power to the inverters, while simultaneously charging the battery.

(b) Emergency: Upon failure of utility AC power, the critical AC load which is powered by the inverters will, without any switching, obtain power from the battery plant. There shall be no interruption of power to the critical load upon failure or restoration of the utility AC source.

(c) Recharge: Upon restoration of the utility AC source, the rectifier/charger powers the inverters and simultaneously recharges the battery. This shall be an automatic function and shall cause no interruption to the critical AC load.

(d) Bypass: If the UPS system must be taken out of service for maintenance or repair, the static bypass switch shall transfer the load to the bypass source. The transfer process shall cause no interruption in power to the critical AC load.

(e) Off-Battery: If the battery only is taken out of service for maintenance, it is disconnected from the rectifier/charger and inverter by means of internal disconnect breakers. The UPS shall continue to function and meet all of the specified steady-state performance criteria, except for the power outage back-up time capability.

(3) Rating: The UPS shall be high energy efficient with 91% efficiency, sized to provide a minimum output for all loads as required plus minimum 50% spare capacity for future growth. The utility input voltage, load voltage, and bypass line voltage shall be identical. The UPS battery shall be sealed type and have a capacity to support full load for a minimum period of 15 minutes at a temperature of 25 degrees C.

Input voltage range shall be plus 10 percent to minus 15 percent and frequency range shall be plus or minus 5 percent. Current harmonics at full load shall be 10 percent THD maximum.

(4) The UPS shall incorporate transient voltage surge suppression (TVSS) and meet the requirements of IEEE 587/ANSI 62.41 at 4000V peak. The TVSS shall consist of an electrical noise filter and metal oxide varistors (MOV's) and be capable of withstanding 200 KA.

Steady state output voltage regulation from no load to full load and minimum to maximum input voltages shall be plus or minus 1 percent. Manual voltage adjustment range of plus or minus 5 percent shall be provided. Frequency regulation shall be plus or minus 0.1 Hz free running.

(5) The UPS module cabinet shall consist of a rectifier/charger, a three-phase inverter, static transfer switch, maintenance bypass switch, and associated transformers, logic, synchronizing equipment, protective devices, and accessories as required for proper operation.

(6) UPS manufacturer shall be Eaton Powerware or Liebert and

MGE approved equal.

(7) Service, repair and maintenance shall be available locally. Successful vendor shall provide service/maintenance contract proposal.

(G) Transient Voltage Surge Suppressor (TVSS) devices shall conform to ANSI/IEEE C62.41 and C62.45 and NEMA LS1. The TVSS shall include an electrical noise filter and utilize hybrid Silicon Avalanche Diodes (SAD) as the primary means of protection Metal Oxide Varistors (MOV's) as secondary protection for surge suppression. Each protection circuit shall be independent of each other**.** The minimum surge current per phase that the device can withstand shall be 200 KA for main service and distribution panels and switchboard and 100 KA for branch panels. The unit shall be provided with overcurrent protection and monitoring and mounted in a NEMA 12 enclosure.

(H) Lighting fixtures and lamps shall be as shown, complete with mounting accessories suitable for each installed situation. Verify ceiling types and operating voltage required prior to ordering fixtures.

(1) When given without other qualifications, follow dimensions given.

(2) Finishes for steel fixtures shall be applied over corrosion-resisting treatment of phosphatizing a thoroughly cleansed steel chassis, enamel electrostatically applied and hot baked after fabrication. (Fixtures formed from pre-painted metal stock shall not be allowed.)

(3) Fixture lenses and diffusers shall have a minimum lens thickness of 0.125-inch. Doors shall be constructed with light traps or neoprene gaskets to prevent light leakage.

(4) LED luminaires shall have minimum 5 year warranty and LM70 lumen maintenance value of 50,000 hours as calculated and tested per IES standards.

(5) LED drivers shall comply with NEMA SSL 1 and be electronic, constant current type, with minimum 90 percent PF and less than 20 percent THD, meet class A sound rating, and operate at 120 or 277 volt.

(6) LED light source shall be 4000 degree K color temperature, minimum 80 CRI, 90 lumens per watt efficacy.

(7) Recessed fixtures shall be constructed to provide for access

to junction boxes via removable fixture trims or housings from below non-accessible ceilings. Provide flanges for mounting fixtures in plaster or gypsum board ceilings. See architectural reflected ceiling plans for ceiling types. Provide junction boxes for recessed fixtures for feed-through wiring.

(8) Provide accessories for pendant mounted fixtures such as stems, ball and swivel aligners, canopies, etc.

(9) Fixtures shall be suitable for damp or wet locations and other environments encountered and as required for use and locations shown on plans.

(10) Lighting system shall provide for illumination levels and requirements in accordance with I.E.S. and State Occupational Health and Safety Standards and comply with State and County energy codes.

(l) Emergency Lighting Equipment shall be provided to comply with NFPA 101, UBC and UFC and as shown complete with lamps and mounting accessories suitable for each installed situation. Provide lamps in wattages indicated. Provide accessories required for remote mounted lamps where indicated. Remote mounted lamps shall be as indicated.

(1) Emergency Lighting Unit: Emergency lighting units shall be rated for 12 volts, with automatic solid state charger and batteries sized for minimum 90-minute operation when ac input falls to 75 percent of normal voltage.

(2) Emergency Power Battery Pack. Each system shall consist of an automatic power failure device, cover mounted test switch and pilot light, and fully automatic solid state charger in a self-contained power pack for mounting integral into lighting fixture. Charger shall be either trickle, float, constant current or constant potential type, or a combination of these. Battery shall be sealed electrolyte type with capacity as required to supply power to the number of lamps required and shown for each system. Battery shall operate unattended and require no maintenance, including no additional water, for a period of not less than 5 years. Unit shall be switchable to allow light to be turned off without transfer to battery power unless utility power should fail.

(3) Exit signs shall be provided to comply with NFPA-101, UBC and UFC and as shown with integral emergency power battery pack and for voltage and mounting as required. Provide with automatic power failure device, test switch, pilot light, and fully automatic high/low trickle charger in a self-contained power pack.

Battery shall be sealed electrolyte type, shall operate unattended, and require no maintenance, including no additional water, for a period of not less than 5 years. Unit shall be switchable to allow sign to be turned off without transfer to battery power unless utility power should fail.

(J) Time Switch:

(1) Time switch shall be automatic, adjustable, 7-day, 24-hour reserve power spring carry-over, 120-volt motor, 20A, 277-volt contacts, three circuits, NEMA type 1 enclosure with photo electric control. Provide transformer and fuses for power to motor as required and wiring to remote photo switch.

(2) Manufacturers: Tork #T930L, or Sangamo or Paragon equivalent.

670.11 Installation

(A) General: Comply with manufacturers' instructions and directions pertaining to equipment for this project, also to practices recommended by latest editions of Croft's American Electrician's Handbook, Illuminating Engineering Society Handbook, National Electrical Code (N.E.C.), National Electrical Safety Code, National Fire Code (NFC), Standards of Edison Electric Institute, Institute of Electrical and Electronics Engineers, Telecommunications Industry Association/Electronics Industries Association (TIA/EIA),Public Utilities Commission General Order No. 10 and the serving utility agency requirements.

(1) Installation shall be appropriate for intended location and use and be complete and operable within intent indicated on the plans and specifications. Provide all accessories as required for proper installation and operation.

(2) For actual fabrication, installation and testing of the work of this section, use only thoroughly trained and experienced workmen completely familiar with items required and with manufacturers' recommended methods of installation. In acceptance or rejection of installed work, no allowance will be made for lack of skill on part of workmen.

(3) Where specifically recommended by the manufacturer of specialty electrical items, work performed shall be done by factory trained technicians.

(B) Raceways: Rigid steel conduit with threaded fittings throughout, except EMT with compression fittings is acceptable where concealed

in dry suspended ceiling or dry wall spaces. Underground raceway (ductline) for exterior work shall be PVC Schedule 40 conduit installed minimum 18 inches below finish grade or 24 inches below finish pavement with minimum 3-inch thick concrete jacket. PVC conduits shall transition to rigid steel conduit before rising up through slab on grade. Metal surface raceway with matching boxes and fittings acceptable in dry interior areas only where raceway concealment by chipping walls not permitted by Contracting Officer.

(1) Conceal all raceways unless shown otherwise.

(2) Hangers, trapeze, rods, anchors, etc., to support raceways shall be galvanized steel of adequate size to sustain a steady 500 pound pull. For exposed work and in damp areas, field cut ends of supporting members and hardware shall be painted with cold galvanizing compound.

(3) Exposed raceways shall be neatly arranged; bends concentric if all are mounted on a common plane; common radius if tangent to a common plane, mounted above liquid lines - with allowance for access to boxes; tucked into cornices or routed for minimum profile.

(4) Concrete for electrical work shall be minimum 3000 psi with maximum one-inch aggregate size.

(5) Raceway penetrations through walls, floors and roof and raceway terminations shall be watertight and fire rated as necessary and be caulked, sealed and made with materials approved for that purpose.

(6) Provide locknuts and bushings for all raceway terminations.

(7) Provide hubs for all raceway connections to boxes and enclosures exposed to weather.

(8) Provide pullwires in all telecommunications and empty raceways.

(9) In addition to complying with N.E.C. and serving agency requirements, raceways for telecommunications systems shall comply with TIA/EIA 569.

(a) Telecommunications raceway runs shall not have more than two 90-degree bends between pullboxes. Provide additional pullboxes as required. Pullboxes shall be allowed only in straight sections of raceway runs.

(b) Inside radii of raceway bends shall not be less than six times the internal diameter of the raceway, except for raceways larger than 2-inch trade size shall be minimum 10 times the internal diameter.

(10) Offset raceway runs as required to clear structure, ducts, piping, lights, etc. Provide additional pullboxes as required.

(a) Provide horizontal and vertical cable tray fittings and accessories for all bends and offsets to prevent sharp cable bends.

(11) Provide 4-inch high concrete curb for conduit risers below electrical panels, boxes and other equipment installed outdoors.

(12) Slope ductlines toward pullboxes and handholes and away from buildings.

(13) For underground ductline, thoroughly clean all PVC conduit ends with acetone prior to applying recommended adhesive compound for joining to couplings and end bells. Apply sealing compound around all conduit joints to ensure that underground ductline is watertight.

(14) End bells shall be provided for all duct entries into handholes.

(15) Perform a mandrel test after underground ducts are installed by passing a smooth bullet-shaped wooden test mandrel through the entire length of each conduit and duct to test for freedom of burrs and obstructions and adequate bending radius. Mandrel shall be minimum 12 inches long with diameter 1/4-inch less than the inside diameter of the conduit or duct to be tested. Replace sections of faulty conduit and ductline.

(16) For underground ductline, backfill material shall be placed in maximum of 8" layers in loose thickness before compacting. Backfill shall be thoroughly compacted with hand or mechanical tampers. Compaction of backfill shall be minimum 90% of maximum density per ASTM at landscaped areas, not to exceed 95%, and minimum 95% of maximum density per ASTM under paved areas.

(a) Backfill material shall be completely free of wood or other debris.

(17) Backfill shall be to finished grades and match existing conditions. Suitable topsoil shall be provided for top 6 inches at

backfill in grasses and planting areas.

(18) The Contractor shall be made aware that rocks and boulders and utility lines are known to exist beneath the ground surface. The Contractor shall accept the conditions at the construction site as they are found to exist and no extra compensation will be given by reason of the Contractor's misunderstanding or lack of knowledge of the subsurface or physical conditions.

(19) Check, probe and tone traverse of new ductline and areas around new underground electrical structures for existing underground utilities and tone all other areas of excavation for existing underground electrical and signal/communication lines prior to any trenching and excavation work. Flood drain, sewer and sprinkler piping with water during toning.

(20) Concrete for Electrical Work shall be ready-mixed type with compressive strength of 3,000 lbs. in 28 days. Concrete material and aggregates shall conform to ASTM. Concrete aggregates shall be maximum 3/4" in size.

(C) Boxes and Enclosures: Stray concrete shall be removed and rusty boxes shall be cleaned and painted with oil-base paint enriched with "Pentrol" per manufacturer's direction. Wires shall not be pulled in until boxes are cleaned.

(1) Provide additional junction or pull boxes, as required for pulling wires and detours to resolve conflicts in the field, placement subject to approval of appearance.

(2) Provide supports and mounting accessories and reinforce structure as required to install and secure equipment boxes and enclosures.

(a) Supports shall be able to withstand weight of equipment plus a minimum 500 pound steady pull and shall be galvanized where exposed.

(b) Secure floor-mounted equipment with anchors set into floor slab.

(c) Provide minimum 4-inch high reinforced concrete pad for all transformers. Pad shall not extend more than 2 inches beyond footprint of equipment in any direction.

(D) Wires:

(1) All wires to be installed in raceways.

(2) Provide color coding for all circuit conductors.

(3) Increase circuit conductor and raceway sizes as required to limit voltage drop as allowed per N.E.C.

(4) Provide wiring and equipment as required for proper operation and control of the lighting system.

(5) Provide switched and unswitched circuits for emergency lighting equipment.

(6) Provide separate neutral and ground wires for isolated ground and computer equipment circuits.

(7) Splices (Low-Voltage, 600 Volts or Less): Make splices within boxes in accessible locations. Splice conductors No. 10 AWG and smaller diameter with insulated, pressure-type connector. Splice conductors No. 8 AWG and larger diameter with solderless connector, and cover with insulation material equivalent to conductor insulation.

(a) All splices installed underground or in areas subject to water shall be watertight with epoxy cast resin and mold or heat shrink tubing.

(b) Splicing new cables into existing cables or reusing existing cables for new equipment: Before existing cables are spliced or reused, perform insulation tests per cable manufacturer's recommendations.

(E) Outlets:

(1) Outlets shown “one-over-the-other” shall be placed on a common vertical center line with conduit routed around boxes of different systems. Place boxes for operating and indicating devices (switches, fire alarm stations, push-buttons, etc.), as close as practicable to doors and corners. Mounting heights of outlets shall comply with ADA Standards for Accessible Design and where shown at cabinets and counters shall be coordinated with tops of counters and backsplashes. All boxes shall be installed flush unless indicated otherwise.

(2) Devices shown side by side shall be ganged. Comply with N.E.C. Section 380-8.

(3) Device plates shall be installed with all four edges in continuous contact with finished wall surfaces.

(4) Outlets on common party walls shall be offset and not mounted back-to-back.

(5) Provide receptacles for each cord connected equipment and appliance and as required per N.E.C. At minimum, provide one receptacle in every room.

(F) Protective Device:

(1) Overcurrent protective devices shall be provided for each service, feeder and branch circuit.

(2) All service, feeder and branch circuit and overcurrent protective devices shall be sized to adequately carry the connected loads.

(G) Lighting Control: Provide for local control of lights unless indicated otherwise. Multiple switching zones shall be provided to utilize daylight and conserve energy for rooms with windows. Occupancy sensor controls shall be provided as required to comply with the State Model Energy Code. Provide relay and contactor-controlled lighting circuits where remote switching is required.

(H) Lighting Fixture Mounting and Supports: Provide mounting accessories and additional structural supports and modify ceilings as required to install light fixtures.

(1) Supports for fixtures shall sustain a steady pull of 500 pounds (1,000 pounds for security type fixtures), and not less than 2-1/2 times weight of fixtures and accessories.

(2) Support each recessed fixture directly from structural ceiling members with minimum two No. 10 gauge steel wires in addition to suspended ceiling.

(3) Surface or pendant mounted fixtures shall be furnished and installed with required mounting devices and accessories and shall include hickeys, stud extensions, ball aligners, canopies, stems, metal framing channels, rods, etc. Support each fixture mounted below suspended ceiling from structural ceiling above in addition to suspended ceiling. Locations of fixtures near mechanical equipment shall be coordinated with Mechanical Contractor. Provide mounting stems as required to clear ducts, piping and other obstructions and where pendant fixtures are indicated. Mounting stems of pendant fixtures shall be of the correct length to uniformly maintain the fixture heights shown on

the drawings. The allowable variations tolerance in mounting fixture shall not exceed 1/4-inch and shall not vary more than 1/2-inch from the floor mounting height shown on the drawings. Provide cross bracing as required to prevent excessive swinging for stems longer than 2 feet. Hanging devices and accessories shall comply with Code requirements

(4) Security type fixtures shall be properly secured.

(I) Cut and Patch: Trench, excavate, cut and core as required to install electrical system. Backfill, repair and patch walls, floors, ceilings and structure and pavement and replant/regrass as required to restore finished surfaces, grade and landscape to original condition.

(1) Paint exposed raceways and boxes to match surrounding finish.

(2) Seal all excess openings.

(3) Carefully chip concrete to avoid cutting structural steel. Repair any damage to rebars by welding.

(4) Reframe and modify existing doors and windows and cut and modify existing shelves and cabinets to accommodate new electrical equipment and raceways.

(J) Anchors:

(1) Anchors which are set into horizontal concrete or masonry surfaces shall be limited to machine screw or bolt fasteners with metal (lead, steel, alloy) expansion shields.

(2) Anchors which are set into vertical concrete or masonry surfaces may be lag or wood screw as well as machine screw or bolt fasteners with metal expansion shields.

(3) Plastic or fibre shields are not acceptable as they do not provide sufficient pullout resistance.

(4) Power-driven studs and anchors shall not be used, except as permitted by the Contracting Officer.

(K) Identification: Label equipment by brown plastic, laminated nameplates engraved to expose white inner layer, epoxy cemented to unpainted surface. Type panel directories of branch circuits. Provide arc flash warning labels for panels, meter enclosures, individual circuit breakers, etc. as required per NEC.

(1) Entries:

Feeder Cables:	By panel(s) or load served and voltage.
Panels:	By designation, voltage, phases, wires.
Feeder Breakers and Transformers:	By designation and panel served or load.
Cabinets:	By designation and use (system).
Boxes:	By use (system) and voltage.
Panel Directories:	By use and location and room numbers of load served - Verify room number or area designation as called for by Contracting Officer and indicate accordingly.
Disconnect Switches:	By load served and voltage.
Multiple Gang Switches:	By use and general locations of load served.

(2) Provide conductor identification within each pullbox and enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, color coding shall be by factory applied, color- impregnated insulation. For conductors No. 4 AWG and larger diameter, color coding shall be by plastic-coated, self-sticking markers; colored nylon cable ties or heat shrink-type sleeves. In addition to color coding, provide imprinted plastic labels for feeder cables and control circuit terminations in pullboxes and enclosures. Pullwires shall be identified with imprinted plastic labels at each end of every run.

(L) Service and Metering Equipment: Verify requirements and coordinate installation with the utility companies. Arrange and schedule with the utility companies to insure timely completion of the project.

(M) Equipment Connections: Unless indicated otherwise, provide wiring for all equipment furnished by Owner or other trades. Provide disconnect switches for all motorized equipment and water heaters. Install all magnetic motor starters furnished by other trades. Wiring shown on any drawing is based on equipment rating indicated on

electrical system drawings. Verify equipment rating with State or trade furnishing equipment and adjust wiring as required to accommodate actual size of equipment to be furnished.

(1) Check and insure that proper polarity and phase rotation is provided for all outlets and equipment connections.

(2) Electrical power to all equipment located under hood shall be shut-off upon activation of hood fire protection system.

(N) Existing Conditions: Verify existing field conditions prior to bidding. Reroute existing electrical and signal/ communication lines and relocate equipment as necessary to avoid conflict with new construction.

(1) Verify and check traverse of new electrical and signal/communication lines for possible conflicts with existing utilities and obstructions and new construction for possible conflict with existing electrical and signal/communication lines prior to new work.

(2) Repair any existing utility lines damaged during construction at no additional cost to State of Hawaii.

(3) Remove existing wiring and equipment no longer in use. Phase removal and new work as required to allow existing facility to remain operational.

(4) Maintain continuity of existing wiring for equipment to remain. Rewire as required to restore operation of equipment to remain.

(O) Restrictions:

(1) Noisy construction operations which interfere with the usual existing procedures in adjacent areas shall be as scheduled.

(P) Adjust lighting fixtures and controls as required and directed by the Contracting Officer.

(Q) Adjustment and Settings:

(1) Adjust breaker trips, transformer taps and other equipment settings and controls per manufacturer's recommendations and as required unless otherwise directed by the Contracting Officer.

(2) Balance feeder loading equally on each phase as closely as practicable. Rearrange feeder and branch circuit connections as

necessary to balance loads.

(R) Grounding:

(1) Ground services, metallic enclosures, raceways, and electrical equipment according to requirements of National Electrical Code, Article 250 and TIA/EIA 607. Install 3/4-inch x 8' copperclad ground rod, Copperweld Steel Co., with top 12" below finished grade. Provide additional ground rods spaced minimum six feet apart as required. Bond together with No. 1/0 bare copper wire buried 12" below finished grade or as indicated to obtain a ground resistance of 25 ohms or less as measured by three point fall of potential method with electric ground megger. Connect ground rods to building entrance equipment and nearest cold water pipe with grounding electrode conductor per N.E.C. At water meter, install pipe clamps, Thomas & Betts Co., No. 3900 series, on both sides of meter and bond together. Connection shall not interfere with installation or removal of water meter.

(2) Ground connections to equipment, raceways, motors, grounding type receptacles and other metallic parts directly exposed to ungrounded conductors by insulated conductors, No. 12 minimum, AWG copper, N.E.C. Type TW, green insulation, or continuous approved metal raceways unless indicated otherwise. Provide insulated ground wires (not shown) to all receptacles, panels, and transformers.

(3) All grounding wire runs where exposed and within building in raceways. Run equipment ground wires together with circuit conductors.

670.13 Tests

(A) Contractor shall furnish test equipment and personnel to make operational and evaluation tests required to show compliance with contract requirements. Field tests shall be made for certain systems whenever reserve capability or quality must be demonstrated as specified, by subjecting the equipment to greater loading and stresses than normal. Make adjustments and add and/or replace equipment and wiring as required to correct deficiencies. Lighting level measurements shall be provided upon request and be made at intervals as directed by the Contracting Officer and with a NIST calibrated cosine corrected photometer with a silicon photodiode.

(B) Test electrical equipment and wiring as necessary to check for unspecified grounding, shorts and wrong connections. Perform insulation tests of all feeders and exterior underground circuits per cable manufacturer's recommendations. Minimum resistance shall be

250,000 ohms. Resplice and replace wiring and equipment as required and correct faulty conditions, if any. Submit written results to show compliance.

(C) Test grounding system to ensure continuity, and that resistance to ground does not exceed 25 ohms. Test each ground rod for resistance to ground before making connections to rod and after rods are bonded together. Make measurements in dry weather, not earlier than 48 hours after rainfall. Add ground rods and make corrections as required. Submit written results and indicate location of rods and soil conditions.

(D) Test ground fault protection system for electrical service in accordance with NEC Section 230-95(c). Adjust settings as required and per equipment manufacturer's recommendations.

670.14 Instructions for Operation, Maintenance and Repair

Contractor shall spend not less than sixteen (16) hours instructing and indoctrinating State of Hawaii representatives on the operating procedures for the emergency lighting system, dimmer, time switch and other lighting control systems.

670.15 Outages

Schedule all work to minimize power outages. Outages will be permitted only after normal operating hours unless approved by the State of Hawaii. Contractor shall request for outages in writing at least two weeks in advance. Contractor shall pay for additional utility company charges for utility work required after normal business hours and provide temporary power and wiring as necessary at no additional cost to State of Hawaii.

670.16 Payment

The Engineer will pay for the accepted pay items listed below at the contract price per pay unit, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for each of the following pay items when included in the proposal schedule:

Pay Item	Pay Unit
Electrical System	Lump Sum

END OF SECTION 670

Make the following Section a part of the Standard Specifications:

"SECTION 672 - FINISH HARDWARE

672.01 Description. This section describes the finish hardware work.

(A) Section Includes**:**

(1) Door hardware.

(B) Related Work Specified Elsewhere:

(1) **Section 663 – Sealant**

(2) **Section 669- Fiberglass Reinforced Polyester Doors**

(C) Specific Omissions. Hardware for the following is specified or indicated elsewhere.

(1) Windows.

(2) Cabinets, including open wall shelving and locks.

(3) Signs, except where scheduled.

(4) Toilet accessories, including grab bars.

(5) Installation.

(6) Rough hardware.

(7) Conduit, junction boxes & wiring.

(8) Folding partitions, except cylinders where detailed.

(9) Sliding aluminum doors, except cylinders where detailed.

(10) Access doors and panels, except cylinders where detailed.

(11) Corner Guards.

(12) Welded steel gates and supports.

672.02 Materials.

(A) Locksets, Latchsets, Deadbolts.

(1) Extra Heavy Duty Cylindrical Locks and Latches as scheduled.

(a) Chassis. cylindrical design, corrosion-resistant plated cold-rolled steel, through-bolted.

(b) Locking Spindle. stainless steel, integrated spring and spindle design.

(c) Latch Retractors. forged steel. Balance of inner parts**:** corrosion-resistant plated steel, or stainless steel.

(d) Latchbolt. solid steel.

(e) Backset. 2.75 inches typically, more or less as needed to accommodate frame, door or other hardware.

(f) Lever Trim. accessible design, independent operation, spring-cage supported, minimum 2.00 inches clearance from lever mid-point to door face.

(g) Strikes. 16 gage curved steel, bronze or brass with 1.00 inch deep box construction, lips of sufficient length to clear trim and protect clothing.

(h) Lock Series and Design. Schlage ND series, “Rhodes” design.

(i) **Certifications.**

(i) ANSI A156.2, 1994, Series 4000, Grade 1.

(ii) UL listed for A label and lesser class single doors up to 4 feet x 8 feet.

(B) Closers.

(1) Surface Closers. [4040XP]

(a) Full rack-and-pinion type cylinder with removable non-ferrous cover and cast iron body. Double heat-treated pinion shaft, single piece forged piston, chrome-silicon steel spring.

(b) ISO 2000 certified. Units stamped with date-of-manufacture code.

(c) Independent lab-tested 10,000,000 cycles.

(d) Non-sized, non-handed, and adjustable. Place closer inside building, stairs, and rooms.

(e) Plates, brackets and special templating when needed for interface with particular header, door and wall conditions and neighboring hardware.

(f) Adjustable to open with not more than 8.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors.

(g) Separate adjusting valves for closing speed, latching speed and backcheck.

(h) Extra-duty arms (EDA) at exterior doors scheduled with parallel arm units.

(i) Exterior door closers**:** tested to 100 hours of ASTM B117 salt spray test, furnish data on request.

(j) Exterior doors. seasonal adjustments not required for temperatures from 120 degrees F to -30 degrees F, furnish checking fluid data on request.

(k) Non-flaming fluid, will not fuel door or floor covering fires.

(l) Pressure Relief Valves (PRV) not permitted.

(2) Surface Closers. [1461]

(a) Full rack-and-pinion type cylinder with removable non-ferrous cover and cast iron body. Double heat-treated pinion shaft, single piece forged piston, chrome-silicon steel spring.

(b) ISO 2000 certified. Units stamped with date-of-manufacture code.

(c) Independent lab-tested 5,000,000 cycles.

(d) Non-sized, non-handed and adjustable. Place closers inside building, stairs and rooms.

(e) Plates, brackets and special templating when needed for interface with particular header, door and wall conditions and neighboring hardware.

(f) Adjustable to open with not more than 8.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors.

(g) Separate adjusting valves for closing speed, latching speed and backcheck, fourth valve for delayed action where scheduled.

(h) Extra-duty arms (EDA) at exterior doors scheduled with parallel arm units.

(i) Exterior door closers**:** tested to 100 hours of ASTM B117 salt spray test, furnish data on request.

(j) Exterior doors**.** seasonal adjustments not required for temperatures from 120 degrees F to 0 degrees F, furnish checking fluid data on request.

(k) Non-flaming fluid, will not fuel door or floor covering fires.

(l) Pressure Relief Valves (PRV) not permitted.

(C) Other Hardware.

(1) Kick Plates. Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of bronze or stainless steel to match other hardware.

(2) Door Stops. Provide stops to protect walls, casework or other hardware.

(a) Unless otherwise noted in Hardware Sets, provide floor type with appropriate fasteners. Where floor type cannot be used, provide wall type. If neither can be used, provide overhead type.

(3) Seals. Inelastic, rigid back, not subject to stretching. Self-compensating for warp, thermal bow, door settling, and out-of-plumb. Adhesive warranted for life of installation.

(4) Thresholds. As scheduled and per details. Comply with ICC/ANSI A117.1 Section 404.2.4 & 303. Substitute products**:** certify that the products equal or exceed specified material's thickness. Proposed substitutions**:** submit for approval.

(a) Saddle thresholds. 0.125 inches minimum thickness.

(b) Exteriors. Seal perimeter to exclude water and vermin. Use sealant complying with requirements in Division 7 "Thermal and Moisture Protection". Minimum 0.25 inch diameter fasteners and lead expansion shield anchors, or Red-Head #SFS-1420 (or approved equivalent) Flat Head Sleeve Anchors (SS/FHSL).

(c) Fire-rated openings, 90-minutes or less duration. use thresholds to interrupt floor covering material under the door where that material has a critical radiant flux value less than 0.22 watts per square centimeter, per NFPA 253. Use threshold unit as scheduled. If none scheduled, request direction from Architect.

(d) Plastic plugs with wood or sheet metal screws are not an acceptable substitute for specified fastening methods.

(e) Fasteners. Generally, exposed screws to be Phillips or Robertson drive. Pinned TORX drive at high security areas. Flat head sleeve anchors (FHSL) may be slotted drive. Sheet metal and wood screws**:** full-thread. Sleeve nuts**:** full length to prevent door compression.

(5) Through-bolts. Do not use. Coordinate with wood doors; ensure provision of proper blocking to support wood screws for mounting panic hardware and door closers. Coordinate with metal doors and frames; ensure provision of proper reinforcement to support machine screws for mounting panic hardware and door closers.

(a) Exception. surface-mounted overhead stops, holders, and friction stays.

(6) Silencers. Interior hollow metal frames, 3 for single doors, 4 for pairs of doors. Leave no unfilled/uncovered pre-punched silencer holes. Intent**:** door bears against silencers, seals make minimal contact with minimal compression – only enough to effect a seal.

(D) Schedule of Finish Hardware.

(1) See door schedule in drawings for hardware set assignments.

CATEGORY	VENDOR NAME	MFG
DOOR HARNESS (ELEC)	BY McKINNEY PRODUCTS COMPANY	MCK
ELECTRICAL HINGE	BY McKINNEY PRODUCTS COMPANY	MCK
FRAME HARNESS (ELEC)	BY McKINNEY PRODUCTS COMPANY	MCK
HINGE	BY McKINNEY PRODUCTS COMPANY	MCK
ASTRAGAL	BY PEMKO MANUFACTURING CO.	PEM
AUTO. DOOR BOTTOM	BY PEMKO MANUFACTURING CO.	PEM
DOOR BOTTOM	BY PEMKO MANUFACTURING CO.	PEM
DOOR SEAL	BY PEMKO MANUFACTURING CO.	PEM
SPLIT ASTRAGAL	BY PEMKO MANUFACTURING CO.	PEM
THRESHOLD	BY PEMKO MANUFACTURING CO.	PEM
AUTOMATIC FLUSH BOLT	BY ROCKWOOD MANUFACTURING CO.	ROC
COMB. FLUSH BOLT	BY ROCKWOOD MANUFACTURING CO.	ROC
COORDINATOR	BY ROCKWOOD MANUFACTURING CO.	ROC
WALL OR FLOOR STOP	BY ROCKWOOD MANUFACTURING CO.	ROC
CONCEALED O.H.STOP	BY SARGENT MANUFACTURING COMPANY	SAR
DOOR CLOSER	BY SARGENT MANUFACTURING COMPANY	SAR
ELEC CVR PANIC DEV	BY SARGENT MANUFACTURING COMPANY	SAR
ELEC LOCK	BY SARGENT MANUFACTURING COMPANY	SAR
ELEC RIM PANIC DEV	BY SARGENT MANUFACTURING COMPANY	SAR
POWER SUPPLY	BY SECURITRON MAGNALOCK CORP.	SEC

HW GROUP - 001 (NOT USED)

5.0 EA	HINGE	TA2314 4.5 X 4.5 US10B-NRP	MCK
1.0 EA	ELECTRICAL HINGE	QC12-TA2314 4.5 X 4.5 US10B	MCK
1.0 EA	COMB. FLUSH BOLT	2805/2905 613 AS REQUIRED (TOP BOLT)	ROC
1.0 EA	ELEC LOCK	SN200-82271 BIPS03 LNL US10B WBS KEY TO EXISTING MASTER KEY SYSTEM.	SAR
1.0 EA	COORDINATOR	1700 BLACK	ROC
2.0 EA	DOOR CLOSER	351 CPS EB	SAR
1.0 EA	THRESHOLD	172D	PEM
1.0 EA	DOOR SEAL	PK55D	PEM
2.0 EA	AUTO. DOOR BOTTOM	420APKL OR SIMILAR (PER DETAIL)	PEM
1.0 EA	ASTRAGAL	357D (PER DETAIL)	PEM
1.0 EA	DOOR HARNESS (ELEC)	QC-C___P (SIZE AS REQUIRED)	MCK
1.0 EA	FRAME HARNESS (ELEC)	QC-C1500P	MCK

HW GROUP - 002

2.0	EA	HINGE	TA2314 4.5 X 4.5 US10B-NRP	MCK
			(QTY: 3 HINGES AT DOORS OVER 7'-6" HIGH)	
1.0	EA	ELECTRICAL HINGE	QC12-TA2314 4.5 X 4.5 US10B	MCK
1.0	EA	ELEC RIM PANIC DEV	SN200-8876 BIPS03 ETL US10B WBS	SAR
			KEY TO EXISTING MASTER KEY SYSTEM.	
1.0	EA	DOOR CLOSER	351 CPS EB	SAR
1.0	EA	THRESHOLD	172D	PEM
1.0	EA	DOOR SEAL	PK55D	PEM
1.0	EA	AUTO. DOOR BOTTOM	420APKL OR SIMILAR (PER DETAIL)	PEM
1.0	EA	DOOR BOTTOM	345D (PER DETAIL)	PEM
1.0	EA	DOOR HARNESS (ELEC)	QC-C___P (SIZE AS REQUIRED)	MCK
1.0	EA	FRAME HARNESS (ELEC)	QC-C1500P	MCK

HW GROUP - 003

3.0	EA	HINGE	TA2314 4.5 X 4.5 US10B	MCK
1.0	EA	ELECTRICAL HINGE	QC12-TA2314 4.5 X 4.5 US10B	MCK
1.0	EA	ELEC LOCK	SN200-82271 BIPS03 LNL US10B WBS	SAR
			KEY TO EXISTING MASTER KEY SYSTEM.	
1.0	EA	DOOR CLOSER	351 O EB	SAR
1.0	EA	WALL OR FLOOR STOP	406/441H 613E AS REQUIRED	ROC
1.0	EA	THRESHOLD	172D	PEM
1.0	EA	DOOR SEAL	PK55D	PEM
1.0	EA	AUTO. DOOR BOTTOM	420APKL OR SIMILAR (PER DETAIL)	PEM
1.0	EA	DOOR HARNESS (ELEC)	QC-C___P (SIZE AS REQUIRED)	MCK
1.0	EA	FRAME HARNESS (ELEC)	QC-C1500P	MCK

HW GROUP - 004

3.0	EA	HINGE	TA2314 4.5 X 4.5 US10B	MCK
1.0	EA	ELECTRICAL HINGE	QC12-TA2314 4.5 X 4.5 US10B	MCK
1.0	EA	ELEC LOCK	SN200-82271 BIPS03 LNL US10B WBS	SAR
			KEY TO EXISTING MASTER KEY SYSTEM.	
1.0	EA	DOOR CLOSER	351 O EB	SAR
1.0	EA	CONCEALED O.H.STOP	698 S 10B (32-5/8" - 39-1/8")	SAR
1.0	EA	THRESHOLD	172D	PEM
1.0	EA	DOOR SEAL	PK55D	PEM
1.0	EA	AUTO. DOOR BOTTOM	420APKL OR SIMILAR (PER DETAIL)	PEM
1.0	EA	DOOR HARNESS (ELEC)	QC-C___P (SIZE AS REQUIRED)	MCK
1.0	EA	FRAME HARNESS (ELEC)	QC-C1500P	MCK

HW GROUP - 005

7.0	EA	HINGE	TA2314 4.5 X 4.5 US10B	MCK
1.0	EA	ELECTRICAL HINGE	QC12-TA2314 4.5 X 4.5 US10B	MCK
1.0	EA	AUTOMATIC FLUSH BOLT		2840/2940-613
1.0	EA	ELEC LOCK	SN200-82271 BIPS03 LNL US10B WBS	SAR
			KEY TO EXISTING MASTER KEY SYSTEM.	
1.0	EA	COORDINATOR	1700 BLACK	ROC
2.0	EA	DOOR CLOSER	351 O EB	SAR
2.0	EA	WALL OR FLOOR STOP	406/441H 613E AS REQUIRED	ROC
1.0	EA	THRESHOLD	172D	PEM
1.0	EA	DOOR SEAL	PK55D	PEM

2.0 EA	AUTO. DOOR BOTTOM	420APKL OR SIMILAR (PER DETAIL)	PEM
1.0 EA	ASTRAGAL	357D (PER DETAIL)	PEM
1.0 EA	DOOR HARNESS (ELEC)	QC-C___P (SIZE AS REQUIRED)	MCK
1.0 EA	FRAME HARNESS (ELEC)	QC-C1500P	MCK
		HW GROUP - 006 (NOT USED)	
6.0 EA	HINGE	TA2314 4.5 X 4.5 US10B-NRP	MCK
2.0 EA	ELECTRICAL HINGE	QC12-TA2314 4.5 X 4.5 US10B	MCK
1.0 EA	ELEC CVR PANIC DEV	55-WD8610 US10B EXIT ONLY	SAR
1.0 EA	ELEC CVR PANIC DEV	SN200-WD8674 BIPS03 ETL 106 US10B KEY TO EXISTING MASTER KEY SYSTEM.	SAR
2.0 EA	DOOR CLOSER	351 CPS EB	SAR
1.0 EA	THRESHOLD	172D	PEM
1.0 EA	DOOR SEAL	PK55D	PEM
2.0 EA	DOOR BOTTOM	345DV	PEM
2.0 EA	SPLIT ASTRAGAL	29310DS	PEM
2.0 EA	DOOR HARNESS (ELEC)	QC-C___P (SIZE AS REQUIRED)	MCK
2.0 EA	FRAME HARNESS (ELEC)	QC-C1500P	MCK
		HW GROUP - 007 (NOT USED)	
3.0 EA	HINGE	TA2314 4.5 X 4.5 US10B-NRP	MCK
1.0 EA	ELECTRICAL HINGE	QC12-TA2314 4.5 X 4.5 US10B	MCK
1.0 EA	ELEC RIM PANIC DEV	SN200-8876 BIPS03 ETL US10B WBS KEY TO EXISTING MASTER KEY SYSTEM.	SAR
1.0 EA	DOOR CLOSER	351 P9 EB	SAR
1.0 EA	WALL OR FLOOR STOP	406/483 613E AS REQUIRED	ROC
1.0 EA	THRESHOLD	172D	PEM
1.0 EA	DOOR SEAL	PK55D	PEM
1.0 EA	AUTO. DOOR BOTTOM	420APKL OR SIMILAR (PER DETAIL)	PEM
1.0 EA	DOOR BOTTOM	345D (PER DETAIL)	PEM
1.0 EA	DOOR HARNESS (ELEC)	QC-C___P (SIZE AS REQUIRED)	MCK
1.0 EA	FRAME HARNESS (ELEC)	QC-C1500P	MCK
		HW GROUP - 008	
1.0 EA	POWER SUPPLY	BPS-24-10 PROVIDE QUANTITY OF POWER SUPPLIES AS REQUIRED.	SEC

672.03 Construction.

(A) References.

(1) Use date of standard in effect as of Bid date.

(a) American National Standards Institute – ANSI 156.18 – Materials and Finishes.

(i) ICC/ANSI A117.1 - 1998 – Specifications for making buildings and facilities usable by physically handicapped people.

(ii) ANSI A156.18 Materials and Finishes

(b) ADA – Americans with Disabilities Act

(c) BHMA – Builders Hardware Manufacturers Association

(d) DHI – Door and Hardware Institute

(e) NFPA – National Fire Protection Association

(i) NFPA 80 – Fire Doors and Windows

(ii) NFPA 105 – Smoke and Draft Control Door Assemblies

(iii) NFPA 252 – Fire Tests of Door Assemblies

(f) UL – Underwriters Laboratories

(i) UL10C – Positive Pressure Fire Tests of Door Assemblies.

(ii) UL 305 – Panic Hardware

(g) WHI – Warnock Hersey Incorporated

(h) Local applicable codes

(i) SDI – Steel Door Institute

(j) WI – Woodwork Institute

(k) AWI – Architectural Woodwork Institute

(l) NAAMM – National Association of Architectural Metal Manufacturers

(2) Abbreviations.

(a) Manufacturers. See table on 672.03(H) of this section

(b) Finishes. See 672.06 of this section.

(B) Submittals and Substitutions.

(1) SUBMITTALS. Submit six copies of schedule. Only submittals printed one sided will be accepted and reviewed. Organize vertically formatted schedule into “Hardware Sets” with index of doors and headings, indicating complete designations of every item required for each door or opening. Minimum 10pt font size. Include following information**:**

(a) Type, style, function, size, quantity and finish of hardware items.

(b) Use BHMA Finish codes per ANSI A156.18.

(c) Name, part number and manufacturer of each item.

(d) Fastenings and other pertinent information.

(e) Location of hardware set coordinated with floor plans and door schedule.

(f) Explanation of abbreviations, symbols, and codes contained in schedule.

(g) Mounting locations for hardware.

(h) Door and frame sizes, materials and degrees of swing.

(i) List of manufacturers used and their nearest representative with address and phone number.

(j) Catalog cuts.

(k) Date of jobsite visit.

(2) Bid and submit manufacturer’s updated/improved item if scheduled item is discontinued.

(3) Deviations. Highlight, encircle or otherwise identify deviations from “Schedule of Finish Hardware” on submittal with notations clearly designating those portions as deviating from this section.

(4) If discrepancy between drawings and scheduled material in this section, bid the more expensive of the two choices, note the discrepancy in the submittal and request direction from Architect for resolution.

(5) Substitutions per Section 106.13. Include product data and indicate benefit to the Project. Furnish operating samples on request.

(6) Items listed with no substitute manufacturers have been requested by Owner to meet existing standard.

(7) Furnish as-built/as-installed schedule with closeout documents, including keying schedule, manufacturers’ installation, adjustment and maintenance information, and supplier’s final inspection report.

(C) Quality Assurance.

(1) Qualifications.

(a) Hardware supplier. direct factory contract supplier who employs a certified architectural hardware consultant (AHC), available at reasonable times during course of work for project hardware consultation to Owner, Architect and Contractor.

(i) Responsible for detailing, scheduling and ordering of finish hardware. Detailing implies that the submitted schedule of hardware is correct and complete for the intended function and performance of the openings.

(2) Hardware. Free of defects, blemishes and excessive play. Obtain each kind of hardware (latch and locksets, exit devices, hinges and closers) from one manufacturer.

(3) Exit Doors. Operable from inside with single motion without the use of a key or special knowledge or effort.

(4) Fire-Rated Openings. NFPA 80 compliant. Hardware UL10C / IBC 2003 Section 715.4.1 (positive pressure) compliant for given type/size opening and degree of label. Provide proper latching hardware, non-flaming door closers, approved-bearing hinges, and resilient seals. Coordinate with wood door section for required intumescent seals. Furnish openings complete.

(5) Furnish hardware items required to complete the work in accordance with specified performance level and design intent, complying with manufacturers' instructions and code requirements.

(D) Delivery, Storage and Handling.

(1) Delivery. coordinate delivery to appropriate locations (shop or field).

(a) Permanent keys and cores. Secured delivery direct to Owner's representative.

(2) Acceptance at Site. Items individually packaged in manufacturers' original containers, complete with proper fasteners and related pieces. Clearly mark packages to indicate contents, locations in hardware schedule and door numbers.

(3) Storage. Provide securely locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, dust, excessive heat and cold, etc.

(E) Project Conditions and Coordination.

(1) Where exact types of hardware specified are not adaptable to finished shape or size of members requiring hardware, provide suitable types having as nearly as practical the same operation and quality as type specified, subject to Architect's approval.

(2) Coordination. Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents. Furnish related trades with the following information**:**

(a) Location of embedded and attached items to concrete.

(b) Location of wall-mounted hardware, including wall stops.

(c) Location of finish floor materials and floor-mounted hardware.

(d) At masonry construction, coordinate with the anchoring and hollow metal supplier prior to frame installation by placing a strip of insulation, wood, or foam, on the back of the hollow metal frame behind the rabbet section for continuous hinges, as well as at rim panic hardware strike locations, silencers, coordinators, and door closer arm locations. When the frame is grouted in place, the backing will allow drilling and tapping without dulling or breaking the installer's bits.

(e) Locations for conduit and raceways as needed for electrical hardware items. Fire/life-safety system interfacing. Point-to-point wiring diagrams plus riser diagrams to related trades.

(f) Coordinate. flush top rails of doors at out-swinging exteriors, and throughout where adhesive-mounted seals occur.

(g) Manufacturers' templates to door and frame fabricators.

(3) Check Shop Drawings for doors and entrances to confirm that adequate provisions will be made for proper hardware installation.

(4) Environmental considerations. segregate unused recyclable paper and paper product packaging, uninstalled metals, and plastics, and have these sent to a recycling center.

(5) Prior to submittal, carefully inspect existing conditions to verify finish hardware required to complete Work, including sizes, quantities, existing hardware scheduled for re-use, and sill condition material. If conflict between the specified/scheduled hardware and existing conditions, submit request for direction from Architect. Include date of jobsite visit in the submittal.

(a) Submittals prepared without thorough jobsite visit by qualified hardware expert will be rejected as non-compliant.

(F) Warranty.

(1) Part of respective manufacturers' regular terms of sale. Provide manufacturers' written warranties**:**

(a) Locksets. Three years

(b) Extra Heavy Duty. Ten years Cylindrical Lock (ND Series Lever)

(c) Exit Devices. Three years mechanical, One year electrical

(d) Closers (4000/1460 Series). Thirty years mechanical, Two years electrical

(e) Hinges. One year

(f) Other Hardware**.** Two years

(G) Commissioning.

(1) Conduct these tests prior to request for certificate of substantial completion**:**

(a) With installer present, test door hardware operation with climate control system and stairwell pressurization system both at rest and while in full operation.

(b) With installer and electrical contractor present, test hardware interfaced with fire/life-safety system for proper operation and release.

(H) Manufacturers.

(1) Manufacturers and their abbreviations used in the schedule:

ACC	Accurate Lock
IVE	H. B. Ives

LCN	LCN Closers
PEM	Pemko
SCH	Schlage Lock Company

(I) Hinging Methods.

(1) Drawings typically depict doors at 90 degrees, doors will actually swing to maximum allowable. Use wide-throw conventional or continuous hinges as needed up to 8 inches in width to allow door to stand parallel to wall for true 180-degree opening. Advise architect if 8-inch width is insufficient.

(2) Conform to manufacturer's published hinge selection standard for door dimensions, weight and frequency, and to hinge selection as scheduled. Where manufacturer's standard exceeds the scheduled product, furnish the heavier of the two choices, notify Architect of deviation from scheduled hardware.

(3) Conventional Hinges. Steel or stainless steel pins and concealed bearings. Hinge open widths minimum, but of sufficient throw to permit maximum door swing.

(a) Outswinging exterior doors. Non-ferrous with non removable (NRP) pins and security studs.

(b) Non-ferrous material exteriors and at doors subject to corrosive atmospheric conditions.

(4) Pivots. high-strength forged bronze or stainless steel, tilt-on precision bearing and bearing pin.

(a) Bottom and intermediate pivots. Adjustability of minus 0.063 inch, plus 0.125 inch.

(J) Finish

(1) General. BHMA 613 Oil Rubbed Bronze.

(a) Areas using BHMA 613. furnish push-plates, pulls and protection plates of BHMA 613.

(2) Door closers. factory powder coated to match other hardware, unless otherwise noted.

(K) Keying Requirements.

(1) Key System. Existing key system. Initiate and conduct meeting(s) with Owner to determine system structure, furnish Owner's written approval of the system; do not order keys or cylinders without written confirmation of actual requirements from the Owner. Furnish temporary construction-keyed and permanent cylinders. Contractor to demonstrate to the Owner that temporary keys no longer operate the locking cylinders at the end of the project.

(L) Acceptable Installers.

(1) Can read and understand manufacturers' templates, suppliers' hardware schedule and printed installation instructions. Can readily distinguish drywall screws from manufacturers' furnished fasteners. Available to meet with manufacturers' representatives and related trades to discuss installation of hardware.

(M) Preparation.

(1) Ensure that walls and frames are square and plumb before hardware installation. Make corrections before commencing hardware installation. Installation denotes acceptance of wall/frame condition.

(2) Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes.

(a) Notify Architect of code conflicts before ordering material.

(b) Locate latching hardware between 34 inches to 44 inches above the finished floor.

(c) Locate panic hardware between 36 inches to 44 inches above the finished floor.

(d) Where new hardware is to be installed near existing doors/hardware scheduled to remain, match locations of existing hardware.

(3) Existing frames and doors to be retrofitted with new hardware**:**

(a) Field-verify conditions and dimensions prior to ordering hardware. Fill existing hardware cut outs not being reused by the new hardware. Remove existing hardware not being reused, return to Owner unless directed otherwise.

(b) Remove existing floor closers not scheduled for reuse, fill cavities with non-shrinking concrete and finish smooth.

(c) Cut and weld existing steel frames currently prepared with 2.25 inch height strikes. Cut an approximate 8 inch section from the strike jamb and weld in a reinforced section to accommodate specified hardware's strike.

(d) Provide wrap-around repair plates at doors where required to cover the original preparation and allow installation of new hardware.

(N) Installation.

(1) Install hardware per manufacturer's instructions and recommendations. Do not install surface-mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation. Remove and reinstall or replace work deemed defective by Architect.

(a) Gaskets. install jamb-applied gaskets before closers, overhead stops, rim strikes, etc.; fasten hardware over and through these seals. Install sweeps across bottoms of doors before astragals, cope sweeps around bottom pivots, trim astragals to tops of sweeps.

(b) When hardware is to be attached to existing metal surface and insufficient reinforcement exists, use RivNuts, NutSerts or similar anchoring device for screws.

(c) Use manufacturers' fasteners furnished with hardware items, or submit Request for Substitution with Architect.

(d) Replace fasteners damaged by power-driven tools.

(2) Locate floor stops no more than 4 inches from walls and not within paths of travel. See paragraph 2.02 regarding hinge widths, door should be well clear of point of wall reveal. Point of door contact no closer to the hinge edge than half the door width. Where situation is questionable or difficult, contact Architect for direction.

(3) Core concrete for exterior door stop anchors. Set anchors in approved non-shrink grout.

(4) Drill pilot holes for fasteners in wood doors and/or frames.

(5) Lubricate and adjust existing hardware scheduled to remain. Carefully remove and give to Owner items not scheduled for reuse.

(6) Field-verify existing conditions and measurements prior to ordering hardware. Fill existing hardware cut outs not being used by the new hardware.

(7) Remove existing hardware not being reused. Tag and bag removed hardware, turn over to Owner.

(8) Where existing wall conditions will not allow door to swing using the scheduled hinges, provide wide-throw hinges and if needed, extended arms on closers.

(9) Provide manufacturer's recommended brackets to accommodate the mounting of closers on doors with flush transoms.

(O) Adjusting.

(1) Adjust and check for proper operation and function. Replace units, which cannot be adjusted to operate freely and smoothly.

(a) Hardware damaged by improper installation or adjustment methods. Repair or replace to Owner's satisfaction.

(b) Adjust doors to fully latch with no more than 1 pound of pressure.

(c) Adjust door closers for proper function.

(2) Fire-rated doors.

(a) Wood doors. Adjust to 0.125 inches clearance at heads, jambs, and meeting stiles.

(b) Steel doors. Adjust to 0.063 inches minimum to 0.188 inches maximum clearance at heads, jambs, and meeting stiles.

(c) Adjust wood and steel doors to 0.75 inches maximum clearance (undercut) above threshold or finish floor material under door.

(3) Final inspection. Installer to provide letter to Owner that upon completion installer has visited the Project and has accomplished the following**:**

(a) Has re-adjusted hardware.

(b) Has evaluated maintenance procedures and recommend changes or additions, and instructed Owner's personnel.

(c) Has identified items that have deteriorated or failed.

(d) Has submitted written report identifying problems.

(P) Demonstration.

(1) Demonstrate mechanical hardware and electrical hardware systems, including adjustment and maintenance procedures.

(Q) Protection/Cleaning.

(1) Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion.

(2) Clean adjacent wall, frame and door surfaces soiled from installation / reinstallation process.

672.04 Measurement. Finish hardware will be paid on a lump sum basis. Measurement for payment will not apply.

672.05 Payment. The Engineer will not pay for the finish hardware separately. The Engineer will consider the price for the finish hardware included in the contract price for Section 672 – FINISH HARDWARE.

The price includes full compensation for finish hardware and furnishing labor, tools, materials, equipment and incidentals necessary to complete the work.

The Engineer will pay for the following pay item when included in the proposal schedule:

Pay Item	Pay Unit
Finish Hardware	Lump Sum”

END OF SECTION 672

Make the following Section a part of the Standard Specifications:

SECTION 673 - PHOTOVOLTAIC SYSTEM

673.01 General

(A) This Section includes the following for electrical work:

(1) Installation of a utility grid connected photovoltaic (PV) system.

(2) Installation, including all materials, labor, equipment, insulation, connectors, roofing system components, services, permits, and incidentals necessary to install an operational PV system as specified hereinafter, including, but not limited to, the work included in this specification.

(3) Work includes any necessary upgrades or modifications to the distribution system panel or new panel as required for the proper operation of the PV system.

(4) Any additional work related to the PV system installation, such as coring, drilling, and securement of miscellaneous related equipment.

(5) Access and lift equipment necessary to move equipment and related components.

673.02 Rules, Regulations and Standards

(A) The most recent edition of any relevant regulation, standard, document, or code shall be in effect. Where conflict among the requirements or with these specifications exists, the most stringent requirements shall apply. Such documents include, but are not limited to, the following:

(1) ASHRAE/IESNA 90.1-2004: Energy Standard for Buildings Except Low-Rise Residential, and Informative Appendix G-Performance Rating Method.

673.03 Job Condition

(A) Examine roof, roof deck surface, and conditions under which PV system work is to be performed, and notify the Contracting Officer in writing of conditions detrimental to proper completion of the work and performance of system. Ensure minimum PV capacity can be met as indicated. Do not proceed with work until unsatisfactory conditions

have been corrected in a manner acceptable to the State of Hawaii.

(B) Weather Conditions: Do not proceed with installation of PV system under adverse weather conditions. Proceed with the work only when weather conditions are favorable for electrical work and proper cure and development of roof sealants.

673.04 Submittals

(A) Submittals shall comply with the following requirements:

(1) Submit shop drawings showing proposed equipment and distribution raceway layouts on plan in not less than 1/8" = 1'-0" scale. Raceway routing shall be coordinated with architectural, structural and mechanical systems and other trades

(a) Mounting details where not shown on drawings or alternate methods are proposed or required.

(b) Photovoltaic system layout and racking system design, including details of the roof/racking system interface.

(2) Manufacturer's product data is required for the following:

(a) Modules

(b) Inverter

(c) Racking system

(d) Roof warranty statement per 673.06.

Submit additional product data upon request; i.e., raceway accessories, boxes and enclosures for exterior and wet locations, wiring devices, etc.

(3) Equipment specified by manufacturer's definitive brands or catalog numbers without modifications need not be submitted, unless clarification is required due to obsolescence, supersedure, or error in identification.

(4) Standard features of equipment specified by manufacturer’s definitive brands or catalog numbers, whether specifically described or not on the drawings or in the specifications, will mandate the inclusion of optimal features of listed equivalent manufacturers and can be also used to evaluate competitive brands proposed by the Contractor.

(5) Any deviation from drawings and specifications shall be clearly identified on the submittal. Unless deviations are clearly identified, then all requirements indicated on the drawings and specifications shall be assumed to be complied with.

(6) Shop drawing and product data shall be checked by Contractor to insure equipment are adequately sized and can be properly installed and with Code clearances maintained for a complete and operable system within intent indicated on plans and specifications. Review and acceptance of shop drawings by Contracting Officer shall not relieve the Contractor of responsibility to provide a proper and complete installation.

(7) Obtain utility company approval for all metering equipment.

(8) Submit samples of materials and equipment upon request.

(9) Warranty: Submit warranty as noted under item entitled ”WARRANTIES” hereinbelow.

(B) Certificates: Certificates of electrical inspection.

(C) As-Built Drawings:

(1) Contractor shall provide drawings of complete electrical system on 24" x 36" mylars showing as-installed locations of equipment and wiring on plans, including circuiting, details, etc., or mylar reproductions of contract drawings with all changes neatly drafted thereon. In addition, Contractor shall update Autocad Release 2010 files of as-built construction drawings on CD recordable disks along with as-built mylars. Incomplete or unsatisfactory as-built drawings or CAD files shall be grounds for rejection by the Contracting Officer. Contractor shall revise and resubmit as-built drawings and CAD files at no additional cost to State of Hawaii until accepted by the Contracting Officer.

(2) Deliver to the Contracting Officer not later than two (2) weeks before final inspection.

(E) Operation and Maintenance Manuals:

(1) Provide six (6) operation and maintenance manuals for the photovoltaic system including technical information for all components, wiring diagrams and instructions for installation, operation, maintenance and repair.

(2) Deliver to the Contracting Officer not later than two (2) weeks before final inspection.

673.05 Drawing and Specifications

(A) Electrical system drawings are diagrammatic and symbolic. Locations of fixtures, outlets, devices, raceways, apparatus, etc., shown are approximate and shall be installed with the required heights, spacing, maintenance and code clearances and to avoid conflict with existing conditions and other systems and trades. Visit site and verify lineal footages required and check scales and dimensions shown on civil and architectural drawings prior to bidding to verify locations, routing and lineal footages of electrical work required for inclusion into bid. Study adjacent civil, architectural, structural and mechanical details and make installation in most logical manner for eye appeal and coordination with other systems and trades. Unless dimensioned or noted otherwise, orderly configuration and visual composition are fully intended.

(B) Include mounting accessories, additional components and wiring which are not shown or specified herein but are required for proper control and operation to provide for a complete and operable system within intent indicated on the drawings and specifications.

(C) Study architectural, mechanical and civil drawings and specifications prior to bidding and provide additional wiring including lighting fixtures, apparatus and devices for equipment furnished by State of Hawaii or other trades without additional cost to State of Hawaii.

(D) Relocate fixtures, outlets, devices, apparatus and associated wiring including raceways, from locations shown, without additional cost to State of Hawaii, for code compliance and to avoid conflict with existing conditions, other systems or trades, structures, utilities and when directed before installation.

(E) Equipment ratings or wire sizes that are missing or shown in error shall have adequate capacity to serve the required and future loads plus minimum 25 percent spare capacity, and be in compliance with N.E.C.

(F) Verify voltages and other ratings of energy conversion, transformation and electrical utilization equipment prior to placing order with factory. Input voltages of equipment shall match system voltage available.

(G) In the event of conflicts within the drawings, specifications or any referenced code, standards or requirements, the more rigorous requirements shall govern.

673.06 Warranties

(A) Entire installation shall be warranted to be free from defects for a one (1) year period commencing from date of final acceptance. Any portion of the installation developing defects within the one year period shall be replaced by identical or better equipment, materials or parts including labor to make such defective portion of the installation complete and operable within the intent indicated on drawings and specifications, at no additional cost to State of Hawaii.

(B) Photovoltaic modules shall have a 5-year material and workmanship manufacturer's warranty, and a 25-year power output warranty. See Performance Guarantee section below. The surety shall not be held liable beyond 2 years from the project acceptance date.

(C) Inverter shall have an extended 20-year manufacturer's warranty. The surety shall not be held liable beyond 2 years from the project acceptance date.

(D) Roof Warranty: Installation of the PV system shall be completed in a fashion that maintains the existing roof warranty. The Contractor shall obtain written confirmation from the roof system manufacturer stating that the warranty for the roof will remain in full effect after the PV system is installed.

673.07 Performance Guarantee

(A) The PV system's Power (kw AC PTC) output will be guaranteed for a period of 5 years.

(B) The power output shall degrade no more than 7% in 12 years, and 15% in 25 years.

673.08 General Materials

(A) All equipment and material shall bear U/L label or be listed by a nationally recognized testing organization in accordance with the National Electrical Code.

(B) Equipment and material specified by manufacturers' catalog numbers and names: In case of obsolescence, supersedure, or error in identification, the intent implied by the description, application, required performance and the features of competitive brands also listed shall govern.

(C) Features of equipment for specified manufacturers can be used to establish the quality of the product.

(D) All equipment and materials shall be suitable for intended location and use and include all accessories for proper installation and operation.

(E) The PV modules shall be certified by Underwriter Laboratories (UL) Standard 1703 Standard for Safety for Flat-Plate Photovoltaic Modules and IEEE Standard 1262-1995 IEEE Recommended Practice for Qualification of Photovoltaic (PV) Modules and Panels. The system shall be composed of UL-listed components in cases where UL-listed components are available.

(F) PV modules shall be tested in the factory for design performance.

(G) Inverters shall be factory tested for performance.

(H) All installations shall meet or exceed OSHA requirements for roof and equipment access.

673.09 Materials

(A) General:

(1) Materials shall be designed to withstand the temperatures and salt environments to which they are exposed.

(2) Dissimilar materials should be isolated from one another using non-conductive shims, washers, or other approved methods.

(3) Metals shall be stainless steel or anodized aluminum.

(4) Aluminum shall not be placed in direct contact with concrete.

(5) Structural members shall be corrosion-resistant aluminum, or type 6061, 6063, or 316 stainless steel in compliance with the drawings.

(6) All electrical equipment shall be rated for the current and voltage ratings necessary for the application.

(B) PV Modules

(1) PV modules shall be rated Class A per IEC 61730-2007 and must be on the CEC eligible equipment list and qualify for federal and state tax credit and local utility rebate programs.

(2) PV modules shall have a minimum module efficiency of 13.5% and provide a minimum of 225 w DC (STC) or 198 w DC (PTC).

(3) PV modules power output shall not decline more than 7% in 12 years, and 15% in 25 years.

(4) Basis of Design Product:

(a) BP 3225T or preapproved equal.

(C) Racking System

(1) PV modules shall be mechanically anchored to the roof deck.

(2) The racking system shall result in the installation of a PV system that meets all local seismic and wind requirements.

(3) The racking system shall be composed of corrosion-resistant materials. Components shall be Type 316 stainless steel and anodized aluminum. Hardware shall be stainless steel.

(4) The racking system shall not alter the roofing system manufacturer's warranty.

(5) Basis of Design Product:

(a) Prosolar Solar Wedge XD or preapproved equal.

(D) Inverter

(1) The inverter shall be rated at 10% greater than the PV system's AC output. The inverter shall be sized so that it can operate the PV array at maximum power for the coldest and hottest expected array operating temperatures.

(2) The inverter shall be on the CEC eligible equipment list and qualify for federal and state tax credit and local utility rebate programs.

(3) Installation shall meet all applicable UL 1741, IEEE Standard 929-2000 and standard 519, NEC codes, and the latest applicable ANSI and FCC standards and addenda dated prior to the award of the purchase order for this procurement.

(4) The inverter shall include:

(a) Automatic operation, which includes start-up, shut-down, self-diagnosis, and fault detection.

(b) Digital Signal Processor (DSP) based controls with self-diagnostics and LCD for display of operating status.

(c) Inverter shut-off and reset switches.

(d) Inverter shut-off and reset switches.

(e) Anti-islanding protection to prevent back-feeding inverter-generated power to the grid in the event of a utility outage.

(f) Maximum power point tracking (MMPT), matching the inverter to the array, as well as adjustable delay periods to customize system shut-down sequences.

(g) Continuous power rating that exceeds the PV array output.

(h) Combiner inputs.

(5) Physical and Electrical Characteristics

(a) 208 Volts, three-phase AC, +/- 10%

(b) Nominal AC frequency of 60 Hz, +/- 0.5 Hz.

(c) Line Power Factor greater than 0.99 at and above 20% of rated power.

(d) AC current distortion at rated power will be less than 5% THD.

(e) Maximum open circuit voltage shall be 600V.

(f) Maximum efficiency shall be greater than 95%.

(g) Standby tare losses shall be 30W or less.

(h) Ambient temperature rating shall be from minus 4F to 122F.

(i) Enclosure shall have an environmental rating of NEMA 3R.

(j) Non-condensing relative humidity from 0-95%.

(k) AC disconnect – NEMA 3R-rated wall mount enclosure; load break-rated.

(l) DC disconnect – NEMA 3R-rated wall mount enclosure; 600VDC load break-rated.

(m) (5) 40ADC combiner inputs with equal fuse ratings.

(6) Basis of Design Product:

(a) Satcon PVS-50 (208V) or approved equal.

(E) Combiner Box

(1) Rated for 600 VDC, integral fuse cover/puller, minimum 100A output current combiner box.

(2) 12-circuit with integral string monitoring system.

(3) Shall be compatible with energy monitoring system.

(4) The enclosure shall be lockable NEMA 4.

(5) Basis of Design Product:

(a) Satcon Smart Subcombiner, or approved equal.

(F) Energy Monitoring System

(1) As a minimum, the remote monitor shall monitor the following:

(a) Building demand.

(b) Photovoltaic generation.

(c) DC string level.

(2) The data monitoring system shall be available online through a Username/Password-designated website mode.

(3) The monitor shall activate an alarm when system is not performing within specified parameters.

(4) The monitoring system shall be able to store historical data

and provide the capability to generate an energy invoice for KWH generated by the photovoltaic system.

(5) Basis of Design Product:

(a) Satcon PV Zone and PV View Plus, or approved equal.

673.10 Apparatus

(A) Control Apparatus and Devices

(1) Lighting Control Panel shall consist of up to 24 single pole contactors, rated at 30 amperes, 120/277 volts, A.C., with a microprocessor based controller with 24 digital outputs to provide for 365-day scheduling, multiple on/off operations per day for each contactor or inputs from an external source or local pushbutton controls, digital LED readouts, minimum 90 day battery backup, in a recessed or surface mounted enclosure with hinged door. A control diagram shall be mounted on the cabinet door.

673.11 Installation

(A) Manufacturer's Instructions: Comply with manufacturer's printed instructions except where more stringent requirements are shown or specified, and except where manufacturer's technical representative directs otherwise.

(B) Examination: Examine roof and concrete deck surfaces at all racking system penetrations for compliance with preparatory requirements for roof repair work. Do not proceed with installation of PV system until satisfactory conditions have been corrected.

(C) General

(1) The installation shall be completed without affecting electrical system components, equipment or wiring systems, mechanical equipment, roof drains, or plumbing.

(2) The installation shall be completed in a "workman-like manner". The area shall be kept clean and free of obstructions at all times.

(3) All electrical connections and terminations shall be fully tightened, secured, and strain-relieved as required by the 2017 National Electrical Code and equipment manufacturers' published directives.

(4) All mounting equipment shall be installed to the manufacturer's specifications. Maintain module tilt as indicated on the plans. Maintain module height across racks.

(5) All roof penetrations shall be sealed.

(6) All cables, conduit, exposed conductors, and electrical boxes should be secured and supported as required by the National Electrical Code unless noted on the electrical drawings.

(7) Comply with adopted, applicable State of Hawaii, and City and County of Honolulu regulations and directives.

(8) Comply with adopted, applicable federal, State of Hawaii, and City and County of Honolulu environmental regulations.

(9) Procure and pay for required permits.

(10) All series-connected strings of modules must include a series fuse as required by UL and NEC to prevent wiring to other system components. Parallel connections of modules in individual source circuits are not permitted. Parallel-connected cells within individual modules are allowable as long as the module listing allows for the series fuse required for this configuration.

(11) System switching and metering equipment shall have convenient access for resetting or repair during electrical outages, and regular monitoring for data retrieval.

673.12 System Electrical

(A) Coordinate with Section 670.

(1) The modules shall be interconnected using cable assemblies. The pigtails shall be electrical wiring connections rated for the application.

(2) All wiring shall be listed for a minimum operation of 600 volts and temperature rating of 90C in wet locations. All current-carrying conductors shall be enclosed in conduit, excluding module interconnections and connections from individual module strings to the combiner boxes.

(3) Each system will have at least one terminal box, providing a watertight entry to the conduit leading to the combiner box. The terminal box and combiner box can be one physical unit.

(4) Each system shall have a combiner box, containing fuses and a bus to combine the outputs of the strings as indicated on the drawings.

(5) Each system shall have one inverter. Full specifications of each inverter shall be supplied as part of the system design documentation submittal. An isolation transformer shall be part of each system for interfacing to the building's electrical system.

673.13 Installation Standards

(A) Obtain certification from a Professional Engineer that the structural integrity of the facility is not compromised by the installation of the PV system and/or the electrical equipment.

(B) The installation shall be completed with a minimum of impact on the environment.

(C) Array-mounting hardware shall be compatible with the site considerations and environment. Special attention shall be paid to minimizing the risk from exposed fasteners, sharp edges, and potential damage to the modules or support structures. Corrosion resistance and durability of the mechanical hardware shall be emphasized – the use of stainless steel fasteners and aluminum support structures are required. The use of ferrous metals, wood, or plastic components is not acceptable.

673.14 Protection

(A) Protect existing roofing system, mechanical, and electrical equipment from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of project acceptance. If, despite such protection, damage or deterioration occurs, repair or replace damaged or deteriorated materials or components immediately at no cost to the State of Hawaii.

673.15 System Startup

(A) System Output Measurement: The Contractor will establish the initial system output to prove that the system is performing as it is designed, and to establish a baseline to be used for warranty. The system output will be verified after construction of the system has been completed, on a clear, sunny day.

(B) Prior to inverter startup, voltages will be recorded for each string, each sub-array, and the entire array. The strings that make up each sub-array will be clearly identified on a drawing by a number. Measurements will be recorded and provided to the State of Hawaii in

a clear, tabular format. Each voltage measurement will include the following data: the date; the time of day that the measurement was taken; a sample panel temperature at the time; the dry-bulb temperature at the time; and the solar irradiation at the time.

(C) After inverter startup, current shall be recorded for each string, each sub-array, and the entire array. Measurements will be recorded and provided to the University in a clear, tabular format. Each voltage measurement will include the following data: the date; the time of day that the measurement was taken; a sample panel temperature at the time; the dry-bulb temperature at the time; and the solar irradiation at the time.

(D) Each module shall be factory flash tested using Standard Test Conditions (STC) to establish the performance of each PV module. A copy of the flash test results shall be supplied to the State of Hawaii. As an alternative, the contractor shall use a "test module" that has been bench tested at STC conditions at the manufacturer's facility to establish the instantaneous performance of the system upon start-up. The contractor shall sample one out of ten strings, comparing the string output to the test module. The test module shall be placed adjacent to the string being tested, on the same slope, and allowed to come to an equal temperature to the string. The string output shall be within 1% of the expected output based on the test module. Any modules that do not perform to specification shall be replaced. If more than one string tests outside of the specification, all strings will be tested.

(E) Start-up shall be per all manufacturers' instructions.

(F) An on-site training session shall be provided. The session will cover safety, maintenance, and system monitoring.

673.16 Project Closeout

(A) Clean all equipment and PV panels with approved materials.

(B) Clean all work areas, removing any debris.

(C) Prepare (3) copies of operating and maintenance manuals in hard cover binders and deliver to the University. At a minimum, the binders shall include:

(1) A complete set of all approved submittals, including shop drawings and product literature.

(2) As built drawings showing the final placement of all modules, combiner boxes, connections, and conduit placement.

(3) As built electrical plans, including three line diagrams and elevation drawings showing the final placement of all electrical equipment.

(4) Cleaning instructions for the PV modules.

(5) Copies of all start-up procedure measurements.

(6) Copies of all testing data and reports.

673.17 Payment

The Engineer will pay for the accepted pay items listed below at the contract price per pay unit, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for each of the following pay items when included in the proposal schedule:

Pay Item	Pay Unit
Photovoltaic System	Lump Sum

END OF SECTION 673

Make the following Section a part of the Standard Specifications:

"SECTION 676 - GYPSUM BOARD

676.01 Description. This section describes the gypsum board work.

(A) Provide all materials, labor, equipment and tools necessary to complete system board installation work where indicated on the drawings and as specified herein. Work shall include, but not be limited to, the following:

(1) Gypsum board on metal framing and furring.

(2) Metal wall and soffit framing, furring, and ceiling framing and suspension system for gypsum board partitions and ceilings.

(3) Additional metal wall framing and backer plates for support of fixtures and toilet accessories.

(B) Related Work Specified Elsewhere:

(1) **Section 677 – CERAMIC TILE**: Coordinate installations.

(2) **Section 681 – PAINTING.**

676.02 Materials.

(A) Gypsum Board. ASTM C 36 “Gypsum Board”, 5/8-inch thick unless indicated otherwise, tapered edges, 48-inches wide, Type “X”.

(B) Water Resistant Gypsum Board**.** ASTM C 630 “Water-Resistant Gypsum Backing Board”, Type “WR”, 5/8-inch thick unless indicated otherwise, tapered edges, 48-inches wide, Type “WR-X”.

(C) Cementitious Backer Unit. ANSI A118.9, ANSI C 1186, 5/8-inch thick glass mesh mortar units, used for base under ceramic tile in wet areas. “Wonder Board” by Glasscrete, Inc., “Durock Tile Backer Board” by USG Industries, Inc. or approved equal products. Provide tape and joint compound materials as recommended by manufacturer.

(D) Board Fasteners. ASTM C 1002 “Steel Drill Screws for the Application of Gypsum or Metal Plaster Bases”, standard bugle head self-drilling, self-tapping corrosive-resistant drywall screws. Screws used in fire-resistive rated construction shall be of type approved for use by governing building code.

(E) Non-Load Bearing Studs. ASTM C 645 “Non-Load (Axial) Bearing Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board”. Studs shall be rolled formed channel of minimum 20 gauge galvanized steel, ASTM A 653 “Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process”, G60 coating. Provide holes and notches for conduit or electrical wiring. Adjust stud to a heavier gauge where required by the manufacturer’s recommendations for stud wall heights and ceiling supports.

(F) Furring Channels. ASTM C 645, hat-shaped, 7/8-inch deep, hot-dipped galvanized, 25 gauge.

(G) Ceiling Support Materials and Systems.

(1) General. Size ceiling support components to comply with ASTM C 754 “Installation of Steel Framing Members to Receive Screw-Attached Gypsum” unless indicated otherwise.

(2) Direct Suspension Systems. Provide systems where indicated and/or required. Manufacturer’s standard zinc-coated or painted steel system of furring runner, furring tees, furring channels, carrying channels, and accessories designed for concealed support of gypsum drywall ceilings; of proper type for use intended. Provide system from one of the following or approved equal or as indicated.

(a) Chicago Metallic Corp.

(b) Donn Corp.

(c) United States Gypsum Co.

(3) Wire for Hangers and Ties. ASTM A 641 “Zinc-Coated (Galvanized) Carbon Steel Wire”, Class 1 zinc coating, soft temper, 8 gauge for hangers and 18 gauge for ties.

(H) PVC Trim Accessories. Provide cornerbeads, edge trim, etc. as indicated on the drawings or as required complying with ASTM C 1047, and formed of polyvinyl chloride (PVC).

(I) Joint Treatment Materials. ASTM C 475; type recommended by board manufacturer for the application indicated, except as otherwise noted. Perforated tape, and joint and topping compound, or “all-purpose” compound.

676.03 Construction Requirements.

(A) Submittals

(1) Product Data. Submit for each type of product specified. Include manufacturer's recommended installation instructions.

(2) Shop Drawings**.** Submit drawings showing locations, fabrication, and installation of control and expansion joints including plans, elevations, details of components, and attachments to other units of work.

(3) Samples.

(a) Submit trim accessories full-size samples in 12-inch lengths.

(b) Submit gypsum board finish sample for approval.

(B) Quality Assurance

Industry Standard: Comply with applicable requirements of GA-216 "Application and Finishing of Gypsum Board" by the Gypsum Association, except where more detailed or more stringent requirements are indicated including the recommendations of the manufacturer, and GA-214, "Recommended Specification: Levels of Gypsum Board Finish" by the Gypsum Association.

(C) Product Handling

Deliver gypsum board materials in sealed containers and bundles, fully identified with manufacturer's name, brand, type and grade; store in a dry well-ventilated space, protected from the weather, under cover and off the ground. Stack gypsum panels flat to prevent sagging.

(D) Examination

Examine substrates to which drywall construction attaches or abuts, preset hollow metal frames, and structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of drywall construction. Do not proceed with installation until unsatisfactory conditions have been corrected.

(E) Installation of Steel Framing, General

(1) Steel Framing Installation Standard. Install steel framing to comply with ASTM C 754 requirements that apply to framing installation.

(2) Install supplementary framing, blocking and bracing at terminations in the work and for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, and similar construction to comply with details indicated and with recommendations of gypsum board manufacturer, or if none available, with “Gypsum Construction Handbook” published by United States Gypsum Co.

(F) Installation of Steel Framing for Walls and Partitions

(1) Install runners (tracks) at floors, ceilings, and structural walls and columns where gypsum drywall stud system abuts other construction. Where studs are installed directly against exterior walls, install asphalt felt strips between studs and wall.

(2) Installation Tolerances. Install each steel framing and furring member so that fastening surface do not vary more than 1/8 inch from plane of faces of adjacent framing. Align plumb and square.

(3) Extend partition framing full height to structural supports. Continue framing over frames for doors and openings to provide support for gypsum board.

(4) Install steel studs and furring in sizes and at spacings indicated but not less than that required by referenced steel framing installation standard. For single layer construction: 16 inches on center, except as otherwise indicated.

(5) Install steel studs so that flanges point in the same direction and gypsum boards can be installed in the direction opposite to that of the flange.

(6) Frame door openings to comply with details indicated, with GA-219 and with applicable published recommendations of gypsum board manufacturer. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

(7) Frame openings other than door openings to comply with details indicated, or if none indicated, in same manner as required for door openings.

(G) Application and Finishing of Gypsum Board, General

(1) Gypsum Board Application and Finishing Standards. Install and finish gypsum board to comply with ASTM C 840, GA-216, and GA-214.

(2) Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 24 inches in alternate courses of board.

(3) Install ceiling boards in the manner which minimizes the number of end-butt joints, and which avoids end joints in the central area of each ceiling. Stagger end joints at least 24 inches.

(4) Install wall/partition boards in manner which minimizes the number of end-butt joints or avoids them entirely where possible.

(5) Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16 inch open space between boards. Do not force into place.

(6) Locate either edge or end joints over supports, except in horizontal applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field-cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.

(7) Attach gypsum board to studs so that leading edge or end of each board is attached to open (unsupported) edge of stud flange first.

(8) Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.

(9) Space fasteners in gypsum boards in accordance with referenced gypsum board application and finishing standard and manufacturer's recommendations.

(H) Method of Gypsum Board Application

(1) Single-Layer Application. Install gypsum board as follows: On partitions/walls, apply gypsum board vertically (parallel to framing), unless otherwise indicated, and provide sheet lengths which will minimize end joints. Fasten with screws at 6-inch centers.

(2) Single-Layer Fastening Method. Apply gypsum boards to supports by fastening with screws.

(I) Cementitious Backer Unit Application

Install on partitions/walls, in single-layer application, with screws at 6-inch centers, and in accordance with manufacturer's recommendations. Panel surfaces shall be finished/prepared to receive ceramic tile as per manufacturer's recommendations.

(J) Installation of Drywall Trim Accessories

(1) General. Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges to comply with manufacturer's recommendations.

(2) Install corner beads at external corners.

(3) Install edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed. Provide type with face flange to receive joint compound.

(a) Install "LC" bead where drywall construction is tightly abutted to other construction and back flange can be attached to framing or supporting substrate.

(b) Install "L" bead where edge trim can only be installed after gypsum board is installed.

(K) Finishing of Drywall

(1) General. Apply joint treatment at gypsum board joints (both directions); flanges of corner bead, edge trim, and control joints; penetrations; fastener heads, surface defects and elsewhere as required to prepare work for decoration.

(2) Prefill open joints and rounded or beveled edges, if any, using setting-type joint compound.

(3) Apply joint tape at joints between gypsum boards, except where trim accessories are indicated.

(4) Finish interior gypsum board by applying the following levels of gypsum board finish in accordance with GA-214.

(a) Level 2: For wall panels to form substrates for ceramic tile.

(b) Level 3: Not used.

(c) Level 4: Not used.

(d) Level 5: For exposed walls and ceiling surfaces receiving paints.

(e) Where Level 2 gypsum board finish is specified, embed tape in joint compound and apply first coat of joint compound.

(f) Where Level 5 gypsum board finish is specified, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories; and apply a thin, uniform skim coat of joint compound over entire surface. For skim coat, use joint compound specified for third coat, or a product specially formulated for this purpose and acceptable to gypsum board manufacturer. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects, tool marks, and ridges and ready for decoration.

(L) Protection

Provide final protection and maintain conditions, in a manner suitable to Installer, which ensures gypsum drywall construction

being without damage or deterioration at time of project acceptance.

676.04 Method of Measurement. Gypsum Board will be paid for on a lump sum basis. Measurement for payment will not apply.

676.05 Basis of Payment. The Engineer will pay for the accepted Gypsum Board on a contract square foot basis. Payment will be in full compensation for gypsum board and furnishing labor, tools, materials, equipment and incidentals necessary to complete the work.

The Engineer will pay for the following pay item when included in the proposal schedule:

Pay Item	**Pay Unit**
Gypsum Board at _____	Square Foot”

END OF SECTION 676

Make the following Section a part of the Standard Specifications:

"SECTION 678 - ACOUSTICAL PANEL CEILINGS

678.01 Description. This section describes the acoustical panel ceilings work.

(A) Section Includes:

(1) Acoustical ceiling panels.

(2) Exposed grid suspension system.

(3) Wire hangers, fasteners, main runners, cross tees, and wall angle moldings.

(B) Related Sections:

(1) **Section 694 – GENERAL MECHANICAL REQUIREMENTS, Section 695 – PLUMBING, Section 697 – AIR CONDITIONING AND VENTILATION**: Coordinate all mechanical items.

(2) **Section 651 – ELECTRICAL WORK**: Coordinate all electrical items.

(C) System Description

Seismic Loads. Design and size components to withstand seismic loads in accordance with the International Building Code, Section 1621 for Category D, E, and F.

(D) References

(1) ASTM A568 Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements.

(2) ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

(3) ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

(4) ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

(5) ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

(6) ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

(7) ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.

(8) ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.

(9) ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.

(10) ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems.

(11) ASTM E 1264 Classification for Acoustical Ceiling Products.

(12) ASTM E 1477 Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.

(13) ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

(14) ASTM E 119 Standard Test Method for Fire Tests of Building Construction and Material.

(15) International Code Council-Evaluation Services - AC 156 Acceptance Criteria for Seismic Qualification Testing of Non-structural Components

(16) International Code Council-Evaluation Services - Evaluation Report, ESR-1308, Fire- and Nonfire-Resistance-Rated Suspended Ceiling Framing Systems

(17) ASCE 7 Standard - American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures

(18) CISCA Seismic Zones 3 & 4 - Ceilings and Interior Systems Construction Association Guidelines for Seismic Restraint for Direct Hung Suspended Ceiling Assemblies

678.02 Materials.

(A) Manufacturers

(1) Ceiling Panels:

Armstrong World Industries, Inc., or approved equal.

(2) Suspension Systems:

Armstrong World Industries, Inc., or approved equal.

(B) Acoustical Ceiling Units

(1) Acoustic Panels. Provide the following acoustic panels where indicated.

(a) Pattern: Type III, Form 1, pattern E1.

(b) Class: A; flame spread 25 or under.

(c) Light Reflectance: 0.85, minimum.

(d) NRC: 0.70, minimum.

(e) CAC: 35.

(f) Size: 24-inches x 48-inches, and as required.

(g) Thickness: 3/4-inch.

(h) Edge: Angled Tegular, lay-in.

(i) Finish: Factory-applied latex paint.

(2) Suspension System. Lay-in system shall consist of regular exposed grid of 15/16-inch main runner and cross tees.

(a) Runner and Tees: Main runner and cross tees shall be as recommended by the manufacturer of the suspended system, conforming to the structural

classification, ASTM C 635. Main runners and cross tees shall be double-web intermediate-duty cold rolled steel, hot dip-galvanized coated, pre-finish bake painted in color as selected from manufacturer's full range.

(b) Moldings: Edge moldings of profile as indicated shall be as recommended by the manufacturer of suspended system, matching carrier and cross tee in metal and finish.

(c) Hanger Wires: ASTM A 641/A 641M zinc coated carbon steel wire, Class 1, 12 gauge, galvanized steel.

(d) Hold Down Clips: Manufacturer's standard hold-down clips spaced 24-inches on center on all cross tees.

(C) Suspension Systems

(1) Components. Main beams and cross tees In accordance with the International Building Code, Section 1621 for Category D, E and F as described in ESR-1308.

(a) Structural Classification: ASTM C 635, Heavy Duty.

(b) Color: White and match the actual color of the selected ceiling tile, unless noted otherwise.

(c) Represented Systems: (Prelude XL 15/16") (Prelude XL Fire Guard 15/16") (Prelude Plus XL Fire Guard 15/16") (Suprafine XL 9/16") (Suprafine XL Fire Guard 9/16") Exposed Tee Systems; (Silhouette XL 1/4" Reveal 9/16" Bolt Slot System) (Silhouette XL 1/8" Reveal 9/16" Bolt Slot System) as manufactured by Armstrong World Industries.

(2) Attachment Devices. In accordance with the International Building Code, Section 1621 for Category D, E, and F.

(3) Wire for Hangers and Ties. In accordance with the International Building Code, Section 1621.

(4) Wall Moldings. In accordance with the International Building Code, Section 1621 for Category D, E. and F or method as described in ESR-1308.

(a) Nominal 7/8 inch x 7/8 inch hemmed, pre-finished angle molding (7800) (7802) (7803) (780036) (HD7801)

(b) Nominal 15/16 inch x 15/16 inch hemmed, pre-finished angle molding (7809)

(5) Accessories.

(a) BERC2 – 2 inch Beam End Retaining Clip, 0.034 inch thick, hot-dipped galvanized cold-rolled steel per ASTM A568 – used to join main beam or cross tee to wall molding.

(b) SJCG – Seismic Joint Clip, 5 inches x 1-1/2 inch, hot-dipped galvanized cold-rolled steel per ASTM A568. The two piece unit is designed to accommodate a seismic separation joint. The clip is compatible with 15/16 inch and 9/16 inch grid systems including Prelude, Suprafine, and Silhouette. The SJCG is not suitable for use with Vector panel installations.

678.03 Construction Requirements.

(A) Submittals

(1) Product Data. Submit manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.

(2) Samples. Minimum 6 inch x 6 inch samples of specified acoustical panel; 8 inch long samples of exposed wall molding and suspension system, including main runner and 4 foot cross tees.

(3) Shop Drawings. Layout and details of acoustical ceilings. Show locations of items which are to be coordinated with, or supported by the ceilings.

(4) Certifications. Manufacturer's certifications that system complies with specified requirements:

(a) For seismic performance: International Code Council Evaluation Report, ESR-1308.

(b) For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.

(5) If the material supplied by the acoustical subcontractor does not have an Underwriter's Laboratory classification of acoustical performance on every carton, subcontractor shall be required to send material from every production run appearing on the job to an independent or NVLAP approved laboratory for testing, at the architect's or owner's discretion. All products not conforming to manufacturer's current published values must be removed, disposed of and replaced with complying product at the expense of the Contractor performing the work.

(B) Quality Assurance

(1) Single-Source Responsibility. Provide acoustical panel units and grid components by a single manufacturer.

(2) Fire Performance Characteristics. Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

(a) Surface Burning Characteristics. As follows, tested per ASTM E 84 and complying with ASTM E 1264 for Class A products.

(i) Flame Spread: 25 or less
(ii) Smoke Developed: 50 or less

(b) Fire Resistance Ratings. As indicated by reference to design designations in UL Fire Resistance Directory, for types of assemblies in which acoustical ceilings function as a fire protective membrane and tested per ASTM E 119.

Protect lighting fixtures and air ducts to comply with requirements indicated for rated assembly.

(3) Seismic Performance. Provide acoustical ceiling system that has been evaluated by an independent party and found to be compliant with the 2003 International Building Code, Seismic Category D, E, and F.

Tested per International Code Council – Evaluation Services – AC 156 Acceptance Criteria for Seismic Qualification Testing of

Non-structural Components as evidenced by International Code Council Evaluation Report, ESR-1308.

(4) Coordination of Work. Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

(C) Delivery, Storage, and Handling

(1) Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

(2) Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

(3) Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

(D) Project Conditions

Space Enclosure:

Standard Ceilings: Do not install interior ceilings until space is enclosed and weatherproof; wet work in place is completed and nominally dry; work above ceilings is complete; and ambient conditions of temperature and humidity are continuously maintained at values near those intended for final occupancy. Building areas to receive ceilings shall be free of construction dust and debris.

(E) Warranty

(1) Acoustical Panel. Submit a written warranty executed by the manufacturer, agreeing to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to:

(a) Acoustical Panels: Sagging and warping

(b) Grid System: Rusting and manufacturer's defects

(2) Warranty Period.

(a) Acoustical panels: Two (2) year from date of substantial completion.

(b) Cirrus Acoustical panels: Ten (10) years from data of substantial completion. Note Space Enclosure requirements.

(c) Grid: Ten years from date of substantial completion.

(3) The Warranty shall not deprive the State of other rights the State may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

(F) Maintenance

Extra Materials. Deliver extra materials to State. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.

(1) Acoustical Ceiling Units. Furnish quality of full-size units equal to 5.0 percent of amount installed.

(2) Exposed Suspension System Components. Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

(G) Examination

Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer’s printed recommendations. (Exception: HumiGuard Max Ceilings)

(H) Preparation

(1) Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

(2) Coordination. Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.

Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

(l) Installation (Category D,E,F)

(1) Install suspension system and panels in accordance with the International Building Code, Section 1621, except as noted in Section 4.4.3.1 of ESR-1308, and with the authorities having jurisdiction.

(2) ESR-1308, Section 4.4.3.1, Alternate Seismic Design Category D, E and F Installation.

Under this installation, the runners must be rated heavy-duty and have a minimum simple span uniform load of 16.35 pounds per lineal foot (238 N/m); maximum ceiling weight permitted is 1.80 pounds per square foot (8.78 kg/m2).

(a) The BERC-2 clip is used to secure the main runners and cross runners on two adjacent walls to the structure and the two opposite walls to the perimeter trim, as detailed below. A nominal 7/8-inch (22 mm) wall molding is used in lieu of the 2-inch (51 mm) perimeter supporting closure angle required by Section 9.6.2.6.2.2 (b) of ASCE-7 for Seismic Design Categories D, E and F. Except for the use of the BERC-2 clip and the 7/8-inch (22 mm) wall molding and elimination of spreader bars, installation of the ceiling system must be as prescribed by the applicable code.

(b) The BERC-2 clip is attached to the wall molding by sliding the locking lances over the hem of the vertical leg of the wall molding. Clips installed on the walls where the runners are fixed are attached to the runner by a sheet metal screw through the horizontal slot in the clip into the web of the runner.

(c) Clips installed on the walls where the runners are not fixed to the runner allow the terminal runner end to move 3/4 inch (19.1 mm) in both directions. BERC-2 clips installed in this manner are an acceptable means of

preventing runners from spreading in lieu of spacer bars required in CISCA 3-4, which is referenced in ASCE 7, Section 9.6.2.6.2.2, which is referenced in IBC Section 1621.

(3) The SJCG Seismic Separation Joint Clip is to be installed per the manufacturer's instructions, CS-3815.

(4) The presence of a hanger wire within 3 inches of an expansion relief joint as called for in ASTM C636 shall be required in addition to the requirements of the International Building Code, Section 1621.2.5 and with the authorities having jurisdiction.

Only applies when using Prelude XL Fire Guard 15/16"; Prelude Plus XL Fire Guard 15/16"; and Suprafine XL Fire Guard 9/16" Exposed Tee Systems.

(5) For reveal edge panels: Cut and reveal or rabbet edges of ceiling panels at border areas and vertical surfaces.

(6) Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.

(J) Adjusting and Cleaning

Replace damaged and broken panels:

Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

678.04 Method of Measurement. Acoustical Panel Ceilings will be paid for on a lump sum basis. Measurement for payment will not apply.

678.05 Basis of Payment. The Engineer will pay for the accepted Acoustical Panel Ceilings on a contract square foot basis. Payment will be in full compensation for acoustical panel ceilings and furnishing labor, tools, materials, equipment and incidentals necessary to complete the work.

The Engineer will pay for the following pay item when included in the proposal schedule:

Pay Item	**Pay Unit**
Acoustical Panel Ceiling	Square Foot”

END OF SECTION 678

Make the following Section a part of the Standard Specifications:

"SECTION 686 – SIGNAGE

686.01 Description. This section describes all room identification signage that are directly attached to the building

(A) Provide all materials, labor, equipment and tools necessary to provide all room identification signage as indicated on the drawings and specified herein/

686.02 Materials

(A) Performance Requirements. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design", the ABA standards of the Federal agency having jurisdiction and ICC A117.1.

(B) Room Identification Signs.

(1) Room-Identification Sign: Sign system with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

(a) Acceptable Manufacturer: InPro SignScape, InPro Corporation, P.O. Box 406, Muskego, WI 53150 USA, Telephone: 800-222-5556, Fax: 888-715-8407, Email: service@inprocorp.com, or approved equal.

(a) Basis of Design Product: Manhattan Collection.

(b) Laminated-Sheet Sign: Rigid vinyl face sheet with raised graphics laminated to rigid vinyl backing sheet to produce composite sheet.

1. Composite-Sheet Thickness: Manufacturer's standard for size of sign.

(c) Color(s): Match Architect's sample.

(d) Sign-Panel Perimeter: Finish edges smooth.

(e) Edge Condition: As indicated on Drawings.

(f) Corner Condition in Elevation: As indicated on Drawings.

(g) Mounting: Manufacturer's standard method for substrates indicated.

(h) Text and Typeface: Accessible raised characters and Braille typeface as selected by Architect from manufacturer's full range and variable content as scheduled. Finish raised characters to contrast with background color, and finish Braille to match background color.

(C) Sign Materials

(1) Extruded Vinyl: Vinyl shall be extruded from chemical and stain resistant polyvinyl chloride.

(2) Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

(D) Accessories

(1) Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

(2) Use concealed fasteners and anchors unless indicated to be exposed.

(3) For exterior exposure, furnish nonferrous-metal, stainless-steel or hot-dip galvanized devices unless otherwise indicated.

(4) Exposed Metal-Fasteners Components, General:

(a) Fabricated from same basic metal and finish of fastened sign unless otherwise indicated.

(b) Fastener Heads: Use flathead or oval countersunk screws and bolts with tamper-resistant Allen-head, spanner-head or one-way-head slots unless otherwise indicated.

(5) Sign Mounting Fasteners:

(a) Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.

(b) Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.

(E) Adhesive. As recommended by sign manufacturer.

(F) Two-Face Tape. Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

(G) **F**abrication**.**

(1) General: Provide manufacturer's standard sign assemblies according to requirements indicated.

(2) Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.

(3) Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.

(4) Conceal connections if possible; otherwise, locate connections where they are inconspicuous.

(5) Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

(6) Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.

(7) Subsurface-Etched Graphics: Reverse etch back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.

(8) Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:

(a) For snap-in changeable inserts beneath removable face sheet, furnish one suction or other device to assist in removing face sheet. Furnish initial changeable insert.

(b) For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Furnish initial changeable insert.

(c) For frame to hold changeable sign panel, fabricate frame without burrs or constrictions that inhibit function. Furnish initial sign panel.

(H) General Finish Requirements

(1) Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective coating before shipping.

(2) Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

(I) Aluminum Finishes

(1) Clear Anodic Finish: AAMA 611, Class II, 0.010 mm or thicker.

(2) Color Anodic Finish: AAMA 611, Class II, 0.010 mm or thicker.

(3) Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

686.02 Construction

(A) Submittals.

(1) Product Data.

(2) Shop Drawings: For room identification signage to Include:

(a) Fabrication and installation details and attachments

(b) Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories

(c) Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

(3) Samples. For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

(a) Room-Identification Signs: Full-size Sample.

(b) Variable Component Materials: Full-size Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.

(c) Exposed Accessories: Full-size Sample of each accessory type.

(d) Full-size Samples, if approved, will be returned to Contractor for use in Project.

(4) Product Schedule. For room-identification signs. Use same designations indicated on Drawings or specified.

(5) Informational Submittals.

(b) Qualification Data: For manufacturer.

(c) Sample Warranty: For special warranty

(6) Closeout Submittals. Maintenance data. For signs to include in maintenance manual

(7) Quality Assurance. Installer Qualifications: Manufacturer of products.

(8) Field Conditions Field Measurements: Verify locations of anchorage devices and electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

(9) Warranty. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

(b) Deterioration of finishes beyond normal weathering.

(c) Deterioration of embedded graphic image.

(d) Separation or delamination of sheet materials and components.

(e) Warranty Period: Five years shall commence from the project acceptance date

Installation

(A) General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

(1) Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.

(2) Install signs so they do not protrude or obstruct according to the accessibility standard.

(3) Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

(B) Accessibility: Install signs in locations on walls as indicated on Drawings and according to the accessibility standard.

(C) Mounting Methods:

(1) Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

(2) Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes.

(3) Temporarily support sign in position until adhesive fully sets.

(4) Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

(5) Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.

(6) Adhesive: Clean bond-breading materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of

suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility or cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

(7) Two-Face Type: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

Adjusting and Cleaning

(A) Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

(B) Remove temporary protective coverings and strippable films as signs are installed.

(C) On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

686.04 Measurement. The Engineer will measure signage in Lump Sum in accordance with the contract documents.

686.05 Payment. The Engineer will pay for the accepted pay items listed below at the contract lump sum price, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for each of the following pay items when included in the proposal schedule:

Pay Item	**Pay Unit**
Signage	Lump Sum"

END OF SECTION 686

SECTION 699 – MOBILIZATION

Make the following amendments to said Section:

(I) Amend **699.03 Applicability** by revising from lines 21 to 24 to read as follows:

"**699.03 Applicability.** Maximum bid allowed for this item is an amount not to exceed 6 percent of the sum of all items excluding the bid price of this item."

(II) Amend **699.05 Payment** by revising from lines 44 to 47 to read as follows:

"Mobilization (Not to exceed 6 percent of the sum of all items excluding the bid price of this item) Lump Sum"

END OF SECTION 699

Requirements of Chapter 104, HRS
Wages and Hours of Employees on Public Works Law

Chapter 104, HRS, applies to every public works construction project over $2,000, regardless of the method of procurement or financing (purchase order, voucher, bid, contract, lease arrangement, warranty, SPRB).

Rate of Wages for Laborers and Mechanics

- Minimum prevailing wages (basic hourly rate plus fringe benefits), as determined by the Director of Labor and Industrial Relations and published in wage rate schedules, shall be paid to the various classes of laborers and mechanics working on the job site. [§104-2(a), (b), Hawaii Revised Statutes (HRS)]

- If the Director of Labor determines that prevailing wages have increased during the performance of a public works contract, the rate of pay of laborers and mechanics shall be raised accordingly. [§104-2(a) and (b), HRS; §12-22-3(d) Hawaii Administrative Rules (HAR)]

Overtime

- Laborers and mechanics working on a Saturday, Sunday, or a legal holiday of the State or more than eight hours a day on any other day shall be paid overtime compensation at not less than one and one-half times the basic hourly rate plus the cost of fringe benefits for all hours worked. If the Director of Labor determines that a prevailing wage is defined by a collective bargaining agreement, the overtime compensation shall be at the rates set by the applicable collective bargaining agreement [§§104-1, 104-2(c), HRS; §12-22-4.1, HAR]

Weekly Pay

- Laborers and mechanics employed on the job site shall be paid their full wages at least once a week, without deduction or rebate, except for legal deductions, within five working days after the cutoff date. [§104-2(d), HRS]

Posting of Wage Rate Schedules

- Wage rate schedules with the notes for prevailing wages and special overtime rates, shall be posted by the contractor in a prominent and easily accessible place at the job site. A copy of the entire wage rate schedule shall be given to each laborer and mechanic employed under the contract, except when the employee is covered by a collective bargaining agreement. [§104-2(d), HRS]

Withholding of Accrued Payments

- If necessary, the contracting agency may withhold accrued payments to the contractor to pay to laborers and mechanics employed by the contractor or subcontractor on the job site any difference between the wages required by the public works contract or specifications and the wages received. [§104-2(e), HRS]

Certified Weekly Payrolls and Payroll Records

- A certified copy of all payrolls shall be submitted weekly to the contracting agency. [§104-3(a), HRS; §12-22-10, HAR]

- The contractor is responsible for the submission of certified copies of the payrolls of all subcontractors. The certification shall affirm that the payrolls are correct and complete, that the wage rates listed are not less than the applicable rates contained in the applicable wage rate schedule, and that the classifications for each laborer or mechanic conform with the work the laborer or mechanic performed. [§104-3(a), HRS; §12-22-10, HAR]

- Payroll records shall be maintained by the contractor and subcontractors for three years after completion of construction. The records shall contain: [§104-3(b), HRS; §12-22-10, HAR]
  - the name and home address of each employee
  - the last four digits of social security number
  - a copy of the apprentice's registration with DLIR
  - the employee's correct classification
  - rate of pay (basic hourly rate + fringe benefits)
  - itemized list of fringe benefits paid
  - daily and weekly hours worked
  - weekly straight time and overtime earnings
  - amount and type of deductions
  - total net wages paid
  - date of payment

- Records shall be made available for examination by the contracting agency, the Department of Labor and Industrial Relations (DLIR), or any of its authorized representatives, who may also interview employees during working hours on the job. [§§104-3(c), 104-22(a), HRS; §12-22-10, HAR]

Termination of Work on Failure to Pay Wages

- If the contracting agency finds that any laborer or mechanic employed on the job site by the contractor or any subcontractor has not been paid prevailing wages or overtime, the contracting agency may, by written notice to the contractor, terminate the contractor's or subcontractor's right to proceed with the work or with the part of the work in which the required wages or overtime compensation have not been paid. The contracting agency may complete this work by contract or otherwise, and the contractor or contractor's sureties shall be liable to the contracting agency for any excess costs incurred. [§104-4, HRS]

Apprentices

- Apprentice wage rates apply to contractors who are a party to a bona fide apprenticeship program which has been registered with the DLIR. In order to be paid apprentice rates, apprentices must be parties to an agreement either registered with or recognized as a USDOL nationally approved apprenticeship program by the DLIR, Workforce Development Division, (808) 586-8877, and the apprentice must be individually registered by name with the DLIR. [§12-22-6(1) and (2), HAR]

- The number of apprentices on any public work in relation to the number of journeyworkers in the same craft classification as the apprentices employed by the same employer on the same public work may not exceed the ratio allowed under the apprenticeship standards registered with or recognized by the DLIR. A registered or recognized apprentice receiving the journeyworker rate will not be considered a journeyworker for the purpose of meeting the ratio requirement. [§12-22-6(3), HAR]

Enforcement

- To ensure compliance with the law, DLIR and the contracting agency will conduct investigations of contractors and subcontractors. If a contractor or subcontractor violates the law, the penalties are: [§104-24, HRS]

  - First Violation — Equal to 25% of back wages found due or $250 per offense up to $2,500, whichever is greater.
  - Second Violation — Equal to amount of back wages found due or $500 for each offense up to $5,000, whichever is greater.
  - Third Violation — Equal to two times the amount of back wages found due or $1,000 for each offense up to $10,000, whichever is greater; and
    Suspension from doing any new work on any public work of a governmental contracting agency for three years.

  - A violation would be deemed a second violation if it occurs within two years of the **first notification of violation**, and a third violation if it occurs within three years of **the second notification of violation**. [§104-24, HRS; §12-22-25(b), HAR]

  - **Suspension**: For a first or second violation, the department shall immediately suspend a contractor who fails to pay wages or penalties until all wages and penalties are paid in full. For a third violation, the department shall penalize and suspend the contractor as described above, **except that if the contractor continues to violate the law, then the department shall immediately suspend the contractor for a mandatory three years. The contractor shall remain suspended until all wages and penalties are paid in full.** [§§104-24, 104-25, HRS]

- **Suspension**: Any contractor who fails to make payroll records accessible or provide requested information within 10 days, or fails to keep or falsifies any required record, shall be assessed a penalty including suspension as provided in Section 104-22(b) and 104-25(a)(3), HRS. [§104-3(c), HRS; §12-22-26, HAR]

- If any contractor interferes with or delays any investigation, the contracting agency shall withhold further payments until the delay has ceased. Interference or delay includes failure to provide requested records or information within ten days, failure to allow employees to be interviewed during working hours on the job, and falsification of payroll records. The department shall assess a penalty of $10,000 per project, and $1,000 per day thereafter, for interference or delay. [§104-22(b), HRS; §12-22-26, HAR]

- Failure by the contracting agency to include in the provisions of the contract or specifications the requirements of Chapter 104, HRS, relating to coverage and the payment of prevailing wages and overtime, is not a defense of the contractor or subcontractor for noncompliance with the requirements of this chapter. [§104-2(f), HRS]

For additional information, visit the department's website at *http://labor.hawaii.gov/wsd* or contact any of the following DLIR offices:

Oahu (Wage Standards Division).....(808) 586-8777
Hawaii Island .....(808) 974-6464
Maui and Kauai.....(808) 243-5322

STATE OF HAWAII

DEPARTMENT OF TRANSPORTATION

HIGHWAYS DIVISION

HONOLULU, HAWAII

P R O P O S A L

6/02/98

PROPOSAL TO THE

STATE OF HAWAII

DEPARTMENT OF TRANSPORTATION

PROJECT: **MATERIALS TESTING LAB FACILITY RENOVATION**

PROJECT NO.: **HWY-L01-22**

COMPLETION TIME: **200 Working days from the date indicated in the Start Work Date from the Department.**

DESIGN PROJECT MANAGER:

NAME:	**Mung Fa Chung**
ADDRESS:	**2530 Likelike Highway**
	Honolulu 96819
PHONE NO.:	**808 832-3405 x 105**
EMAIL:	**mungfa.chung@hawaii.gov**
FAX NO.:	**808 832-3407**

ELECTRONIC SUBMITTAL: **Bidders shall submit and upload the complete proposal to HIePRO prior to the bid opening date and time. Any additional support documents explicitly designated as confidential and/or proprietary shall be uploaded as a separate file to HIePRO. Bidders shall refer to SPECIAL PROVISIONS 102.09 Delivery of Proposal for complete details. FAILURE TO UPLOAD THE COMPLETE PROPOSAL TO HIePRO SHALL BE GROUNDS FOR REJECTION OF THE BID.**

Director of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Sir:

The undersigned bidder declares the following:

1. It has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with this proposal.

2. It has not been assisted or represented on this matter by any individual who has, in a State capacity, been involved in the subject matter of this contract within the past two years.

3. It has not and will not, either directly or indirectly offered or given a gratuity (i.e.. an entertainment or gift) to any State or County employee to obtain a contract or favorable treatment under a contract.

The undersigned bidder further agrees to the following:

1. If this proposal is accepted, it shall execute a contract with the Department to provide all necessary labor, machinery, tools, equipment, apparatus and any other means of construction, to do all the work and to furnish all the materials specified in the contract in the manner and within the time therein prescribed in the contract, and that it shall accept in full payment therefore the sum of the unit and/or lump sum prices as set forth in the attached proposal schedule for the actual quantities of work performed and materials furnished and furnish satisfactory security in accordance with Section 103D-324, Hawaii Revised Statutes, within 10 days after the award of the contract or within such time as the Director of Transportation may allow after the undersigned has received the contract documents for execution, and is fully aware that non-compliance with the aforementioned terms will result in the forfeiture of the full amount of the bid guarantee required under Section 103D-323, Hawaii Revised Statutes.

2. That the quantities given in the attached proposal schedule are approximate only and are intended principally to serve as a guide in determining and comparing the bids.

3. That the Department does not either expressly or by implication, agree that the actual amount of work will correspond therewith, but reserves the right to increase or decrease the amount of any class or portion of the work, or to omit portions of the work, as may be deemed necessary or advisable by the Director of Transportation, and that all increased or decreased quantities of work shall be performed at the unit prices set forth in the attached proposal schedule except as provided for in the specifications.

4. In case of a discrepancy between unit prices and the totals in said Proposal Schedule, the unit prices shall prevail.

5. Agrees to begin work within 10 working days after the date of notification to commence with the work, which date is in the notice to proceed, and shall finish the entire project within the time prescribed.

6. The Director of Transportation reserves the right to reject any or all bids and to waive any defects when in the Director's opinion such rejections or waiver will be for the best interest of the public.

The bidder acknowledges receipt of and certifies that it has completely examined the following listed items: Hawaii Standard Specifications for Road and Bridge Construction, 2005, the Notice to Bidders, the Special Provisions, the Technical Provisions, the Proposal, the Contract and Bond Forms, and the Project Plans.

In accordance with Section 103D-323, Hawaii Revised Statutes, this proposal is accompanied with a bid security in the amount of 5% of the total amount bid, in the form checked below. (Check applicable bid security submitted with bid.)

_____ Surety Bid Bond (Use standard form),

_____ Cash,

_____ Cashier's Check,

_____ Certified Check, or

_____ _____
(Fill in other acceptable security.)

The undersigned bidder acknowledges receipt of any addendum issued by the Department by recording in the space below the date of receipt.

Addendum No. 1 _____ Addendum No. 3 _____

Addendum No. 2 _____ Addendum No. 4 _____

In accordance with Section 103D-302, Hawaii Revised Statutes, the undersigned as bidder has listed the name of each person or firm, who will be engaged by the bidder on the project as Joint Contractor or Subcontractor and the nature of work to be done by each. It is understood that failure to comply with the aforementioned requirements may be cause for rejection of the bid submitted.

	Name of Subcontractor	Nature and Scope of Work
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		

	Name of Joint contractor	Nature and Scope of Work
1.		
2.		
3.		

("None" or if left blank indicates no Subcontractor or Joint Contractor; if more space is needed, attach additional sheets.)

The undersigned hereby certifies that the bid prices contained in the attached proposal schedule have been carefully checked and are submitted as correct and final.

This declaration is made with the understanding that the undersigned is subject to the penalty of perjury under the laws of the United States and is in violation of the Hawaii Penal Code, Section 710-1063, unsworn falsification to authorities, of the Hawaii Revised Statutes, for knowingly rendering a false declaration.

_____
Bidder

By _____
Authorized Signature

_____
Title

_____
Business Address

_____

_____
Email Address

_____
Date

_____
Contact Person (If different from above.)

_____
Phone Number and Email Address

NOTE:

If bidder is a CORPORATION, the legal name of the corporation shall be set forth above, the corporate seal affixed, together with the signature(s) of the officer(s) authorized to sign contracts for the corporation. Please attach to this page current (not more than six months old) evidence of the authority of the officer(s) to sign for the corporation.

If bidder is a PARTNERSHIP, the true name of the partnership shall be set forth above, with the signature(s) of the general partner(s). Please attach to this page current (not more than six months old) evidence of the authority of the partner authorized to sign for the partnership.

If bidder is an INDIVIDUAL, the bidder's signature shall be placed above.

If signature is by an agent, other than an officer of a corporation or a partner of a partnership, a POWER OF ATTORNEY must be on file with the Department before opening bids or submitted with the bid. Otherwise, the Department may reject the bid as irregular and unauthorized.

PREFERENCES

Bidders agree that preferences shall be taken into consideration to determine the low bidder in accordance with said Sections and the rules promulgated, however, the award of contract will be in the amount of the bid offered exclusive of any preferences.

A. HAWAII PRODUCTS PREFERENCE

In accordance with ACT 174, SLH 2022, effective June 27, 2022, Hawaii Products Preference shall not apply to solicitations for public works construction. Therefore, the Hawaii Products Preference shall not apply to this project.

B. APPRENTICESHIP PROGRAMS PREFERENCE

In accordance with ACT 17, SLH 2009 – Apprenticeship Program, a 5% bid adjustment for bidders that are parties to apprenticeship agreements pursuant to Hawaii Revised Statutes (HRS) Section 103-55.6 may be applied to the bidder's price for evaluation purposes.

Any bidder seeking this preference must be a party to an apprenticeship agreement registered with the Department of Labor and Industrial Relations at the time the offer is made for each apprenticeable trade the bidder will employ to construct the public works projects for which the offer is being made.

The bidder is responsible for complying with all submission requirements for registration of its apprenticeship program before requesting the preference.

( ) Yes, I wish to be considered for the Apprenticeship Programs Preference. I have included Certification Form(s) 1 with my bid.

C. RECYCLED PRODUCT PREFERENCE

Recycled product preference shall not apply to this proposal.

PROPOSAL SCHEDULE – BASE BID					
ITEM NO.	**ITEM**	**APPROX. QUANTITY**	**UNIT**	**UNIT PRICE**	**AMOUNT**
201.0100	BASE BID Clearing and Grubbing	3,100	S.F.	$_____	$_____
202.0300	Removal of Wheelstops	4	Each	$_____	$_____
209.0100	Installation, Maintenance, Monitoring and Removal of BMP	L.S.	L.S.	L.S.	$_____
209.0200	Additional Water Pollution, Dust and Erosion Control	L.S.	L.S.	$_____	$_____
304.0100	Aggregate Base Course	2	C.Y.	L.S.	$_____
401.0100	HMA Pavement, Mix No. IV	106	Ton	$_____	$_____
404.0100	Slurry Seal, Type I	L.S.	L.S.	L.S.	$_____
415.0100	Cold Planing	L.S.	L.S.	L.S.	$_____
503.0300	Concrete Wheelstop	2	Each	$_____	$_____
601.0100	Concrete Stair and Handrail	L.S.	L.S.	L.S.	$_____
608.0100	Existing Conditions – Asbestos/Lead/Hazardous Material Survey				
609.0100	Removal and Disposal of Asbestos Containing Material (ACM)	L.S.	L.S.	L.S.	$_____
612.0100	Grouted Rubble Paving	L.S.	L.S.	L.S.	$_____

PROPOSAL SCHEDULE – BASE BID					
ITEM NO.	**ITEM**	**APPROX. QUANTITY**	**UNIT**	**UNIT PRICE**	**AMOUNT**
615.0100	Demolition of Existing Ceilings and Grids	8232	SF	$_____	$_____
615.0200	Demolition of Existing “Baldwin”	1	Each	$_____	$_____
615.0300	Demolition of Existing Doors	9	Each	$_____	$_____
615.0400	Demolition of Existing Gutters	330	L.F.	$_____	$_____
615.0700	Demolition of Existing Roofing down to roof deck	11000	S.F.	$_____	$_____
615.0800	Demolition of Roof Flashing/Counterflashing down to substrate	510	L.F.	$_____	$_____
618.0100	Metal Fabrication	L.S.	L.S.	L.S.	$_____
621.0100	Wood Treatment	L.S.	L.S.	L.S.	$_____
626.0100	Adjust sewer clean-out to finish grade	L.S.	L.S.	L.S.	$_____
629.0100	4-inch Pavement Striping (Thermoplastic Extrusion)	2000	L.F.	$_____	$_____
629.0200	ISA Pavement Symbol (Thermoplastic Extrusion)	2	Each	$_____	$_____
631.0100	Accessible Aisle Sign	2	Each	$_____	$_____
631.0200	Van Accessible and Accessible Stall Sign	2	Each	$_____	$_____
631.0300	Sign Post	2	Each	$_____	$_____

PROPOSAL SCHEDULE – BASE BID					
ITEM NO.	**ITEM**	**APPROX. QUANTITY**	**UNIT**	**UNIT PRICE**	**AMOUNT**
634.0100	Portland Cement Concrete Sidewalk	11	S.Y.	$_____	$_____
652.0100	Rough Carpentry	L.S.	L.S.	L.S.	$_____
657.0100	Fire Stop	L.S.	L.S.	L.S.	$_____
658.0100	Thermoplastic Polyolefin Roofing	11,000	S.F.	$_____	$_____
658.0200	Cover Board, ½" thick	10,550	S.F.	$_____	$_____
658.0300	Vapor Barrier	11,000	S.F.	$_____	$_____
658.0400	Rigid Insulation	10,500	S.F.	$_____	$_____
658.0500	VTR Flashing, 2"	9	Each	$_____	$_____
660.0100	General Mechanical - Pre-Tab Air Systems	1	L.S.	$_____	$_____
660.0200	General Mechanical – HVAC Start-up and Testing	1	L.S.	$_____	$_____
660.0300	General Mechanical – TAB Air & Water Systems	1	L.S.	$_____	$_____
660.0400	General Mechanical – Certifications As-Builts O&M	1	L.S.	$_____	$_____
661.0100	Sheet Metal Flashing and Trim	330	L.F.	$_____	$_____
661.0200	Fascia	330	L.F.	$_____	$_____

PROPOSAL SCHEDULE – BASE BID					
ITEM NO.	**ITEM**	**APPROX. QUANTITY**	**UNIT**	**UNIT PRICE**	**AMOUNT**
661.0300	Gutters	330	L.F.	$_____	$_____
662.0100	Removal – Insulation of Mechanical Systems – Pipe Insulation	40	L.F.	$_____	$_____
662.0200	Removal – Insulation of Mechanical Systems – Ductwork Insulation	40	L.F.	$_____	$_____
662.0300	Pipe Insulation	40	L.F.	$_____	$_____
662.0400	Ductwork Insulation	260	S.F.	$_____	$_____
662.0500	Mobilization & Clean-Up	1	Each	$_____	$_____
668.0100	Removal Automatic Wet Pipe Sprinkler – Heads	146	Each	$_____	$_____
668.0200	Removal Automatic Wet Pipe Sprinkler – Piping	300	L.F.	$_____	$_____
668.0300	Automatic Wet Pipe Sprinkler – Heads	146	Each	$_____	$_____
668.0400	Automatic Wet Pipe Sprinkler – Pre-Action Systems	1	Each	$_____	$_____
668.0500	Piping	420	L.F.	$_____	$_____
664.0100	Removal of Plumbing – Plumbing Fixtures	8	Each	$_____	$_____
664.0200	Removal of Plumbing – Roof Vents	9	Each	$_____	$_____

PROPOSAL SCHEDULE – BASE BID					
ITEM NO.	**ITEM**	**APPROX. QUANTITY**	**UNIT**	**UNIT PRICE**	**AMOUNT**
664.0300	Plumbing – EWC Dual Height w/ Bottle Filler	2	Each	$_____	$_____
664.0400	Plumbing – Eye/Face Wash	2	Each	$_____	$_____
664.0500	Plumbing – Cup Sinks Fitting, Acid Resistant	4	Each	$_____	$_____
664.0600	Waste & Vent Piping – Polypropylene Piping	240	L.F.	$_____	$_____
664.0700	Waste & Vent Piping – Cast-Iron No-Hub	180	L.F.	$_____	$_____
664.0800	Waste & Vent Piping – Roof Vent	9	Each	$_____	$_____
664.0900	Waste & Vent Piping – Water Piping	180	L.F.	$_____	$_____
664.1000	Waste & Vent Piping – Gas Piping	80	L.F.	$_____	$_____
664.1100	Waste & Vent Piping – Mobilization & Clean-Up	1	L.S.	$_____	$_____
665.0100	Removal – CHW Piping	40	L.F.	$_____	$_____
665.0200	CHW Piping	40	L.F.	$_____	$_____
665.0300	Mobilization & Clean-Up	1	L.S.	$_____	$_____
666.0100	Removal Air Conditioning and Ventilation – FCU	1	Each	$_____	$_____
666.0200	Removal Air Conditioning and Ventilation – Air Device Removal	9	Each	$_____	$_____

PROPOSAL SCHEDULE – BASE BID					
ITEM NO.	**ITEM**	**APPROX. QUANTITY**	**UNIT**	**UNIT PRICE**	**AMOUNT**
666.0300	Removal Air Conditioning and Ventilation – Roof Caps	15	Each	$_____	$_____
666.0400	Removal Air Conditioning and Ventilation – Fume Hood Exhaust Fan	4	Each	$_____	$_____
666.0500	Removal Air Conditioning and Ventilation – Exhaust Fan	9	Each	$_____	$_____
666.0600	Air Conditioning and Ventilation – Air Device Reinstall	2	Each	$_____	$_____
666.0700	Air Conditioning and Ventilation – Roof Caps (OA)	15	Each	$_____	$_____
666.0800	Air Conditioning and Ventilation – 4-Foot Fume Hood & Cabinet	4	Each	$_____	$_____
666.0900	Air Conditioning and Ventilation – FRP Fume Hood Exhaust Fan	4	Each	$_____	$_____
666.1000	Air Conditioning and Ventilation – Exhaust Fan Reinstall	4	Each	$_____	$_____
666.1100	Air Conditioning and Ventilation – FCU-CHW	1	Each	$_____	$_____
666.1200	Air Conditioning and Ventilation – Condensate Drain Piping	40	L.F.	$_____	$_____
666.1300	Air Conditioning and Ventilation – Ductwork S.S. Fume	800	LB	$_____	$_____
666.1400	Air Conditioning and Ventilation – Ductwork Galvanized	2,400	LB	$_____	$_____

PROPOSAL SCHEDULE – BASE BID					
ITEM NO.	**ITEM**	**APPROX. QUANTITY**	**UNIT**	**UNIT PRICE**	**AMOUNT**
666.1500	Air Conditioning and Ventilation – Duct Insulation	1,200	S.F.	$_____	$_____
666.1600	Mobilization and Clean-Up	1	L.S.	$_____	$_____
667.0100	Removal – Controls – FCU-CHW	1	Each	$_____	$_____
667.0200	Removal – Controls – Exhaust Fan	11	Each	$_____	$_____
667.0300	Removal – Controls – Fume Hood Exhaust Fan	4	Each	$_____	$_____
667.0400	Removal – Controls – Chiller	2	Each	$_____	$_____
667.0500	Removal – Controls – CHW Pump	4	Each	$_____	$_____
667.0600	Controls – FCU-CHW	1	Each	$_____	$_____
667.0700	Controls – Reconnect Exhaust Fan	11	Each	$_____	$_____
667.0800	Controls – Fume Hood Exhaust Fan	4	Each	$_____	$_____
667.0900	Mobilization & Clean-Up	1	L.S.	$_____	$_____
669.0100	FRP Doors - Double	1	Each	$_____	$_____
669.0200	FRP Doors – Single	8	Each	$_____	$_____
670.0100	Demolition Existing Lighting	L.S.	L.S.	L.S.	$_____

PROPOSAL SCHEDULE – BASE BID

ITEM NO.	ITEM	APPROX. QUANTITY	UNIT	UNIT PRICE	AMOUNT
670.0200	Electrical System Upgrade	L.S.	L.S.	L.S.	$_____
672.0100	Finish Hardware	L.S.	L.S.	L.S.	$_____
673.0100	Photovoltaic System	L.S.	L.S.	L.S.	$_____
673.0200	Lighting	L.S.	L.S.	L.S.	$_____
676.0100	Gypsum Board Ceiling	146	S.F.	$_____	$_____
678.0100	Acoustical Tile Ceiling	8,900	S.F.	$_____	$_____
681.0100	Painting	8,000	S.F.	$_____	$_____
686.0100	Signage	L.S.	L.S.	$_____	$_____
699.0100	Mobilization (Not to exceed 6% of the sum of all items Excluding the bid price of this item.)	L.S.	L.S.	L.S.	$_____
	a. O - S				$_____

PROPOSAL SCHEDULE – BID ADDITIVE ALTERNATE NO.1					
ITEM NO.	**ITEM**	**APPROX. QUANTITY**	**UNIT**	**UNIT PRICE**	**AMOUNT**
	<u>BID ADDITIVE ALTERNATE 1 – AIR CONDITIONING</u>				
660.0100	General Mechanical Requirements - Pre-TAB Air Systems	1	L.S.	$_____	$_____
660.0200	General Mechanical Requirements -HVAC Start-Up and Testing	1	L.S.	$_____	$_____
660.0300	General Mechanical Requirements - TAB Air & Water Systems	1	L.S.	$_____	$_____
660.0400	General Mechanical Requirements - Certifications As-Builts O&M	1	L.S.	$_____	$_____
662.0100	Insulation of Mech Systems-Demolition - Pipe Insulation	420	L.F.	$_____	$_____
662.0200	Insulation of Mech Systems-Demolition - Ductwork Insulation	3,400	S.F.	$_____	$_____
662.0300	Insulation of Mech Systems-New - Pipe Insulation	420	L.F.	$_____	$_____
662.0400	Insulation of Mech Systems-New - Ductwork Insulation	3,400	S.F.	$_____	$_____
662.0500	Mobilization & Clean-Up	1	L.S.	$_____	$_____
664.0100	Plumbing - Demolition - Heater Flue	1	Each	$_____	$_____
664.0200	Plumbing - Demolition - Roof Vents	6	Each	$_____	$_____
664.0300	Plumbing - New - Roof Vents	6	Each	$_____	$_____

PROPOSAL SCHEDULE – BID ADDITIVE ALTERNATE NO.1					
ITEM NO.	**ITEM**	**APPROX. QUANTITY**	**UNIT**	**UNIT PRICE**	**AMOUNT**
665.0100	Chilled Water Piping & Accessories - Demolition - CHW Pump	4	Each	$_____	$_____
665.0200	Chilled Water Piping & Accessories - Demolition - CHW Pipe	40	Each	$_____	$_____
665.0300	Chilled Water Piping & Accessories - New - CHW Pump	4	Each	$_____	$_____
665.0400	Chilled Water Piping & Accessories - New - CHW Piping	260	L.F.	$_____	$_____
665.0500	Mobilization & Clean-Up	1	L.S.	$_____	$_____
666.0100	Air Conditioning and Ventilation-Demolition-FCU	9	Each	$_____	$_____
666.0200	Air Conditioning and Ventilation-Demolition-Air Device Reinstall	141	Each	$_____	$_____
666.0300	Air Conditioning and Ventilation-New-Desiccant Dehumdifier	2	Each	$_____	$_____

PROPOSAL SCHEDULE – BID ADDITIVE ALTERNATE NO.1					
ITEM NO.	**ITEM**	**APPROX. QUANTITY**	**UNIT**	**UNIT PRICE**	**AMOUNT**
666.0400	Air Conditioning and Ventilation-New Dehumidifier Support DH	2	Each	$_____	$_____
666.0500	Air Conditioning and Ventilation-New-FCU (DX Split System) Cassette (1.0 Ton) - IT Room	1	Each	$_____	$_____
666.0600	Air Conditioning and Ventilation-New-FCU (DX Split System) High Wall (1.0 Ton) - Office Room	1	Each	$_____	$_____
666.0700	ACCU (DX Split System) - 1.0 ton systems - IT ROOM	1	Each	$_____	$_____
666.0800	ACCU (DX Split System) - 1.0 ton systems - Office Room	1	Each	$_____	$_____
666.0900	ACCU (DX Split System) - Refrigerant Piping	320	L.F.	$_____	$_____
666.1000	ACCU (DX Split System) - Refrigerant Pipe Insulation	320	L.F.	$_____	$_____
666.1100	ACCU (DX Split System) - Wall Support ACCU	2	Each	$_____	$_____
666.1200	ACCU (DX Split System) - Condensate Drain Piping	180	L.F.	$_____	$_____
666.1300	ACCU (DX Split System) - Air Device Reinstall	140	Each	$_____	$_____
666.1400	ACCU (DX Split System) - FCU-CHW	9	Each	$_____	$_____
666.1500	ACCU (DX Split System) - Ductwork S.S. Fume	800	LB	$_____	$_____

PROPOSAL SCHEDULE – BID ADDITIVE ALTERNATE NO.1					
ITEM NO.	**ITEM**	**APPROX. QUANTITY**	**UNIT**	**UNIT PRICE**	**AMOUNT**
666.1600	ACCU (DX Split System) - Ductwork Galvanized	2000	LB	$_____	$_____
666.1700	ACCU (DX Split System) - Duct Insulation	1	L.S.	$_____	$_____
666.1800	Mobilization & Clean-Up	1	L.S.	$_____	$_____
667.0100	Controls - Demolition - FCU-CHW	26	Each	$_____	$_____
667.0200	Controls - Demolition - Disconnect Exhaust Fan	8	Each	$_____	$_____
667.0300	Controls - Demolition - Fume Hood Exhaust Fan	4	Each	$_____	$_____
667.0400	Controls - Demolition - Chiller	2	Each	$_____	$_____
667.0500	Controls - Demolition - CHW Pump	2	Each	$_____	$_____
667.0600	Controls - New - FCU-CHW	26	Each	$_____	$_____
667.0700	Reconnect Exhaust Fan	8	Each	$_____	$_____
667.0800	Controls - New - Fume Hood Exhaust Fan	4	Each	$_____	$_____
667.0900	Controls - New - Chiller	2	Each	$_____	$_____
667.1000	Controls - New - CHW Pump	4	Each	$_____	$_____

PROPOSAL SCHEDULE – BID ADDITIVE ALTERNATE NO.1					
ITEM NO.	**ITEM**	**APPROX. QUANTITY**	**UNIT**	**UNIT PRICE**	**AMOUNT**
667.1100	Controls - New - Building AC Controller	1	L.S.	$_____	$_____
667.1200	Mobilization & Clean-Up	1	L.S.	$_____	$_____

b. O - R O.1.....$_____

BID SUMMARY	
ITEM NO.	**Amount**
TOTAL - BASE BID	$_____
TOTAL - BID ADDITIVE ALTERNATE NO.1	$_____
TOTAL AMOUNT FOR COMPARISON OF BIDS	$_____

PROPOSAL SCHEDULE NOTES:

1. Bids shall include all Federal, State, County and other applicable taxes and fees.
2. The TOTAL AMOUNT FOR COMPARISON OF BIDS shall be used to determine the lowest responsible bidder.
3. Bidders shall complete all unit prices and amounts. Failure to do so shall be grounds for rejection of bid.
4. If a discrepancy occurs between unit bid price and the bid price, the unit bid price shall govern.
5. **Bidders shall submit and upload the complete proposal to HIePRO prior to the bid opening date and time. Proposals received after said due date and time shall not be considered. Any additional support documents explicitly designated as confidential and/or proprietary shall be uploaded as a separate file to HIePRO. Bidders shall not include confidential and/or proprietary documents with the proposal. The record of each bidder and respective bid shall be open to public inspection.** Original (wet ink, hard copy)

proposal documents are not required to be submitted. **Contract award shall be based on evaluation of proposals submitted and uploaded to HIePRO.**
FAILURE TO UPLOAD THE COMPLETE PROPOSAL TO HIePRO SHALL BE GROUNDS FOR REJECTION OF THE BID.
If there is a conflict between the specification document and the HIePRO solicitation, the specifications shall govern and control, unless otherwise specified.

6. Prior to opening bids, the State will announce the project control budget. All bids will be evaluated on the basis of the same alternate item.

7. The TOTAL - ADDITIVE ALTERNATE NO.1 is added to the TOTAL – BASE BID price. This sum is compared to the project control budget, and must be within the project control budget.

8. The bidder with the lowest aggregate amount, within the project control budget, for the TOTAL - BASE BID plus TOTAL - ADDITIVE ALTERNATE is the lowest responsible bidder.

9. Should the TOTAL BASE BID price exceed the project control budget, the State reserves the right to negotiate with the lowest responsible bidder as permitted under Section 103D-302, Hawaii Revised Statutes, to further reduce the scope of work and award a contract thereafter.

PROPOSAL SCHEDULE

The bidder is directed to Subsection 105.16 – Subcontracts.

The bidder's attention is directed to Sections 696 - Field Office and Project Site Laboratory and 699 - Mobilization for the limitation of the amount bidders are allowed to bid.

If the bid price for any proposal item having a maximum allowable bid indicated therefore in any of the contract documents is in excess of such a maximum amount, the bid price for such proposal item shall be adjusted to reflect the limitation thereon. The comparison of bids to determine the successful bidder and the amount of contract to be awarded shall be determined after such adjustments are made, and such adjustments shall be binding upon the bidder.

The bidder is directed to Section 717 – Cullet and Cullet-Made Materials regarding recycling of waste glass.

SURETY BID BOND

Bond No. _____

KNOW ALL BY THESE PRESENTS:

That we, _____
(Full name or legal title of offeror)

as Offeror, hereinafter called the Principal, and

_____
(Name of bonding company)

as Surety, hereinafter called Surety, a corporation authorized to transact business as a Surety in the State of Hawaii, are held and firmly bound unto

_____
(State/county entity)

as Owner, hereinafter called Owner, in the penal sum of

_____
(Required amount of bid security)

Dollars ($_____), lawful money of the United States of America, for the payment of which sum well and truly to be made, the said Principal and the said Surety bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS:

The Principal has submitted an offer for _____

_____
(Project by number and brief description)

NOW, THEREFORE:

The condition of this obligation is such that if the Owner shall reject said offer, or in the alternate, accept the offer of the Principal and the Principal shall enter into a contract with the Owner in accordance with the terms of such offer, and give such bond or bonds as may be specified in the solicitation or Contract Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof as specified in the solicitation then this obligation shall be null and void, otherwise to remain in full force and effect.

Signed this _____ day of _____, _____

(Seal) _____
Name of Principal (Offeror)

_____
Signature

_____
Title

(Seal) _____
Name of Surety

_____
Signature

_____
Title

STATE OF HAWAII

DEPARTMENT OF TRANSPORTATION

HONOLULU, HAWAII

FORMS

Contents

CONTRACT

THIS AGREEMENT, made this day of _____, by and between the STATE OF HAWAII, by its Director of Transportation, hereinafter referred to as "STATE", and «CONTRACTOR», «STATE_OF_INCORPORATON», whose business/post office address is «ADDRESS», hereinafter referred to as CONTRACTOR";

WITNESSETH: That for and in consideration of the payments hereinafter mentioned, the CONTRACTOR hereby covenants and agrees with the STATE to complete in place, furnish and pay for all labor and materials necessary for "«PROJECT_NAME_AND_NO»", or such a part thereof as shall be required by the STATE, the total amount of which labor, material and construction shall be computed at the unit and/or lump sum prices set forth in the attached proposal schedule and shall be the sum of «BASIC»----DOLLARS ($«BASIC_NUMERIC») as follows:

TOTAL AMOUNT FOR COMPARISON OF BIDS……$«BASIC_NUMERIC»

which sum shall be provided from State funds, all in accordance with the specifications, the special provisions, if any, the notice to bidders, the instructions to bidders, the proposal and plans for «PROJECT_NO_ONLY», and any supplements thereto, on file in the office of the Director of Transportation. These documents, together with all alterations, amendments, and additions thereto and deductions therefrom, are attached hereto or incorporated herein by reference and made a part of this contract.

The CONTRACTOR hereby covenants and agrees to complete such construction within «WORKING_DAYS» from the date indicated in the Notice to Proceed from the State subject, however, to such extensions as may be provided for in writing under the specifications.

For and in consideration of the covenants, undertakings and agreements of the CONTRACTOR herein set forth and upon the full and faithful performance thereof by the CONTRACTOR, the STATE hereby agrees to pay the CONTRACTOR the sum of «BASIC»---DOLLARS ($«BASIC_NUMERIC») in lawful money, but not more than such part of the same as is actually earned according to the STATE's determination of the actual quantities of work performed and materials furnished by the CONTRACTOR at the unit or lump sum prices set forth in the attached proposal schedule. Such payment, including any extras, shall be made, subject to such additions or deductions hereto or hereafter made in the manner and at the time prescribed in the specifications and this contract.

An additional sum of «EXTRAS»-----DOLLARS ($«EXTRA_NUMERIC») is hereby provided for extra work.

All words used herein in the singular shall extend to and include the plural. All words used in the plural shall extend to and include the singular. The use of any gender shall extend to and include all genders.

IN WITNESS WHEREOF, the parties hereto have caused this instrument to be duly executed the day and year first above written.

STATE OF HAWAII

_____
Director of Transportation

«CONTRACTOR» (Seal)

_____
Signature

_____
Print name

_____
Print Title

_____
Date

PERFORMANCE BOND (SURETY)
(6/21/07)

KNOW TO ALL BY THESE PRESENTS:

That _____,
(Full Legal Name and Street Address of Contractor)

as Contractor, hereinafter called Principal, and _____

_____
(Name and Street Address of Bonding Company)

as Surety, hereinafter called Surety, a corporation(s) authorized to transact business as a surety in the State of Hawaii, are held and firmly bound unto the _____,
(State/County Entity)

its successors and assigns, hereinafter called Obligee, in the amount of _____

_____
DOLLARS ($_____), to which payment Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the above-bound Principal has signed a Contract with Obligee on _____, for the following project:_____
_____
_____
_____
_____
_____
hereinafter called Contract, which Contract is incorporated herein by reference and made a part hereof.

NOW THEREFORE, the condition of this obligation is such that:

If the Principal shall promptly and faithfully perform, and fully complete the Contract in strict accordance with the terms of the Contract as said Contract may be modified or amended from time to time; then this obligation shall be void; otherwise to remain in full force and effect.

Surety to this Bond hereby stipulates and agrees that no changes, extensions of time, alterations, or additions to the terms of the Contract, including the work to be performed thereunder, and the specifications or drawings accompanying same, shall in any way affect its obligation on this bond, and it does hereby waive notice of any such changes, extensions of time, alterations, or additions, and agrees that they shall become part of the Contract.

In the event of Default by the Principal, of the obligations under the Contract, then after written Notice of Default from the Obligee to the Surety and the Principal and subject to the limitation of the penal sum of this bond, Surety shall remedy the Default, or take over the work to be performed under the Contract and complete such work, or pay moneys to the Obligee in satisfaction of the surety's performance obligation on this bond.

Signed this _____ day of _____, _____.

(Seal) _____
Name of Principal (Contractor)

* _____
Signature

_____
Title

(Seal) _____
Name of Surety

* _____
Signature

_____
Title

*ALL SIGNATURES MUST BE ACKNOWLEDGED
BY A NOTARY PUBLIC

PERFORMANCE BOND

KNOW TO ALL BY THESE PRESENTS:

That we, _____
(full legal name and street address of Contractor)

as Contractor, hereinafter called Contractor, is held and firmly bound unto the

_____
(State/County entity)

its successors and assigns, as Obligee, hereinafter called Obligee, in the amount

_____DOLLARS $_____),
(Dollar amount of Contract)

lawful money of the United States of America, for the payment of which to the said Obligee, well and truly to be made, Contractor binds itself, its heir, executors, administrators, successors and assigns, firmly by these presents. Said amount is evidenced by:

☐ **Legal Tender;**

☐ **Share Certificate** unconditionally assigned to or made payable at sight to _____
Description:_____;

☐ **Certificate of Deposit**, No. _____, dated _____ issued by _____ drawn on _____ a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

☐ **Cashier's Check** No. _____, dated _____ drawn on _____ a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

☐ **Teller's Check** No. _____, dated _____ drawn on _____ a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

☐ **Treasurer's Check** No. _____, dated _____ drawn on _____ a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

☐ **Official Check** No. _____, dated _____ drawn on _____ a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

☐ **Certified Check** No. _____, dated _____ accepted by a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

WHEREAS:

The Contractor has by written agreement dated _____ entered into a contract with Obligee for the following Project:_____

_____

hereinafter called Contract, which Contract is incorporated herein by reference and made a part hereof.

NOW THEREFORE,

The Condition of this obligation is such that, if Contractor shall promptly and faithfully perform the Contract in accordance with, in all respects, the stipulations, agreements, covenants and conditions of the Contract as it now exists or may be modified according to its terms, and shall deliver the Project to the Obligee, or to its successors or assigns, fully completed as in the Contract specified and free from all liens and claims and without further cost, expense or charge to the Obligee, its officers, agents, successors or assigns, free and harmless from all suits or actions of every nature and kind which may be brought for or on account of any injury or damage, direct or indirect, arising or growing out of the doing of said work or the repair or maintenance thereof or the manner of doing the same or the neglect of the Contractor or its agents or servants or the improper performance of the Contract by the Contractor or its agents or servants or from any other cause, then this obligation shall be void; otherwise it shall be and remain in full force and effect.

AND IT IS HEREBY STIPULATED AND AGREED that suit on this bond may be brought before a court of competent jurisdiction without a jury, and that the sum or sums specified in the said Contract as liquidated damages, if any, shall be forfeited to the Obligee, its successors or assigns, in the event of a breach of any, or all, or any part of, covenants, agreements, conditions, or stipulations contained in the Contract or in this bond in accordance with the terms thereof.

The amount of this bond may be reduced by and to the extent of any payment or payments made in good faith hereunder.

Signed and sealed this _____ day of _____, _____.

(Seal)_____
Name of Contractor

_____
Signature*

_____
Title

*ALL SIGNATURES MUST BE ACKNOWLEDGED
BY A NOTARY PUBLIC

LABOR AND MATERIAL PAYMENT BOND (SURETY)
(6/21/07)

KNOW TO ALL BY THESE PRESENTS:

That _____,
(Full Legal Name and Street Address of Contractor)

as Contractor, hereinafter called Principal, and _____

_____,
(Name and Street Address of Bonding Company)
as Surety, hereinafter called Surety, a corporation(s) authorized to transact business as a surety in the State of Hawaii, are held and firmly bound unto the _____,
(State/County Entity)

its successors and assigns, hereinafter called Obligee, in the amount of _____

_____
_____ Dollars ($_____), to which payment Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the above-bound Principal has signed Contract with the Obligee on _____ for the following project:_____
_____
_____
_____
_____
hereinafter called Contract, which Contract is incorporated herein by reference and made a part hereof.

NOW THEREFORE, the condition of this obligation is such that if the Principal shall promptly make payment to any Claimant, as hereinafter defined, for all labor and materials supplied to the Principal for use in the performance of the Contract, then this obligation shall be void; otherwise to remain in full force and effect.

1. Surety to this Bond hereby stipulates and agrees that no changes, extensions of time, alterations, or additions to the terms of the Contract, including the work to be performed thereunder, and the specifications or drawings accompanying same, shall in any way affect its obligation on this bond, and it does hereby waive notice of any such changes, extensions of time, alterations, or additions, and agrees that they shall become part of the Contract.

2. A "Claimant" shall be defined herein as any person who has furnished labor or materials to the Principal for the work provided in the Contract.

Every Claimant who has not been paid amounts due for labor and materials furnished for work provided in the Contract may institute an action against the Principal and its Surety on this bond at the time and in the manner prescribed in Section 103D-324, Hawaii Revised Statutes, and have the rights and claims adjudicated in the action, and judgment rendered thereon; subject to the Obligee's priority on this bond. If the full amount of the liability of the Surety on this bond is insufficient to pay the full amount of the claims, then after paying the full amount due the Obligee, the remainder shall be distributed pro rata among the claimants.

Signed this _____ day of _____, _____.

(Seal) _____
Name of Principal (Contractor)

* _____
Signature

_____
Title

(Seal) _____
Name of Surety

* _____
Signature

_____
Title

*ALL SIGNATURES MUST BE ACKNOWLEDGED
BY A NOTARY PUBLIC

LABOR AND MATERIAL PAYMENT BOND

KNOW ALL BY THESE PRESENTS:

That we, _____
(full legal name and street address of Contractor)

as Contractor, hereinafter called Contractor, is held and firmly bound unto _____
(State/County entity)

its successors and assigns, as Obligee, hereinafter called Obligee, in the amount

_____ DOLLARS ($_____),
(Dollar amount of Contract)

lawful money of the United States of America, for the payment of which to the said Obligee, well and truly to be made, Contractor binds itself, its heir, executors, administrators, successors and assigns, firmly by these presents. Said amount is evidenced by:

- ❑ **Legal Tender**;

- ❑ **Share Certificate** unconditionally assigned to or made payable at sight to_____
  Description:_____

- ❑ **Certificate of Deposit, No.** _____, dated _____
  issued by _____
  drawn on _____
  a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

- ❑ **Cashier's Check No.** _____, dated _____
  drawn on _____
  a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

- ❑ **Teller's Check No.** _____, dated _____
  drawn on _____
  a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

- ❑ **Treasurer's Check No.** _____, dated _____
  drawn on _____
  a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

- ❑ **Official Check No.** _____, dated _____
  drawn on _____
  a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

- ❑ **Certified Check No.** _____, dated _____
  accepted by a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

WHEREAS:

The Contractor has by written agreement dated _____ entered into a contract with Obligee for the following Project:_____

_____

hereinafter called Contract, which Contract is incorporated herein by reference and made a part hereof.

NOW THEREFORE,

The condition of this obligation is such that, if Contractor shall promptly and faithfully perform the Contract in accordance with, in all respects, the stipulations, agreements, covenants and conditions of the Contract as it now exists or may be modified according to its terms, free from all liens and claims and without further cost, expense or charge to the Obligee, its officers, agents, successors or assigns, free and harmless from all suits or actions of every nature and kind which may be brought for or on account of any injury or damage, direct or indirect, arising or growing out of the doing of said work or the repair or maintenance thereof or the manner of doing the same or the neglect of the Contractor or its agents or servants or the improper performance of the Contract by the Contractor or its agents or servants or from any other cause, then this obligation shall be void; otherwise it shall be and remain in full force and effect.

AND IT IS HEREBY STIPULATED AND AGREED that suit on this bond may be brought before a court of competent jurisdiction without a jury, and that the sum or sums specified in the said Contract as liquidated damages, if any, shall be forfeited to the Obligee, its successors or assigns, in the event of a breach of any, or all, or any part of, covenants, agreements, conditions, or stipulations contained in the Contract or in this bond in accordance with the terms thereof.

AND IT IS HEREBY STIPULATED AND AGREED that this bond shall inure to the benefit of any and all persons entitled to file claims for labor performed or materials furnished in said work so as to give any and all such persons a right of action as contemplated by Sections 103D-324(d) and 103D-324(e), Hawaii Revised Statutes.

The amount of this bond may be reduced by and to the extent of any payment or payments made in good faith hereunder, inclusive of the payments of mechanics' liens which may be filed of record against the Project, whether or not claim for the amount of such lien be presented under and against this bond.

Signed this _____ day of _____, _____.

(Seal) _____
Name of Contractor

* _____
Signature

_____
Title

*ALL SIGNATURES MUST BE
ACKNOWLEDGED BY A NOTARY PUBLIC

CHAPTER 104, HRS COMPLIANCE CERTIFICATE

The undersigned bidder does hereby certify to the following:

1. Individuals engaged in the performance of the contract on the job site shall be paid:

   A. Not less than the wages that the director of labor and industrial relations shall have determined to be prevailing for corresponding classes of laborers and mechanics employed on public works projects; and

   B. Overtime compensation at one and one-half times the basic hourly rate plus fringe benefits for hours worked on Saturday, Sunday, or a legal holiday of the State or in excess of eight hours on any other day.

2. All applicable laws of the federal and state governments relating to workers' compensation, unemployment compensation, payment of wages, and safety shall be fully complied with.

DATED at Honolulu, Hawaii, this _____ day of _____, 20___.

«CONTRACTOR»
Name of Corporation, Partnership, or Individual

_____
Signature and Title of Signer

Notary Seal
NOTARY ACKNOWLEDGEMENT

Subscribed and sworn before me this
_____day of_____
Notary signature_____
Notary public, State of _____
My Commission Expires:_____

Notary Seal
NOTARY CERTIFICATION

Doc. Date: _____ #Pages: ____
Notary Name: _____ _____Circuit
Doc. Description: _____
_____
Notary signature_____
Date _____

PROVISIONS TO BE INCLUDED IN CONSTRUCTION PROCUREMENT SOLICITATIONS

1. Definitions for terms used in HRS Chapter 103B as amended by Act 192, SLH 2011:

   a. "Contract" means contracts for construction under 103D, HRS.

   b. "Contractor" has the same meaning as in Section 103D-104, HRS, provided that "contractor" includes a subcontractor where applicable.

   c. "Construction" has the same meaning as in Section 103D-104, HRS.

   d. "General Contractor" means any person having a construction contract with a governmental body.

   e. "Procurement Officer" has the same meaning as in Section 103D-104, HRS.

   f. "Resident" means a person who is physically present in the State of Hawai'i at the time the person claims to have established the person's domicile in the State of Hawai'i and shows the person's intent is to make Hawai'i the person's primary residence.

   g. "Shortage trade" means a construction trade in which there is a shortage of Hawai'i residents qualified to work in the trade as determined by the Department of Labor and Industrial Relations.

2. HRS Chapter 103B as amended by Act 192, SLH 2011–Employment of State Residents Requirements:

   a. A Contractor awarded a contract shall ensure that Hawai'i residents comprise not less than 80% of the workforce employed to perform the contract work on the project. The 80% requirement shall be determined by dividing the total number of hours worked on the contract by Hawai'i residents, by the total number of hours worked on the contract by all employees of the Contractor in the performance of the contract. The hours worked by any Subcontractor of the Contractor shall count towards the calculation for this section. The hours worked by employees within shortage trades, as determined by the Department of Labor and Industrial Relations (DLIR), shall not be included in the calculation for this section.

EXHIBIT 1

b. Prior to award of a contract, an Offeror/Bidder may withdraw an offer/bid without penalty if the Offeror/Bidder finds that it is unable to comply with HRS Chapter 103B as amended by Act 192, SLH 2011.

c. Prior to starting any construction work, the Contractor shall submit the subcontract dollar amount for each of its Subcontractors.

d. The requirements of this section shall apply to any subcontract of $50,000 or more in connection with the Contractor; that is, such Subcontractors must also ensure that Hawai'i residents comprise not less than 80% of the Subcontractor's workforce used to perform the subcontract.

e. The Contractor and any Subcontractor whose subcontract is $50,000 or more shall comply with the requirements of HRS Chapter 103B as amended by Act 192, SLH 2011.

1) Certification of compliance shall be made in writing under oath by an officer of the General Contractor and applicable Subcontractors and submitted with the final payment request.

2) The certification of compliance shall be made under oath by an officer of the company by completing a "Certification of Compliance for Employment of State Residents" form and executing the Certificate before a licensed notary public.

3) In addition to the certification of compliance as indicated above, the Contractor and Subcontractors shall maintain records such as certified payrolls for laborers and mechanics who performed work at the site and time sheets for all other employees who performed work on the project. These records shall include the names, addresses and number of hours worked on the project by all employees of the Contractor and Subcontractor who performed work on the project to validate compliance with HRS Chapter 103B as amended by Act 192, SLH 2011. The Contractor and Subcontractors shall retain these records and provide access to the State for a minimum period of four (4) years after the final payment, except that if any litigation, claim, negotiation, investigation, audit or other action involving the records has been started before the expiration of the four-year period, the Contractor and Subcontractors shall retain the records until completion of the action and resolution of all issues that arise from it, or until the end of the four-year period, whichever occurs later. Furthermore, it shall be the Contractor's responsibility to enforce compliance with this provision by any Subcontractor.

f. A General Contractor or applicable Subcontractor who fails to comply with this section shall be subject to any of the following sanctions:

1) With respect to the General Contractor, withholding of payment on the contract until the Contractor or its Subcontractor complies with HRS Chapter 103B as amended by Act 192, SLH 2011.

2) Proceedings for debarment or suspension of the Contractor or Subcontractor under Hawai'i Revised Statues §103D-702.

3. Conflict with Federal Law: This section shall not apply if the application of this section is in conflict with any federal law, or if the application of this section will disqualify the State from receiving Federal funds or aid.

EXHIBIT 1

CERTIFICATION OF COMPLIANCE
FOR
EMPLOYMENT OF STATE RESIDENTS
HRS CHAPTER 103B, AS AMENDED BY ACT 192, SLH 2011

Project Title: _____

Agency Project No: _____

Contract No.: _____

As required by Hawai'i Revised Statutes Chapter103B, as amended by Act 192, Session Laws of Hawaii 2011–Employment of State Residents on Construction Procurement Contracts, I hereby certify under oath, that I am an officer of _____ and
(Name of Contractor or Subcontractor Company)
for the Project Contract indicated above, _____ was in
(Name of Contractor or Subcontractor Company)
compliance with HRS Chapter 103B, as amended by Act 192, SLH 2011, by employing a workforce of which not less than eighty percent are Hawai'i residents, as calculated according to the formula in the solicitation, to perform this Contract.

☐ I am an officer of the **Contractor** for this contract.

☐ I am an officer of a **Subcontractor** for this contract.

CORPORATE SEAL

_____
(Name of Company)

_____
(Signature)

_____
(Print Name)

_____
(Print Title)

Subscribed and sworn to me before this
_____ day of _____, 2011.

_____
Notary Public, 1st Circuit, State of Hawai'i
My commission expires: _____

Doc. Date: _____ # of Pages_____ 1st Circuit
Notary Name: _____
Doc. Description: _____
_____
_____

_____
Notary Signature Date
NOTARY CERTIFICATION

EXHIBIT 2